Klickitat Subbasin Anadromous Fishery Master Plan

Prepared for

Northwest Power Planning & Conservation Council

Prepared by

Yakama Nation
in cooperation with
Washington Department of Fish and Wildlife

December 2004

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Cover Photo: Fall Chinook at Lyle Falls, Klickitat River
Courtesy of Les Brown, CRITFC Salmon Marketing Program

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Where to Find NPPCC Review Elements in this Plan

The following introduction and list of Project Review Elements is copied from the document headed "Three-Step Review Process as approved by Northwest Power Planning Council on October 18, 2001" (Council document 2001-29). The sections in the Klickitat Subbasin Anadromous Fishery Master Plan that address each review element are noted in red type.

V. Review Elements
An important part of the major project review process will include an independent scientific review of the responses to the technical elements listed below. The Council is looking for a full explanation of how the project is consistent with these elements. These elements reflect and refer to specific elements delineated under relevant sections in the fish and wildlife program (e.g. artificial production and subbasin assessment protocols). In addition, the independent scientists reviewing the project in the future will be applying these or similar standards as a reflection of the current state of the science. In addition, these elements may be supplemented with issues raised in previous reviews.

A. All Projects
All projects are expected to:

- address the relationship and consistencies of the proposed project to the eight scientific principles (see 2000 Columbia River Basin Fish and Wildlife Program, Basinwide Provisions, Section B.2) (Step 1) Chapter 2.
- describe the link of the proposal to other projects and activities in the subbasin (Appendix D) and the desired endstate condition for the target subbasin (Appendix E, which summarizes from the Klickitat Subbasin Summary) (Step 1)
- define the biological objectives (see 2000 Columbia River Basin Fish and Wildlife Program, Basinwide Provisions, Section C.2 (1) and (2), and Technical Appendix) with measurable attributes that define progress, provide accountability and track changes through time associated with this project (Step 1) The program as a whole addresses all the Overarching Objectives listed in Section C of the 2000 FW Program (see Chapter 2 for explanation). Measurable basin-level biological objectives are summarized in Chapter 2 of the master plan, and developed in detail in chapters 4 - 10.
- define expected project benefits (e.g. preservation of biological diversity, fishery enhancement, water optimization, and habitat protection) (Step 1) Addressed in general in Section 2.1 and specifically in the rationale for individual programs and strategies in chapters 4 - 10.
- describe the implementation strategies (see 2000 Columbia River Basin Fish and Wildlife Program, Basinwide Provisions, Section D.2) as they relate to the current conditions and restoration potential of the habitat for the target species and the life stage of interest (Step 1) Section 3.3.3.
- address the relationship to the habitat strategies (see 2000 Columbia River Basin Fish and Wildlife Program, Basinwide Provisions, Section D.3) (Step 1) The entire Master Plan shows consistency with the applicable provisions in Section D3, including its emphasis on building from strength, restoring ecosystems not just single species, and use of native species wherever feasible.
- ensure that cost-effective alternate measures are not overlooked and include descriptions of alternatives for resolving the resource problem, including a description of other management

activities in the subbasin, province and basin (Step 1) Alternative production programs were evaluated in Oshie and Ferguson 1998; Ferguson and Sharp 2002; Sharp and Hubble 2002 (see Section 1.3). Appendix C (Wahkiacus Hatchery and Acclimation Facility) points out the evaluation and permitting processes, including NEPA, that would be needed before a site is developed. Appendix F (Upper Klickitat Acclimation Sites) evaluates alternative types of acclimation sites.

- provide the historical and current status of anadromous and resident fish and wildlife in the subbasin most relevant to the proposed project (Step 1) Chapter 3
- describe current and planned management of anadromous and resident fish and wildlife in the subbasin (Step 1) Sections 1.2 and 1.3; Appendix E.
- demonstrate consistency of the proposed project with National Marine Fisheries Service recovery plans and other fishery management and watershed plans (Step 1) Section 1.3; Appendix D. In addition, the Master Plan recognizes that consultation with NOAA Fisheries and with U.S. Fish and Wildlife Service will be needed before some strategies are implemented (see individual strategy discussions).
- describe the status of the comprehensive environmental assessment (Step 1 and 2) Section 1.3. See also Appendices B and C for environmental requirements met or still to be completed for aspects of this program.
- describe the monitoring and evaluation plan (see 2000 Columbia River Basin Fish and Wildlife Program, Basinwide Provisions, Section D.9) (Step 1, 2 and 3) M&E is fundamental to all parts of this program. Specific actions are summarized in Chapter 2 and discussed in detail in chapters 4 - 10. Appendix G summarizes the M&E data to be collected.
- describe and provide specific items and cost estimates for 10 Fiscal Years for planning and design (i.e. conceptual, preliminary and final), construction, operation and maintenance and monitoring and evaluation (Step 1, 2 and 3) Appendix A.

B. Artificial Production Initiatives

Artificial production initiatives are expected to:

- address the relation and link to the artificial production policies and strategies (see 2000 Columbia River Basin Fish and Wildlife Program, Basinwide Provisions, Section D.4 and Technical Appendix) (Step 1) Chapter 2.
- provide a completed Hatchery and Genetic Management Plan (HGMP) for the target population (s) (Step 1) As discussed in Section 1.1, Appendix D and elsewhere in the Master Plan, HGMPs are being developed in a basin-wide process led by NOAA Fisheries. The process is not yet complete. HGMPs exist for the target species in the Klickitat basin but do not reflect the proposed program. This Master Plan has included listed species take estimates for all applicable activities proposed.
- describe the harvest plan (see 2000 Columbia River Basin Fish and Wildlife Program, Basinwide Provisions, Section D.5) (Step 1)
  Spring chinook: Chapter 5, including Overall Goal, Section 5.1, and Section 5.6.
  Steelhead: Section 6.1, Strategy S1c
  Coho: Section 7.3, 7.4 (Strategies C4a and C4b)
  Fall chinook: Section 8.1, 8.3 (Strategies FC3a and FC3b).
- provide a conceptual design of the proposed facilities, including an assessment of the availability and utility of existing facilities (Step 1) Chapter 4; Appendix F.
- provide a preliminary design of the proposed facilities (Step 2) Appendices B and C.

- provide a final design of the proposed facilities, including appropriate value engineering review, consistent with previous submittal documents and preliminary design (Step 3) Not applicable.

C. Other Project Initiatives

Other major project initiatives are expected to:

- provide a conceptual design of the proposed strategies and/or facilities (Step 1) For habitat proposals, this Master Plan outlines a process to identify needs in a comprehensive way, so at this point, conceptual designs are premature, except for projects already approved for funding.
- provide a preliminary design of the proposed strategies and/or facilities (Step 2) See above.
- provide a final design of the proposed strategies and/or facilities, including appropriate value engineering review, consistent with previous submittal documents and preliminary design (Step 3) See above.

Chapter 1. Background

1.1 How This Plan is Organized

Scope: This master plan addresses proposed facilities, production protocols, monitoring and evaluation, and habitat improvements needed to manage spring and fall chinook salmon, coho salmon, and winter and summer steelhead in the Klickitat subbasin through 2010. It also addresses research needs for Pacific lamprey. Because some facilities and habitat work are proposed to benefit more than one of the target species, and because proposed changes to production practices for one target species could affect practices for another target species, the Yakama Nation decided to prepare one master plan for all five species. The plan incorporates goals and objectives of the Yakima/Klickitat Fisheries Project (YKFP), of which these programs are a part; and it is expected to be consistent with soon-to-be negotiated agreements under *U.S. v. Oregon*, which is a major driving force behind decisions related to fisheries in the area.

Document Organization:

- **Section 1.2** summarizes overall YKFP goals and management philosophy; they guide projects relating to all target species in both the Yakima and Klickitat subbasins. **Section 1.3** outlines the history of anadromous fishery programs in the Klickitat subbasin, including the role of *U.S. v. Oregon* agreements.
- **Chapter 2** **summarizes** goals, objectives, and strategies for the Klickitat subbasin, including:
  - ✓ Multi-species goals, objectives and strategies, specifically, those related to
    - ➢ Production levels
    - ➢ Fishway improvements and multi-species facility development
    - ➢ Data collection and reporting
  - ✓ Species-specific goals, objectives and strategies, including those related to
    - ➢ Single-species acclimation site development
    - ➢ Smolt and fry releases
    - ➢ Broodstock collection
    - ➢ Monitoring and evaluation
  - ✓ Habitat improvement goals and objectives
- **Chapter 3** briefly describes the existing environment in the subbasin that might be affected by actions proposed in this plan. It focuses on existing habitat conditions that limit anadromous fish production, and on the history and current status of each target species and other anadromous and resident fish in the subbasin.
- **Chapters 4 - 10** are the **heart of this document**. They expand on the list of goals, objectives and strategies from Chapter 2 by explaining the rationale for proposing them and the methods and risks of their implementation.
- **Appendices** contain supporting information, including **cost estimates** (Appendix A); descriptions of **ongoing and proposed facility improvements** (Appendices B and C); summaries of **other plans, goals, and legislation** that affect this master plan (Appendices

D and E); upper basin **acclimation site descriptions** (Appendix F); and **monitoring and evaluation data** to be collected (Appendix G). At the time of the writing of this Master Plan, Hatchery and Genetics Management Plans (HGMPs) were being finalized though a collaborative effort with basin managers and NOAA Fisheries. Current versions are available on-line at www.apre.info.

1.2 Yakima/Klickitat Fisheries Project

Fisheries programs in the Klickitat River subbasin that are managed primarily by the Yakama Nation are part of the Yakima/Klickitat Fisheries Project (YKFP). The YKFP is a project designed to use artificial propagation in an attempt to re-establish, supplement, or increase natural production and harvest opportunities of anadromous salmonids while maintaining the long-term fitness of the target population, and while keeping ecological and genetic impacts on non-target species within specified limits. The framework developed by the Regional Assessment of Supplementation Project (RASP 1992) guides the planning, implementation, and evaluation of the YKFP, which is also an experiment to resolve uncertainties associated with supplementation. As a "laboratory," the YKFP will help determine the role of supplementation in increasing natural production of anadromous salmonids. Both controlled experiments and basic monitoring contribute information.

Consistent with the Pacific Northwest Power Planning Council's[1] (NPPC) Fish and Wildlife Program (NPPC 1994), the objectives of the YKFP are to:

- Enhance existing stocks of anadromous fish in the Yakima and Klickitat river basins, while maintaining genetics and ecological resources.
- Reintroduce stocks formerly present in the basins.
- Apply the knowledge gained through supplementation throughout the Columbia River Basin.

YKFP objectives are achieved while adhering to all relevant environmental laws and regulations, including National Environmental Policy Act (NEPA) and Endangered Species Act (ESA) requirements. The YKFP endorses an adaptive management policy, which allows for Project objectives and strategies to change as new information becomes available from Project experiments, monitoring and evaluation, and literature reviews.

1.3 History of Fishery Programs in the Klickitat Subbasin

The Klickitat Hatchery, originally constructed between 1950 and 1954, was funded under the Mitchell Act of 1938 as mitigation for effects of hydropower development and operation. It is currently operated by the Washington State Department of Fish and Wildlife (WDFW) and is the centerpiece of artificial propagation activities in the Klickitat subbasin. It is used at least in part to rear and release spring and fall chinook and coho. In addition, steelhead smolts are released annually directly into the lower Klickitat at several locations downstream of the Klickitat

[1] The Council is now known as the Northwest Power and Conservation Council (NPCC). For documents pre-dating the name change, we will continue to use the former name and acronym.

Hatchery. On June 2, 2003, a Memorandum of Understanding (MOU) was completed that describes the proposed transfer of ownership and operational responsibility of the Klickitat Hatchery and the Lyle Falls and Castile Falls fishways from the WDFW to the Confederated Tribes and Bands of the Yakama Nation (YN). Figure 1 shows existing fish production facilities in the Klickitat basin.

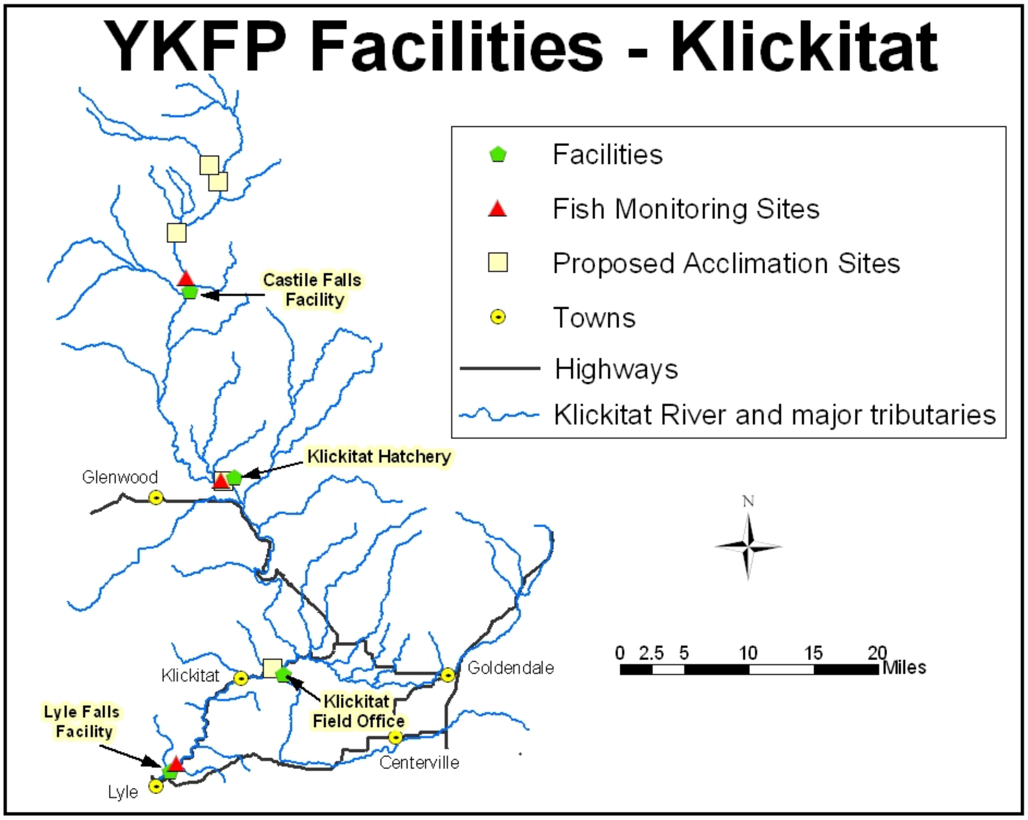

Figure 1. Klickitat Basin Anadromous Fish Production Facilities

The *U.S. v. Oregon* litigation was a landmark lawsuit over Indian treaty fishing rights. The case is still under the jurisdiction of the United States District Court of Oregon. Decisions reached in that case are implemented under the Columbia River Fish Management Plan (CRFMP). The plan governs management of chinook, coho, and steelhead in the Klickitat basin, including fish production at Klickitat Hatchery, as well as salmonids throughout the Columbia River basin. Although the latest plan (1998) has now expired, its requirements have been followed until new ones are negotiated. In the Klickitat, current programs focus on harvest augmentation for coho and fall chinook, and on supplementation for spring chinook and summer steelhead.

Although spring chinook, steelhead, fall chinook and coho programs in the Klickitat basin nominally were considered part of the YKFP from the project's inception[2], production and releases of the four species continued under WDFW management using Mitchell Act funding. Bonneville Power Administration (BPA), which funds the YKFP, has not participated in funding Klickitat Hatchery artificial production to date. However, BPA funded additional research and monitoring in the Klickitat after the effects of those proposed activities were evaluated in a Supplement Analysis (BPA 1999) to the original Environmental Impact Statement (EIS) prepared for the Yakima portion of the project (BPA et al. 1996). To date, the YKFP in the Klickitat basin has focused on monitoring and evaluation, passage improvements, habitat enhancement, and planning for the Klickitat Hatchery.

YKFP plans for various aspects of the future anadromous salmonid program in the Klickitat basin have been analyzed, approved, and in some cases, implemented. These plans, some of which presented alternative production levels for all four species, are documented in the following:

- Draft Klickitat Hatchery Facility Management Plan (Oshie and Ferguson 1998)
- Draft Klickitat Hatchery Transition Production Plan (Ferguson and Sharp 2002)
- Interim Klickitat River Basin Resource Management Plan (Sharp and Hubble 2002)

Improvements to the Castile Falls fishway (Figure 1) were approved by NOAA Fisheries in 1999 under the Mitchell Act. To date, refurbishment of the uppermost tunnel has been completed and construction is under way on the remainder of the improvements, with completion expected in 2004 (see Appendix B for a description of the facilities and improvements). Engineering design for Lyle Falls improvements (BPA project 1995-068-00) has been completed; implementation is awaiting funding.

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[2] On page 6 of Chapter 1, the EIS states:

"In 1982, the Council [NPPC] first encouraged BPA to 'fund the design, construction, operation, and maintenance of a hatchery to enhance the fishery for the Yakima 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 number to be produced, facility descriptions, management structure, schedule, and steps for evaluating the success of planned activities (Fish Management Consultants, 1987)."

Chapter 2. Summary of Goals, Objectives, and Strategies

This master plan was developed in response to Northwest Power and Conservation Council (NPCC) requirements. The plan includes goals, objectives, and strategies for five species: spring chinook, steelhead, fall chinook, coho, and Pacific lamprey. Lamprey, however, currently are not subject to artificial production in the Klickitat basin. The plan also includes goals, objectives and strategies for habitat improvements in the basin.

Because proposals affecting one species also affect others in the basin, the plan identifies overall goals for the four production species of anadromous fish in the Klickitat basin, and proposes changes to existing production practices and facilities. It also establishes goals, objectives and strategies for each of the five species targeted by the YKFP, and shows the relationship of ongoing and proposed facility and habitat improvements to the basin-wide and species-specific goals. All proposals incorporate recommendations from, and are consistent with, Tribal, NPCC, BPA, and other federal, state, and regional policies and plans. Proposals also are consistent with mandates under *U.S. v. Oregon*. Appendix D shows how this master plan relates to and is consistent with other relevant plans, programs, processes, legislation, and court decisions.

The Klickitat program's consistency with the Council's 2000 Fish and Wildlife Program deserves special attention here. The 2000 Program includes eight scientific principles that are intended to provide a stable scientific foundation for actions taken to implement the program (Section B, NPPC 2000); biological objectives that the overall program aims to achieve (Section C, NPPC 2000); and strategies to implement the objectives (Section D, NPPC 2000).

The Council's scientific principles recognize that program actions must maintain and promote ecosystem functions by acknowledging and acting in accordance with the holistic nature of ecosystem relationships, the need for biological diversity, the role of each species in maintaining ecological functions, and the need to adapt human actions to minimize adverse impacts on ecosystems. As can be seen in this Master Plan, the YKFP Klickitat program is consistent with these principles, from holistic consideration of actions for all target species in one plan and proposed improvements to the natural production of indigenous species, to its focus on incorporating habitat improvements into the fish production program.

Within the limits of the program's scope and other mandates (e.g., *U.S. v. Oregon*), the Klickitat program clearly contributes to the Council's Overarching Objectives (Section C1[3]) and Basin Level Biological Objectives related to anadromous fish losses (Section C2[4]).

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[3] These overarching objectives are:

- A Columbia River ecosystem that sustains an abundant, productive, and diverse community of fish and wildlife.
- Mitigation across the basin for the adverse effects to fish and wildlife caused by the development and operation of the hydro system.
- Sufficient populations of fish and wildlife for abundant opportunities for tribal trust and treaty right harvest and for non-tribal harvest.
- Recovery of the fish and wildlife affected by the development and operation of the hydrosystem that are listed under the Endangered Species Act.

[4] These objectives basically are to halt declining trends in salmon and steelhead populations above Bonneville Dam by 2005; to restore the widest possible set of healthy naturally reproducing population of salmon and steelhead in

As an artificial production program, the Klickitat program is consistent with the Council's artificial production policies, including those discussed in Section D4 (NPPC 2000). For example, artificial production is used in the context of the ecological environment of the Klickitat and Columbia River basins; the program is adaptively managed, according to YKFP principles; it supplements at-risk stocks and attempts to minimize the effects of hatchery production on naturally spawning populations; it makes artificial production decisions in the context of subbasin-level goals, objectives, and strategies; and has adopted a number of risk management strategies.

2.1 Multi-Species Goal, Objectives, and Strategies

The Klickitat Subbasin Summary (Sharp 2000) identified goals, objectives, and strategies which are summarized in Appendix E. This master plan incorporates and builds on them. In general, the YKFP proposes to focus efforts in the subbasin based on recognition of certain key issues.

- Spring chinook are a priority species for the Yakama Nation for harvest in tribal Zone 6 (the mainstem Columbia River from Bonneville to McNary Dams) and Lyle Falls dip net fisheries. The primary use of these fish is ceremonial and subsistence, with larger runs producing some commercial opportunity in recent years. Spring chinook also are important to state commercial and sport fisheries in the mainstem Columbia and Klickitat rivers.
- Because steelhead are listed as Threatened under the Endangered Species Act, they are considered a priority for rebuilding efforts.
- Substantial harvest of all four species is of vital economic and cultural importance to the Yakama Nation and to smaller communities along the Columbia River and in Klickitat County. Numerous reports (e.g., IFWF 2003) have been published in recent years detailing the economic benefits of salmon fisheries. Based on the data in these reports, the annual direct and indirect benefit of only the estimated 14,000 Klickitat-origin fall chinook harvested in the Pacific Ocean, Columbia River, and Klickitat River fisheries could exceed one million dollars.
- A native run of coho was not identified as historically present in the Klickitat (Bryant 1949). Undoubtedly coho did exploit the Klickitat River to some degree. The natural falls at river mile (RM) 2.2 were assumed to be difficult for coho to pass during low fall flows. The habitat above the falls does not provide ideal spawning and rearing habitat for coho, as gradients are generally too steep. For these reasons, YN does not believe natural production is or should be the focus of coho production actions and strategies. However, YN recognizes that some natural production will still occur and believes that coho have a significant role to play in meeting *U.S. v. Oregon* harvest and regional mitigation obligations.
- Concern over Pacific lamprey is increasing in the region, yet little is known with certainty about the current status of this species that is an important traditional food source for the Yakama Nation and other tribes. The YN believes it is vital to begin research into the feasibility of restoring this population.

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each relevant province by 2012; and to increase total adult salmon and steelhead runs above Bonneville Dam by 2025.

- Court decisions and subsequent agreements arising out of *U.S. v. Oregon*, as well as YKFP policies, provide over-arching guidance to any activities proposed in the Klickitat basin.
- While monitoring and evaluation (M&E) activities are critical to measuring project success, they also can be very expensive. It is not cost-effective to duplicate studies that have been done in other basins if results are transferable to the Klickitat.

With these issues in mind, the **YKFP proposes to focus supplementation and natural production efforts on spring chinook and steelhead, while maintaining a focus on harvest augmentation for fall chinook and coho**. In doing so, the project would increase production of spring chinook and steelhead at the Klickitat Hatchery and eliminate in-basin artificial production of coho. In-basin fall chinook production levels would remain the same, but half the production would be transferred from Klickitat Hatchery to a proposed new facility at Wahkiacus. The program proposes further improvements to existing facilities that would increase the ability of spring chinook and steelhead to access high quality habitat, thus improving natural production; and that would allow collection of spring chinook and steelhead broodstock to meet supplementation goals for those two species. The M&E measures proposed in this plan are designed to use, to the maximum extent possible, work that is being or has been done in other basins (particularly the Yakima basin) on key issues such as domestication selection and ecological interactions that remain the subject of scientific debate on supplementation.

The following paragraphs list the goal, objectives, and strategies that would affect multiple species as defined by this program. **This is only a summary.** Methods and risks are discussed in Chapter 4. In addition, habitat improvement objectives include a long list of strategies that are expected to benefit numerous salmonid species as well as many terrestrial and amphibian species. The habitat objectives and strategies are listed in section 2.3 and more fully described in Chapter 10.

Note that objectives and strategies are identified using an alpha-numeric system for ease of tracking in a database. Thus, multi-species objectives and strategies are tagged as MS1 (objective), MS1a (strategy), etc; spring chinook objectives and strategies as SC1 (objective), SC1a (strategy); and so on for each proposed species and habitat action.

Following this list, Table 1 provides a summary of proposed infrastructure additions and upgrades that BPA is being requested to fund from this proposal.

Overall Goal: Protect, restore, and enhance fish species and habitats in the Klickitat basin, while implementing agreements under *U.S. v. Oregon*.

Objective MS1. Focus spring chinook and steelhead programs on supplementation; focus coho and fall chinook programs on harvest augmentation.

> **Strategy MS1a.** Increase production of spring chinook and steelhead at Klickitat Hatchery by eliminating in-basin hatchery production of coho and transferring half the fall chinook production to the lower Klickitat River.
>
> **Strategy MS1b**. To meet coho harvest objectives, rely on releases of coho smolts reared out-of-basin and acclimated in the lower Klickitat.
>
> **Strategy MS1c.** Maintain current production numbers and harvest levels for fall chinook, but change the location of half the production.

Objective MS2. Develop new facilities to meet supplementation, survival, monitoring, and natural production goals for the target species.

> **Strategy MS2a**. Install adult trapping and video monitoring facility at Castile Falls by 2006.
>
> **Strategy MS2b.** Improve passage at Lyle Falls No. 5 fishway by 2006.
>
> **Strategy MS2c.** Install adult trapping and video monitoring at Lyle Falls No. 5 fishway by 2006.
>
> **Strategy MS2d.** Use mobile rotary traps or incline traps at key tributary locations to monitor life history characteristics and basin productivity.
>
> **Strategy MS2e.** By 2006, develop acclimation sites for spring chinook and steelhead in the upper Klickitat basin.
>
> **Strategy MS2f**. By 2007, develop the Wahkiacus Hatchery and Acclimation Facility.

Objective MS3. Comply with independent science recommendations for collecting and reporting the data and statistics critical to measuring overall project success.

> **Strategy MS3a.** Refer to Appendix G for a summary of strategies for collecting and reporting data for monitoring and evaluation purposes.

Table 1. Summary of infrastructure improvements proposed in this master plan

Facility	Location, Action
Lyle Fall Fishway & Broodstock Collection Facility	Lyle Falls Fishway No 5. Rivermile 2.2 • Reconstruct fishway to meet WDFW & NOAA design criteria to facilitate increased upstream passage. • Construct broodstock collection facility within fishway • Construct PIT detecting capabilities within fishway • Construct video monitoring capabilities within fishway
Klickitat Hatchery	Klickitat Hatchery, near Glenwood Washington. Rivermile 42.4 Conduct an engineering design study for Klickitat Hatchery to determine costs and feasibility of the following actions: • Water Transmission Line Replacement - Secure water transmission line by replacing 55 year old steel line. • Spring Intakes - Enhance efficiencies of existing water supplies to increase available water to achieve proper rearing densities. • New Water Supply – Develop new water supplies from available spring water to achieve proper rearing densities. • Adult Holding Pond - Construct new adult holding facility for increased numbers and duration of supplementation broodstock. • Chiller – Install chiller to cool spring water to delay egg incubation in order to closely mimic natural emergence timing. • Pond 25 Upgrade – deliver more spring water to pond, replace pond liner with concrete, redesign and reconstruct Pond #25's sediment retention pond. • Wonder Spring water transmission line - Reroute Wonder Springs water line to energy building to add volume and back-up security to incubation and rearing operations. • Predator Control - Install bird netting over the raceways, and provide power to Pond #26 to operate the electric otter fence. • Hazardous Materials Building – Construct building to meet NPDES requirements for safe storage of hazardous materials away from well-traveled areas.
Castile Falls Fishway Escapement Monitoring	Castile Falls Fishway 10/11. Rivermile 64.0 • Construct drop-in-place aluminum structure to house video monitoring equipment for adult enumeration purposes
McCreedy Creek Acclimation Site	McCreedy Creek Acclimation Site. Rivermile 70.7 Construct acclimation site for supplementation stocks: • 200,000 spring chinook smolts • 200,000 summer steelhead smolts

Table 1 (continued

Facility	Location, Action
Wahkiacus Hatchery & Acclimation Facility	Wahkiacus Hatchery & Acclimation Facility. Rivermile 17.0 • Construct hatchery capable of hatching and early rearing of 2 million URB fall chinook • Construct acclimation ponds for rearing to release 2 million fall chinook. • Construct acclimation ponds for final rearing of 1 million coho pre-smolts. • Construct adult trap to collect coho.

2.2 Species-Specific Goals, Objectives, and Strategies

This section outlines goals, objectives, and strategies for each of the five target species. **Rationale, methods and risks** are discussed in detail in Chapters 5 – 9.

2.2.1 Klickitat spring chinook

Overall Goal: While improving the fitness of the target stock, increase the number of returning spring chinook adults that result from both artificial and natural production (Ferguson and Sharp 2002), which will serve to increase harvest. Consistent with the regional goal of doubling salmon returns (NPPC 1994), the goal is to at least double the annual river mouth return, harvest, and escapement from current levels.

Objective SC1. Increase spring chinook returns, harvest, and natural escapement as follows:

- Total Run: The short-term (10- to 25-year) goal is to increase the number of spring chinook returning to the Klickitat basin to an average of 5,000 to 10,000 fish annually (as compared to the recent average of 1,900), recognizing the cyclic nature of ocean and freshwater conditions and productivity. The longer-term goal is to increase the number of spring chinook returning to the Klickitat basin to an average of 20,000 fish annually, consistent with the goals established in *Wy-Kan-Ush-Mi Wa-Kish-Wit* (CRITFC 1995 and 2000).

- Harvest: Harvest would be managed consistent with guidelines established in *U.S. v. Oregon* agreements. It is expected that in-basin harvest rates would continue to average about 35-40% annually and would rarely exceed 50%.

- Natural Escapement: In most years, more than 50% of the spring chinook return would be available for natural escapement; however, some of these fish will be used for broodstock.

Strategy SC1a. Beginning in approximately 2006, increase the production goal for spring chinook at Klickitat Hatchery from 600,000 to 800,000 smolts, using capacity made available by reductions in hatchery coho production. (The current *U.S. v. Oregon* production plan calls for release of 600,000 smolts and 200,000 fry.)

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Strategy SC1b. By 2006, begin acclimated releases of spring chinook smolts as follows:

- 200,000 from acclimation sites in the upper Klickitat basin
- 600,000 from the on-station acclimation pond at Klickitat Hatchery.

Deleted: 85

Objective SC2. Implement methods to improve the fitness of the spring chinook population.

Strategy SC2a. Transition from hatchery-origin broodstock to natural-origin broodstock, so that by 2010, the vast majority (approaching 100%) of releases would be the progeny of at least one natural-origin parent.

Strategy SC2b. Implement strategies and protocols for broodstock collection, spawning, rearing, and release that are consistent with the strategies and protocols developed under the YKFP for spring chinook in the Yakima River basin.

Strategy SC2c. Beginning with the 2002 brood, reduce the size of smolts at release to more closely match the size of natural migrants.

Objective SC3. Monitor and evaluate survival, life history, and habitat use.

Strategy SC3a. Use rotary traps and manual PIT tag detection (hand-held portable scanners) to document juvenile emergence timing, out-migration timing, and age composition; and to estimate overall basin productivity (by treatment group).

Strategy SC3b. Use coded wire tags and PIT tags to assess differences in survival (smolt-smolt and smolt-adult) among sizes of fish released and acclimation/release locations.

Strategy SC3c. Continue to conduct foot/boat spawner surveys throughout the Klickitat basin.

Strategy SC3d. Use radio telemetry, mark-recapture, and/or run reconstruction to determine passage and entrainment rates at Lyle and Castile Falls and to track natural spawners to their spawning grounds.

Strategy SC3e. Implement automated data tracking systems in use at Cle Elum and Prosser hatcheries.

Objective SC4. Monitor and evaluate ecological interactions.

Strategy SC4a. Use findings from Yakima and upper Columbia Basin studies in conjunction with information from risk assessments to target ecological interactions studies in the Klickitat basin.

Objective SC5. Monitor and evaluate the genetic changes in the spring chinook population, both hatchery and naturally produced.

Strategy SC5a. Collect DNA samples and morphometric data from fish passing through the Lyle Falls and Castile Falls traps. Use findings from Yakima and other Columbia Basin studies in conjunction with information from these samples to target genetic studies in the Klickitat basin. Convene meetings of tribal and state geneticists as necessary to further develop sampling rates, protocols, and evaluation measures.

Objective SC6. Monitor in-basin and Columbia River harvest of Klickitat-origin spring chinook.

Strategy SC6a. Increase tribal and sport fishery monitoring and bio-sampling rates as necessary to maintain a minimum 20% sampling rate.

Strategy SC6b. Update and maintain all Klickitat-related databases with historical and current harvest data.

Strategy SC6c. Use run reconstruction methods developed for Yakima basin spring chinook to reconstruct Klickitat run and harvest to the Columbia River mouth.

Strategy SC6d. Use the regional mark information system (RMIS) to monitor CWT recoveries of Klickitat spring chinook in marine and freshwater fisheries coast-wide.

2.2.2 Klickitat winter and summer steelhead

Objective S1. Rebuild natural populations of steelhead in the Klickitat subbasin.

Strategy S1a. Use supplementation to enhance the summer-run steelhead stock.

Strategy S1b. Beginning in 2006, release summer steelhead from new acclimation sites above Castile Falls.

Strategy S1c. Beginning in approximately 2006, eliminate scatter-plant releases of 120,000 Skamania stock steelhead smolts in the Klickitat subbasin.

Strategy S1d. Collect data to test the feasibility of using supplementation to enhance the winter-run steelhead population in the Klickitat subbasin.

Strategy S1e. Investigate feasibility of using the Wahkiacus Hatchery and Acclimation Facility (WHAF) for steelhead rearing and release either as an acclimation site or for kelt reconditioning.

Objective S2. Monitor and evaluate ecological interactions.

Strategy S2a. Use findings from Yakima and upper Columbia Basin studies in conjunction with information from risk assessments to target ecological interactions studies in the Klickitat basin.

2.2.3 Klickitat coho

Overall Goal: Focus the Klickitat coho program on harvest augmentation, with a combined annual average harvest (ocean, Columbia River, and Klickitat basin) of approximately 14,000 coho, while releasing in-basin production capacity for priority species (spring chinook and steelhead).

Objective C1. Reduce efforts to establish a natural run of coho in the Klickitat subbasin.

Strategy C1a. Beginning in approximately 2006, eliminate production of approximately one million coho at Klickitat Hatchery, and phase out direct stream releases of coho in the Klickitat subbasin if harvest goals can be met with acclimated smolts.

Strategy C1b. Install an adult trap at the outfall of the Wahkiacus acclimation site.

Objective C2. Maximize survival of coho releases to ensure continuation of substantial returns of coho to Columbia and Klickitat river fisheries.

Strategy C2a. Develop a new acclimation site (Wahkiacus) for coho in the lower Klickitat subbasin.

Strategy C2b. Beginning in 2006, release one million coho smolts (transferred from facilities in the Lower Columbia Basin) from acclimation site(s) in the lower Klickitat subbasin.

Objective C3. Maintain a combined average annual harvest (ocean, Columbia River, and Klickitat basin) of approximately 14,000 coho.

Strategy C3a. Continue direct stream releases of coho pre-smolts until studies show that acclimated smolt releases can meet harvest goals.

Strategy C3b. If the 1 million acclimated smolt releases meet harvest goals, investigate alternative locations in the Columbia Basin above Bonneville Dam for release of the 2.5 million *U.S. v. Oregon* coho currently programmed for the Klickitat subbasin that are scatter planted directly into the river.

Objective C4. Monitor and evaluate factors that will help to determine whether goals and objectives are being achieved.

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Strategy C4a. Monitor and evaluate survival of acclimated and direct-stream-released coho.

Strategy C4b. Monitor and evaluate harvest numbers of acclimated and direct-stream-released coho.

Strategy C4c. Conduct spawning surveys in the Klickitat basin to determine location and amount of natural coho spawning.

Strategy C4d. Use findings from Yakima and upper Columbia Basin studies in conjunction with information from risk assessments to target ecological interactions studies in the Klickitat basin.

Strategy C4e. Use the regional mark information system (RMIS) to monitor CWT recoveries of Klickitat coho releases in marine and freshwater fisheries coast-wide.

2.2.4 Klickitat fall chinook

Overall Goal: Maintain the Klickitat fall chinook program for harvest augmentation, with a combined annual average harvest (ocean, Columbia River, and Klickitat basin) of 14,000 fish.

Objective FC1. Leave current production numbers unchanged at 4 million.

Strategy FC1a. Maintain production of 4 million URB (Priest Rapids Hatchery) fall chinook in the Klickitat subbasin. Shift half the production from Klickitat Hatchery to the Wahkiacus Hatchery and Acclimation Facility.

Objective FC2. Distribute fall chinook spawning throughout the lower Klickitat subbasin.

Strategy FC2a. By 2007, release half the current 4 million fall chinook production from the Wahkiacus facility in the lower Klickitat.

Objective FC3. Monitor and evaluate factors that will help to determine whether goals and objectives are being achieved.

Strategy FC3a. Monitor and evaluate survival.

Strategy FC3b. Monitor and evaluate harvest numbers.

Strategy FC3c. Conduct spawning surveys in the Klickitat subbasin to determine location and amount of natural spawning.

Strategy FC3d. Use the regional mark information system (RMIS) to monitor CWT recoveries of Klickitat fall chinook releases in marine and freshwater fisheries coast-wide.

2.2.5 Pacific lamprey

Overall Goal: Rebuild the lamprey population in the Klickitat basin to a self-sustaining level that is capable of supporting harvest.

Objective L1. Determine feasibility of rebuilding lamprey populations in the Klickitat basin.

Strategy L1a. Develop baseline data on current existing lamprey population levels, distribution, limiting factors, and potential carrying capacity for the Klickitat basin.

2.3 Habitat Improvement Goal and Objectives

Overall Goal: Restore, enhance, and protect stream habitat and watershed conditions in the Klickitat subbasin, emphasizing actions that benefit native fish populations.

Objective H1. Assess habitat conditions and evaluate need for restoration, enhancement, and/or protective measures.

Objective H2. Identify, prioritize, and plan actions that address needs identified in Objective H1.

Objective H3. Implement projects that address actions identified in Objective H2.

Objective H4. Monitor habitat conditions and evaluate project effectiveness and further need for restoration, enhancement, and/or protective measures at site-specific and subbasin scales.

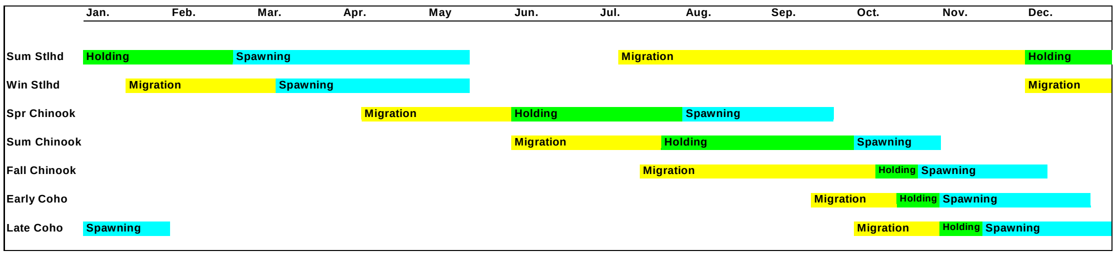
Chapter 3. Existing Environment

3.1 The Historical and Current Status of Anadromous and Resident Fish in the Subbasin

This section discusses the status of each of the five target species: spring chinook, steelhead, coho, fall chinook, and Pacific lamprey. Figure 2 shows the run timing of four of the target species in relationship to each other and to other selected salmonid runs. These relationships are important in assessing the potential for ecological interactions between species.

Section 3.2 briefly describes the status of other important fish species in the Klickitat basin.

Figure 2. Klickitat Basin Anadromous Adult Run Timing by Stock



Source: YN Fisheries and WDFW 2000

3.1.1 *Spring chinook (Oncorhynchus tshawytscha)*

Spring chinook salmon are native to the Klickitat River basin. Bryant (1949) cited reports of large runs of spring chinook and a significant tribal fishery at Lyle Falls (RM 2) prior to about 1920, despite difficult passage at the falls. By 1951, the annual spring chinook run varied from 1,000 adults to 5,000 adults (WDFW 1951 [in] Sharp 2000).

The Klickitat Hatchery (RM 42.5) and two fishways at Lyle Falls were constructed in 1952, using Mitchell Act funds. Managers trapped spring chinook broodstock at the upper fishway (Falls 5) each year from 1952 through at least 1959. Estimates of spring chinook run sizes ranged from 1,614 fish to 3,488 fish, with a mean of 2,523 fish (adults plus jacks).

Since 1977, estimates of spring chinook (adults plus jacks) returning to the Klickitat River mouth have ranged from about 500 to 5,300 fish, averaging about 1,900 fish annually (Table 2). In-basin harvest has ranged from under 100 to nearly 1,800 fish, averaging about 800 fish annually. Tribal fishers account for nearly 75% of the harvest on average since 1977.

Based on redd counts, natural escapement has ranged from under 100 fish to about 1,100 fish and averaged about 300 fish since 1977 (Table 2). These figures likely include some hatchery-origin fish spawning in the wild. While WDFW considers this population depressed (WDF & WDW 1993), these fish are not listed under the Endangered Species Act.

Table 2. Klickitat spring chinook (adult age 4/5/6) returns, harvest, and escapement

Return Year	Returns			Harvest					Escapement		
					Sport		Tribal				
	Total	Hat.	Wild	Total	Hat.	Wild	Hat.	Wild	Total	Hat.	Wild
1977	533	380	153	95	6	3	61	25	438	312	126
1978	1,528	1,160	368	906	202	64	486	154	622	472	150
1979	851	773	78	89	81	8	0	0	762	692	70
1980	1,685	1,619	66	67	6	0	59	2	1,618	1,555	63
1981	2,528	2,211	317	574	133	19	369	53	1,954	1,709	245
1982	3,238	2,988	250	1,775	399	33	1,239	104	1,463	1,350	113
1983	2,417	2,190	227	1,745	256	27	1,325	137	672	609	63
1984	1,323	1,086	237	754	268	59	350	77	569	467	102
1985	848	340	508	716	73	108	215	320	132	53	79
1986	1,112	860	252	485	19	5	357	104	627	485	142
1987	1,682	1,235	447	507	118	42	255	92	1,175	863	312
1988	3,929	2,239	1,690	1,353	141	107	630	475	2,576	1,468	1,108
1989	5,254	4,807	447	1,783	760	71	871	81	3,471	3,176	295
1990	2,583	1,858	725	1,785	256	100	1,028	401	798	574	224
1991	1,477	1,018	459	702	96	43	388	175	775	534	241
1992	1,540	1,026	514	587	82	41	309	155	953	635	318
1993	3,702	2,985	717	1,483	228	55	967	233	2,219	1,789	430
1994	958	831	127	233	44	7	158	24	725	629	96
1995	696	606	90	140	0	0	122	18	556	484	72
1996	1,156	782	374	308	97	46	112	53	848	574	274
1997	1,861	1,083	778	437	157	113	97	70	1,424	829	595
1998	702	397	305	149	8	6	76	59	553	313	240
1999	728	578	150	151	60	16	60	15	577	458	119
2000	2,708	1,601	1,107	1,446	233	162	621	430	1,262	746	516
2001	1,126	595	531	464	66	58	180	160	662	350	312
2002	2,330	1,143	1,187	568	76	78	203	211	1,762	864	898
2003[1]	3,892	1,895	1,997	1,666	333	350	479	504	2,226	1,084	1,142
Avg:	1,940	1,418	522	776	155	60	408	153	1,164	855	309

Data source: R. Pettit, WDFW database, 3/18/2004.

1. Preliminary

Figure 3 shows distribution of spring chinook in the basin. Currently 600,000 hatchery smolts are released on-station at the Klickitat Hatchery. On average, approximately 150,000 hatchery fry also are out-planted in the upper basin above Castile Falls (RM 64) as a thinning release in late spring.

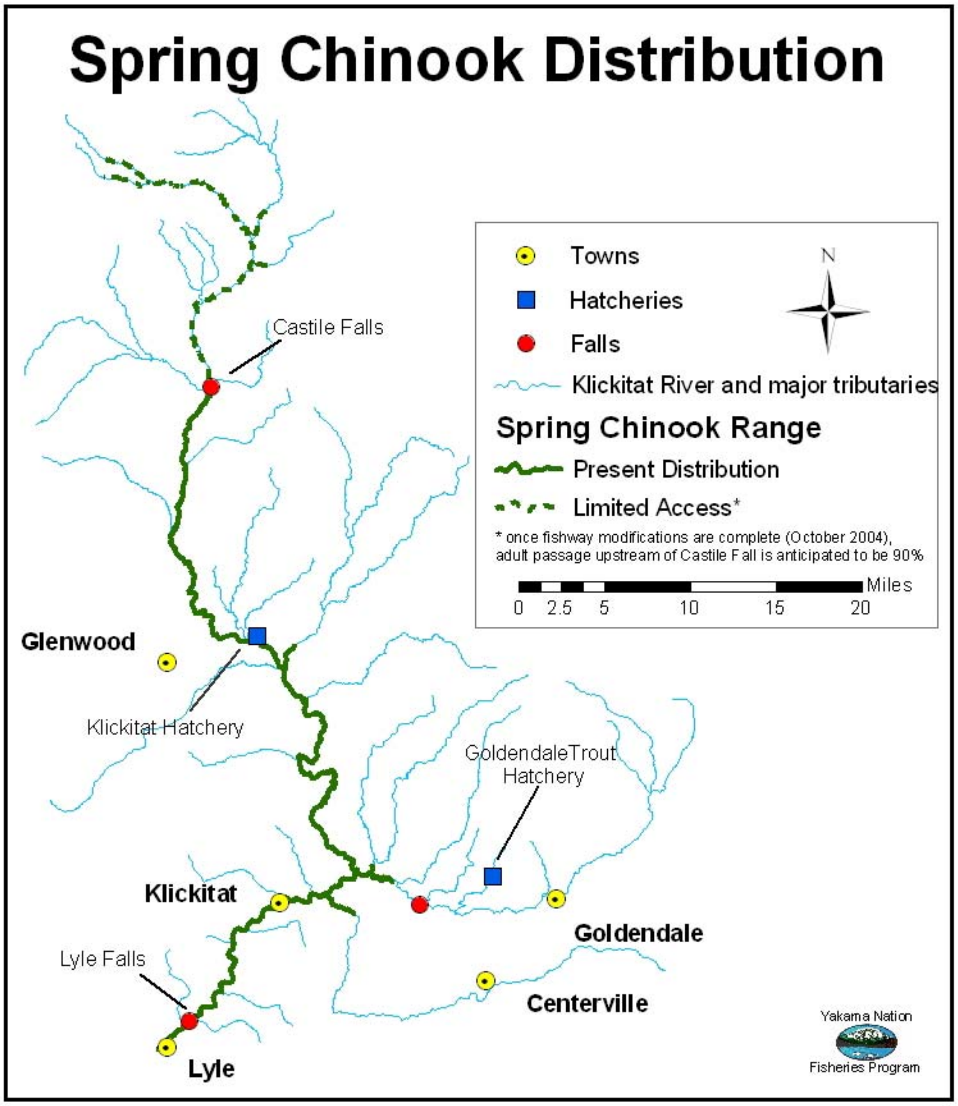


Figure 3. Spring Chinook Distribution in the Klickitat Basin

On average, the Klickitat spring chinook run is comprised of approximately 75% hatchery and 25% wild/natural fish (Table 2). The genetic divergence found between the Klickitat River wild spring chinook population and the Klickitat Hatchery population (Marshall 2000) suggests some amount of reproductive isolation between the two, or perhaps that some natural or production-related factors are maintaining differentiation despite exchange of spawners between them.

Several factors have adversely affected natural production of spring chinook in the Klickitat River.

- Domestication of the hatchery stock may have resulted in a fish that is unable to exploit the upper Klickitat subbasin. Potential truncation of run timing and reduction of overall body size has resulted in an existing hatchery stock that cannot negotiate Castile Falls as effectively as the wild stock. Recently completed hydraulic surveys of Castile Falls illustrate this point. Flow analysis and swimming dynamics of spring chinook indicate that early big fish would have been able to pass April flows at a 60 % success rate, with diminished success on the descending hydrograph (Sharp 2000). The native wild stock negotiating these falls were presumed to be larger fish, thus more fecund and able to produce more offspring to use the available habitat.
- Passage "improvements" to the falls in the 1960s inadvertently resulted in decreased passage.
- More than 70 years of habitat degradation (livestock grazing, logging and road construction) in the upper basin have diminished the quality and quantity of the required key habitat for the incubation and rearing life stages.
- Active debris flows and glacial outwash from the east slope of Mt. Adams result in high mainstem suspended sediment during summer months that colors the Klickitat River from the West Fork to the Columbia River 63 miles downstream. This adversely affects natural production for all species that spawn in the mainstem Klickitat below the Big Muddy Creek confluence (Sharp 2000).

According to the draft HGMP (in development via a Columbia Basin-wide process which NOAA Fisheries is leading), spring chinook spawning occurs between Leidl Bridge (RM 32) and McCormick Meadows (RM 84). The bulk of spawning (96% in 1998) occurs between the confluence with Big Muddy Creek (RM 54) and Castile Falls (RM 64). A project to improve passage at Castile Falls (see Appendix B) is expected to allow spring chinook to access 35 miles of spawning habitat above the falls; in 1998, only 3% spawned above the falls. Spawning is limited in the reach between the confluence with Big Muddy Creek and the Klickitat Hatchery (none in 1998). Spring chinook generally spawn above the hatchery from mid-August to mid-September and from mid- to late September in the area downstream from the hatchery. Spring chinook are not known to spawn in tributaries, although juveniles have been found rearing in the lower reaches of several tributaries.

The tribal fishery is generally open Tuesdays through Saturdays from early April until the end of May and closes for most of June to allow adequate escapement to the Klickitat Hatchery. In years of lower abundance, the tribal fishing season has been shortened by a day or two each week. The sport fishery is generally open 1-3 days per week downstream of the Fisher Hill Bridge (RM 1.8). In years of higher abundance, the fishery is generally open above Lyle Falls to the hatchery.

3.1.2 Steelhead (summer and winter) (*Oncorhynchus mykiss*)

The Klickitat River basin supports two runs of steelhead, winter and summer. Both are native to the system. The winter run is one of only two populations of inland winter steelhead in the United States (NMFS 1999) (the other is in Fifteenmile Creek). Both runs of Klickitat River steelhead are part of the Mid-Columbia Evolutionarily Significant Unit (ESU) and were listed as Threatened under the ESA in March of 1999 (NMFS 1999).

The Mid-Columbia steelhead ESU, as described by National Marine Fisheries Service[5] (NMFS), occupies the Columbia River Basin from Mosier Creek, Oregon, upstream into the Yakima River subbasin in Washington. In proposing to list this ESU, NMFS cited low returns to the Yakima River, poor abundance estimates for Klickitat River and Fifteenmile Creek winter steelhead, and an overall decline for naturally producing stocks within the ESU (NMFS 1999a). Figure 4 shows their distribution in the Klickitat basin. Figure 2 at the beginning of Chapter 3 shows the life history differences between the two runs.

Approximately 120,000 summer-run steelhead from the Skamania Trout Hatchery and Vancouver Hatchery are currently released directly into the Klickitat River annually. Broodstock is made up of Skamania Hatchery returns, although founding broodstock for the Skamania stock included adults trapped in the Klickitat River. Like the Wind River, the Klickitat River has had releases from the Skamania and Vancouver hatcheries for 40 years. Releases were also made from the Beaver Creek Hatchery, Goldendale Hatchery, and Naches Hatchery. Unlike the Wind River, where steelhead releases were terminated because of potential adverse genetic effects on wild steelhead, releases in the Klickitat River were decreased rather than terminated. Skamania steelhead releases in the Klickitat River are mainly to provide for sport fisheries in the river.

In addition to the Skamania stock releases, approximately 200,000 eyed steelhead eggs from Wells Hatchery have been transferred to the Klickitat Hatchery annually for incubation and early rearing and then transferred to Ringold Hatchery for rearing to smolt size and release. Hatchery-reared winter steelhead have never been released in the Klickitat basin (Sharp 2000).

Using available redd count data and assuming an average of 2.5 fish per redd, the average escapement of naturally spawning (summer and winter, hatchery and wild combined) steelhead in the Klickitat River from 1987 to present has been fewer than 630 fish (Table 3). This figure undoubtedly is an underestimate due to the inherent difficulty in conducting accurate counts during spring flow conditions.

Mainstem spawning distribution of steelhead is concentrated between RM 5 and RM 50, with occasional spawning above Castile Falls (RM 64, Figure 4). Tributary spawning occurs in Swale, Summit, and White creeks, the lower (and occasionally upper) Little Klickitat River, and other smaller tributaries.

Harvest of steelhead in the Klickitat River has averaged about 2,100 fish annually from 1987 to 2002 (Table 3). Sport fisheries require anglers to release unmarked fish, so the majority of sport harvest is presumed to be of hatchery origin. Tribal harvest regulations do not require the release of unmarked fish. To protect the winter run, current regulations prohibit sport fishing for

[5] Now called NOAA (National Oceanic and Atmospheric Administration) Fisheries.

steelhead in the Klickitat River from December through May, and the treaty fishery is closed from January through March.

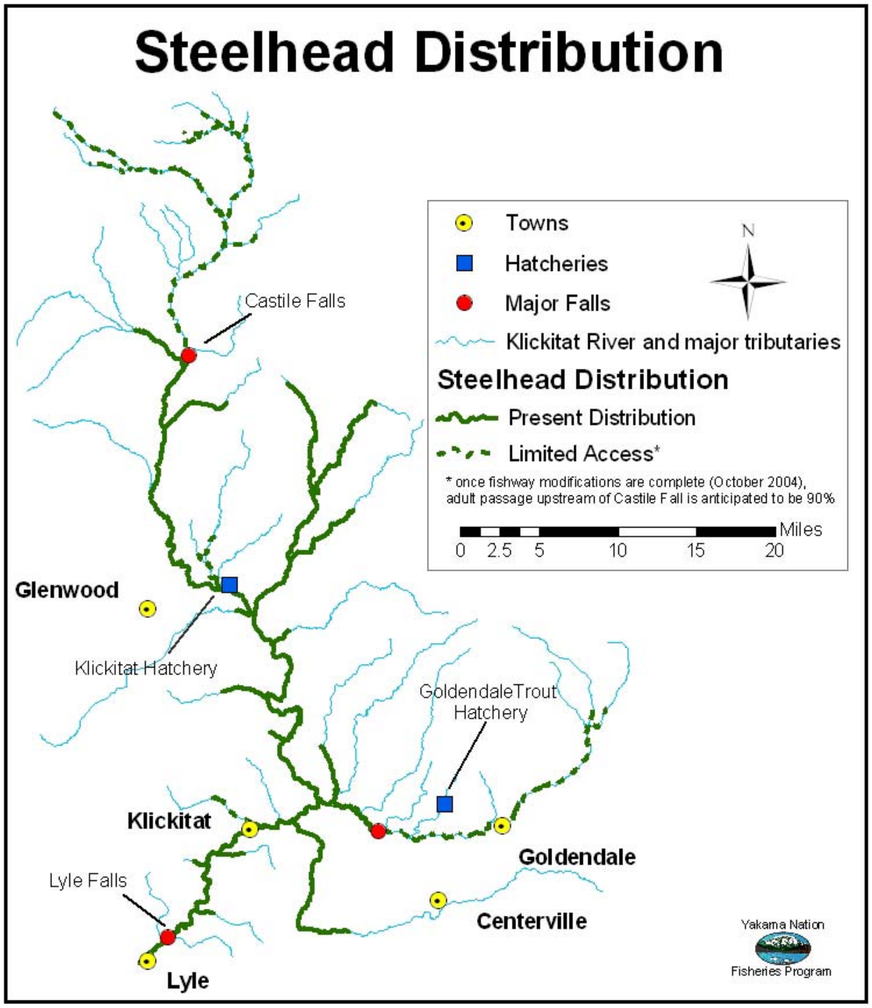


Figure 4. Summer and Winter Steelhead Distribution in the Klickitat Basin

Table 3. Estimated harvest and minimum run size and escapement data for Klickitat River steelhead, 1986-2003

Year	Run[1]	Harvest[2]		Escape[3]	Redds[4]
		Sport	Tribal		
1986-87	9,834	1,480	6,008	2,346	
1987-88	3,751	1,514	1,342	895	
1988-89	4,208	1,718	1,486	1,004	
1989-90	1,702	833	631	238	95
1990-91	2,957	1,055	1,722	180	72
1991-92	3,595	831	1,906	858	
1992-93	3,251	1,260	1,215	776	
1993-94	3,402	1,236	1,354	812	
1994-95	1,915	891	567	457	
1995-96	1,714	873	418	423	169
1996-97	1,081	621	284	176	71
1997-98	2,140	1,080	490	570	228
1998-99	1,437	662	179	596	239
1999-00	1,728	603	217	908	363
2000-01	2,845	1,489	559	797	319
2001-02	5,186	3,713	712	761	304
2002-03[5]			1,014	725	290
Avg:[6]	2,727	1,225	872	630	207

Deleted: Year ... [1]

1. Sum of harvest and escapement.
2. From YN and WDFW databases and *U.S. v. Oregon* Technical Advisory Committee reports.
3. Assumes 2.5 fish per redd. For years when redd counts were unavailable, assumes average escapement-to-total-harvest ratio from years when redd counts were available.
4. Actual redd counts expanded for mileage surveyed.
5. Data are preliminary.
6. Average is for 1987-88 through 2001-02.

3.1.3 Coho (*Oncorhynchus kisutch*)

Coho are not native to the Klickitat basin. Although the Klickitat Hatchery was not completed until 1952, coho releases apparently began in the Klickitat River in 1951, or earlier, as 29 adults were reported to have returned to the hatchery in 1952. Table 4 shows run sizes since 1986.

Table 4. Estimated harvest and run size information for Klickitat River coho (adults and jacks combined), 1986-2002

Year	Klickitat River[1]			L. Col. R.	Marine[4]	Total
	Run	Harvest	Escape[2]	Harvest[3]	Harvest	Harvest
1986	43,056	33,147	9,909	30,250	97,999	161,395
1987	326	256	70	184	639	1,079
1988	12,795	9,619	3,176	8,952	20,610	39,182
1989	9,163	7,185	1,978	5,743		12,928
1990	3,160	2,478	682	1,169		3,647
1991	10,036	7,870	2,166	7,263	17,540	32,673
1992	552	433	119	240	2,044	2,717
1993	568	446	123	277	1,557	2,280
1994	4,016	3,149	867	1,501		4,650
1995	2,081	1,632	449	653		2,285
1996	896	698	198	231	3,200	4,129
1997	1,470	1,010	460	402	2,504	3,916
1998	3,379	2,846	533	546	3,580	6,972
1999	3,930	3,435	495	1,176	5,662	10,274
2000	5,808	4,871	938	1,855	6,744	13,470
2001	14,078	10,450	3,628	5,067	29,276	44,793
2002	4,956	3,756	1,200	1,765		5,521
Avg[5]:	4,826	3,758	1,067	2,381	8,487	14,680

1. YN and WDFW database estimates.
2. Derived from redd count data assuming 2.5 fish per redd. For years when redd counts were unavailable, assumes average escapement-to-total-harvest ratio from years when redd counts were available. These data are likely underestimates, as water conditions often preclude accurate redd count estimates.
3. Derived from *U.S. v. Oregon* Technical Advisory Committee reports.
4. Derived from Regional Mark Information System (RMIS) recovery year data for marine and freshwater coded-wire tag (CWT) recoveries of coho released in the Klickitat River.
5. Klickitat River data are 1987-2002 averages. Averages for all other data are also for the period 1987-2002 and are exclusive of years when available CWT recovery data preclude an accurate estimate of marine harvest.

Currently, 3.5 million hatchery coho smolts are released in the basin for harvest augmentation. They are primarily late-run stock transferred from lower Columbia River hatcheries. Of the total, 1.0 million are transferred as either eyed eggs or pre-smolts to Klickitat Hatchery for on-station rearing and release. The remaining 2.5 million smolts are transported from Washougal Hatchery and the majority released directly into the Klickitat River between RM 10 and 17. The average annual harvest of coho from Klickitat River releases in combined ocean, Columbia River, and Klickitat River fisheries is nearly 15,000 fish (Table 4).

The hatchery releases have resulted in a small population of naturally spawning fish. Figure 5 shows coho distribution in the basin. Coho spawn on the mainstem Klickitat River between RM 5 and RM 42; in Summit, White, and Swale creeks; and in the lower Little Klickitat River. Natural escapement estimates of coho in the Klickitat River have ranged from about 100 to nearly 4,000 fish from 1987 to 2002 (Table 4).

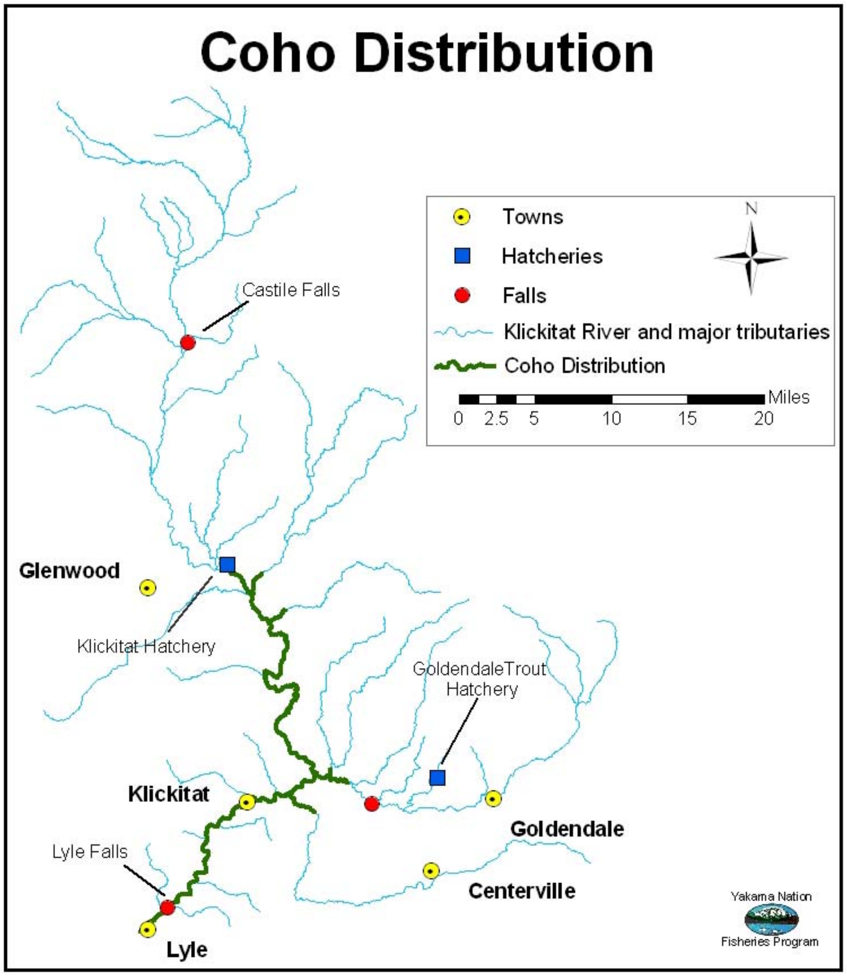


Figure 5. Coho Distribution in the Klickitat Basin

3.1.4 Fall chinook (Oncorhynchus tshawytscha)

Early-fall and/or tule stock

Like coho, fall chinook are not indigenous to the Klickitat basin. Managers and biologists assume that Lyle Falls was impassable to chinook during the low water conditions that generally prevail in late summer and early fall (Bryant 1949). Low egg survival for fall chinook is believed to be the result of glacial sediment from Big Muddy Creek in the Klickitat River.

Hatchery fish from outside the basin were first released in 1946. Releases from the Klickitat Hatchery began in 1952 and continued until 1986. Releases have included stocks from Cowlitz, Toutle, Kalama, Washougal, Bonneville, Cascade, and Ringold hatcheries. The Klickitat fall chinook program was originally developed to rear tule fall chinook from the Spring Creek National Fish Hatchery, which is on the Columbia River, a few miles downstream of the Klickitat River. When the Spring Creek program failed to provide the necessary eggs, the program was changed to upriver bright (URB) chinook (see next section). It is assumed that tule fall chinook from the Spring Creek NFH and other lower Bonneville Pool tributaries occasionally stray into the Klickitat River.

Chinook natural spawners assumed to be summer chinook were sampled for genetic analysis annually from 1991 to 1994 (Marshall 2000). Naturally spawning fall chinook also were sampled during the same period and a very low level of genetic differentiation was found between the sampled summer and fall chinook. Both “summer” and “fall” populations as sampled were relatively similar genetically to “URB” populations in various mid- and up-river hatcheries and in Hanford Reach. None of these sampled chinook showed genetic profiles (allele frequencies) similar to “tule” fall chinook at Spring Creek Hatchery or in the major rivers below Bonneville Dam (e.g., Washougal, Cowlitz, Lewis), which was expected given the historical hatchery stock releases. These results were presented and discussed by Marshall (2000), including a speculative discussion of origins and continuity of the “summer” or early returning group.

Since 1986, production of early-fall or tule chinook has been entirely natural, although comprised primarily of hatchery strays. Natural production estimates from recent (1995-1999) spawner surveys indicate an average natural escapement of 675 adults, primarily in the mainstem between RM 5 and RM 42 (Figure 6).

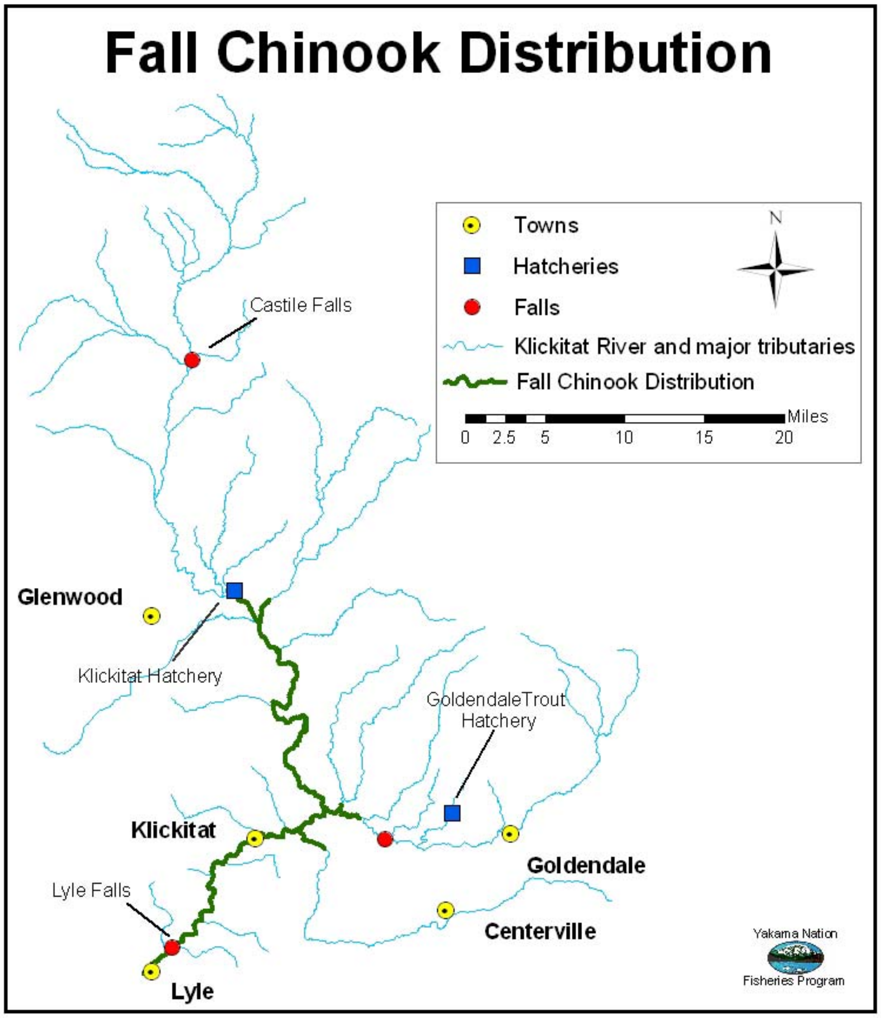


Figure 6. Fall Chinook Distribution in the Klickitat Basin (Early-Fall/Tule and Upriver Bright)

Upriver Bright (URB) stock

Beginning in 1986, Klickitat Hatchery production switched from the tule stock to an upriver bright (URB) fall chinook. Currently, 4 million hatchery URB smolts are released on-station annually, primarily for harvest augmentation. Eyed eggs currently are transferred from Priest Rapids Hatchery to the Klickitat Hatchery for final rearing. Genetic analysis of naturally spawning Klickitat fall chinook sampled from 1991 to 1994 showed them to be very similar genetically to URB chinook at Priest Rapids Hatchery and in Hanford Reach; and they were closely associated with URB populations at Bonneville and Little White Salmon hatcheries and in the Yakima River (Marshall 2000). Klickitat fall chinook were not genetically similar to

Lyons Ferry Hatchery Snake River stock, Snake River natural-origin fall chinook, or Deschutes River fall chinook.

The average annual harvest of fall chinook from Klickitat River releases in combined ocean, Columbia River, and Klickitat River fisheries is estimated to exceed 14,000 fish (Table 5). Natural escapement estimates of fall chinook in the Klickitat River have ranged from about 2,500 to nearly 15,000 fish from 1989 to 2002 (YN and WDFW databases). Natural escapement is a combination of URB and tule (primarily hatchery strays) stock, with tule escapement ranging from about 500 to 2,000 fish annually (TAC 1997). URB fall chinook spawn in the mainstem Klickitat River between RM 5 and RM 42. Figure 6 shows combined tule and URB fall chinook distribution in the basin.

Table 5. Estimated harvest and run size information for Klickitat River fall chinook (adults and jacks, early-fall/tule and URB stocks combined), 1986-2002

Year	Marine[1] Harvest	Columbia R. Mouth Return	Col. R. Harvest[2]		Bonn. Passage Loss[3]	Klickitat R. Mouth Return[4]	Klickitat Harvest[4]	Total Harvest
			Zones 1-5	Zone 6				
1986		25,708	9,022	7,453	462	8,770	8,108	24,584
1987		6,668	2,684	1,633	118	2,234	1,527	5,843
1988		4,204	1,922	996	64	1,221	1,221	4,139
1989	9,323	14,208	6,755	2,868	229	4,356	1,764	20,711
1990	15,270	12,817	4,109	2,952	288	5,468	1,574	23,906
1991	3,553	10,349	2,763	1,547	302	5,737	2,791	10,654
1992		7,687	1,694	1,169	241	4,583	1,148	4,011
1993	23,267	6,520	1,339	1,407	189	3,586	1,118	27,130
1994	1,060	6,823	302	745	289	5,487	1,249	3,357
1995	3,446	5,282	308	539	222	4,213	1,470	5,763
1996	4,475	13,805	1,665	1,528	531	10,081	3,704	11,373
1997	4,196	16,664	2,257	1,839	628	11,940	3,612	11,904
1998	3,732	18,036	2,328	1,455	713	13,541	3,504	11,018
1999	5,193	23,272	2,828	1,596	942	17,906	3,335	12,952
2000	8,163	21,936	3,332	3,098	775	14,730	5,241	19,834
2001	2,648	12,953	2,361	2,703	394	7,495	3,065	10,776
2002		24,961	4,168	5,365	771	14,657	2,892	12,425
Avg:		13,641	2,932	2,288	421	8,000	2,784	12,964
Avg[5]:	7,027	13,556	2,529	1,856	459	8,712	2,702	14,115

1. Derived from Regional Mark Information System (RMIS) recovery year data for marine and freshwater coded-wire tag (CWT) recoveries of fall chinook released in the Klickitat River.
2. Derived from *U.S. v. Oregon* Technical Advisory Committee reports.
3. Assume 5% passage attrition ascending Bonneville Dam and through the reservoir.
4. YN and WDFW database estimates.
5. Exclusive of years when available CWT recovery data preclude an accurate estimate of marine harvest.

3.1.5 Pacific lamprey (*Lampetra tridentata*)

Pacific lampreys are known to occur in the Klickitat basin. The historic and present distribution and status are relatively unknown. Juvenile out-migrants are collected at the rotary screw trap station at RM 2.8. Adult Pacific lampreys have been observed at RM 57. Fine sediment from the Klickitat Glacier provides required rearing conditions during the ammocoete life stage of the Pacific lamprey.

3.2 Other Anadromous and Resident Fish in the Basin

3.2.1 Summer chinook (*Oncorhynchus tshawytscha*)

It is presently unknown whether a summer race of chinook exists that is distinct from spring or fall chinook in the Klickitat basin. See discussion in section 3.1.4.

3.2.2 Resident rainbow trout (*Oncorhynchus mykiss*)

Resident rainbow trout are found throughout the Klickitat basin. Naturally reproducing populations exist within the mainstem from RM 85 to the Columbia River confluence and in virtually all tributaries.

The Yakama Nation currently releases 4,500 hatchery "catchable" rainbow trout on the reservation, 95% of which are planted in high mountain lakes in the western portion of the basin and at two river locations (Table 6). Lake-planted rainbow trout have been observed in outlet streams below the planted lakes.

Table 6. Hatchery trout plants on YN Reservation: average annual hatchery catchable trout plant released into the upper Klickitat basin 2001-2003

Annual Release	Release Location Lat/Long	Tributary to:	# Fish per Pound	Average Annual Number of Fish
Surveyors Creek	46^0 12' 31" N, 121^0 13' 44" W	Klickitat River	3.0	150
Klickitat River @ Twin Bridges	46^0 12' 53" N, 121^0 11' 23" W		3.0	192
Fish Lake Stream	46^0 16' 32" N, 121^0 18' 45" W	West Fork	3.0	568
Mt. Adams Lake	46^0 15' 04" N, 121^0 20' 26" W	Crawford Creek	3.0	1,600
Howard Lake	46^0 23' 45" N, 121^0 22' 15" W	Fish Lake - Fish Lake Stream	3.0	1,250
Tract D lakes - Bench Lake	46^0 09' 34" N, 121^0 23' 54" W	Outlet Creek	2.5 lbs each	700
Tract D lakes - Mirror Lake	46^0 08' 20" N, 121^0 25' 23" W	Outlet Creek	5 lbs each	70

Data from the 2001 - 2003 seasons are indicative of annual plants over the last ten years.
Beginning in 2002, all releases are triploids (sterile) releases.
Stock Source is Trout Lodge, Ephrata Washington

WDFW also plants over 6,000 catchable rainbow trout annually into the Klickitat drainage. The Little Klickitat River near Goldendale receives 1,500; approximately 1,182 are planted in several tributaries of the Little Klickitat; 1,688 go into Spring Creek near Goldendale Fish Hatchery; and another 1,688 go into Outlet and Bird creeks.

3.2.3 Bull trout (Salvelinus confluentus)

Bull trout are listed as Threatened under the ESA. Research on bull trout life history has been on-going for several years, in a cooperative effort between YN and WDFW under a BPA contract. While the life history of bull trout in the mainstem is not yet clearly understood, they have been found in the lower mainstem (from Klickitat Hatchery downstream), as well as in West Fork and several of its tributaries. Figure 7 shows the known current bull trout distribution in the Klickitat subbasin.

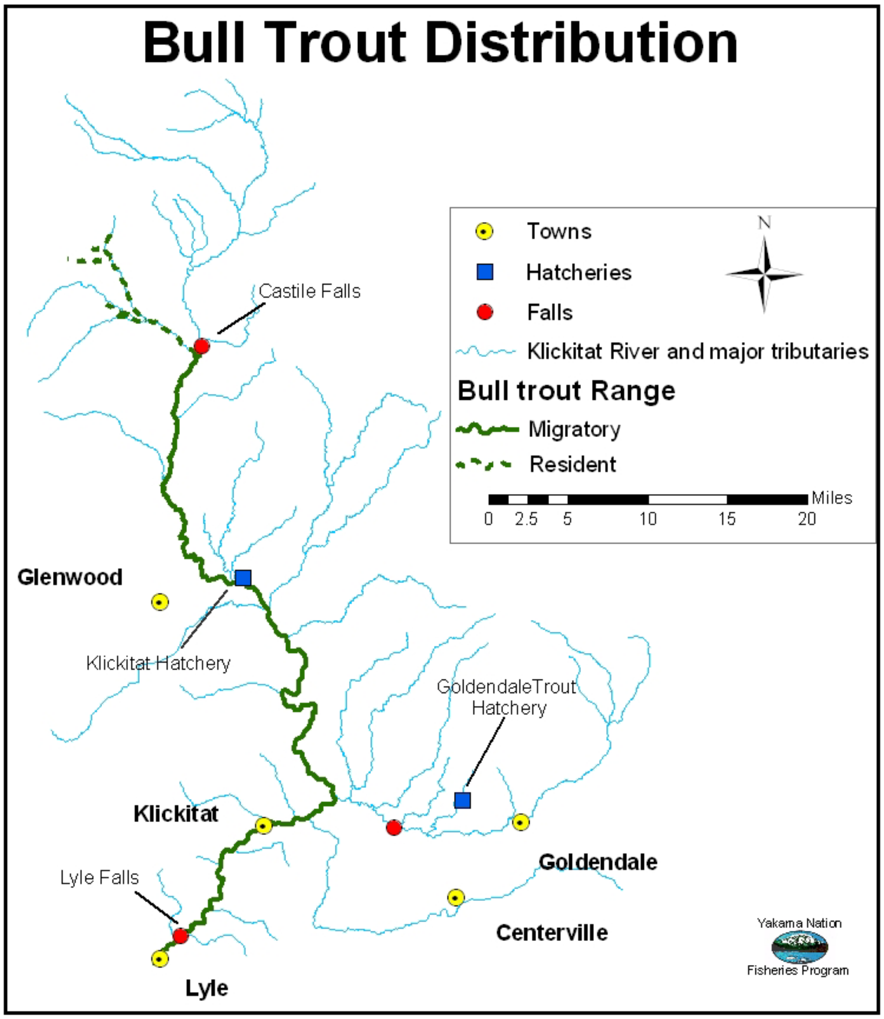


Figure 7. Bull Trout Distribution in the Klickitat Basin

Numerous electro-fishing and snorkeling surveys in the West Fork drainage have observed bull trout that are consistent with a resident life-history size (i.e., generally 10 inches in length and smaller). Portions of the West Fork watershed drain the Primitive Area of the Yakama Reservation, which includes some of the most remote and unroaded areas within the Klickitat subbasin. The presence of brook trout—an introduced species—in these areas raises concerns about hybridization. Falls on the lower West Fork likely isolate most of the resident bull trout population from the mainstem.

Recent evidence indicates fluvial bull trout may also be present in the basin. In 1998, CRITFC tribal pikeminnow gillnetters reported capturing two bull trout at the river's mouth. In May 2000, an additional bull trout recovery and release was reported at the Pikeminnow Sport-reward Registration Station at the river's mouth. Photographs of fish angled in the mid-1980s are of a size associated with mainstem river fluvial populations. Additional survey work is being conducted in portions of the subbasin to determine the distribution and abundance of bull trout. Future work may include assessments of life history and genetic characteristics, as well as reintroduction of bull trout into its known historic range, if appropriate.

3.2.4 Cutthroat trout (*Oncorhynchus clarki*)

During census work of the 1980s, resident cutthroat trout were observed in limited numbers in two tributaries of the Klickitat subbasin, McCreedy and Summit creeks. In the late 1990s, known locations of resident cutthroat were reinvestigated, but no cutthroat trout were observed. It is speculated that hybridization with resident rainbow trout, competition with brook trout, and losses in habitat quantity and quality have led to the elimination of resident cutthroat from their former range, but additional investigation will be needed to determine their status with certainty.

Coastal cutthroat trout have been observed in the Klickitat basin, generally below the Little Klickitat River confluence. Their historic and present distribution and status are relatively unknown.

3.2.5 Brook trout (*Salvelinus fontinalis*)

Brook trout were introduced into the Klickitat basin no later than the late 1970s and early 1980s (possibly earlier), primarily into high mountain lakes. Currently, naturally reproducing populations are found throughout the upper Klickitat mainstem and in major tributaries upstream of Big Muddy Creek (RM 54). They are found in the meadow areas of both the Diamond Fork system and mainstem Klickitat River, and in upper drainage areas also occupied by resident bull trout and cutthroat trout.

3.3 Review of Habitat Quality

3.3.1 Historic conditions

Understanding the historic context within which currently observed conditions exist is an important part of recovery planning. The degree of divergence from prior conditions helps to identify a system's potential and to set priorities. Historically, activities such as road construction, logging, agriculture, residential development, and dam construction were performed without regard for aquatic resources. In most portions of the Klickitat subbasin, these land uses pre-date quantitative evidence of historic habitat condition. Reconstruction of historic conditions is an ongoing process that has involved review of Government Land Office survey records from the 19th century, books and magazines, and discussions with long-time residents of the area.

3.3.2 Existing conditions

This section is taken from the Klickitat Subbasin Summary (Sharp 2000).

The deeply incised lower Klickitat River has remained relatively isolated from direct shoreline development over most of its length. However, floodplain roads, both abandoned and active, have led to channelization and constriction problems in these reaches. Shoreline development is occurring with increasing regularity along the SR 142 highway corridor between RM 0.0 and 19.0 of the mainstem. An abandoned paved road in the floodplain hugs the west bank of the Klickitat River from RM 14 to 31. This former Champion log haul road experienced considerable damage from the 1996 flood. However, the road even now cuts off side channels and river meanders at many key locations.

Middle and lower basin tributaries historically provided the majority of wild steelhead spawning and rearing habitat. The habitat within these tributaries has been severely degraded. For example, the Little Klickitat drainage is heavily logged and roaded in its upper reaches and is grazed and diverted further downstream, resulting in lack of riparian cover, diminished baseflows, and increased temperatures. Nutrients from farming and a sewage treatment outfall cause excessive algal growth in the Little Klickitat. Adjacent tributaries in the lower basin share many of the same problems. Dewatering is a concern on Swale, Wheeler, and Dillacort creeks, where development is believed to have degraded summer instream habitat conditions. Loss of wetlands in tributary headwaters, possibly in conjunction with groundwater withdrawals by agricultural and domestic wells, has diminished storage capacity and recharge capability. Loss of the ability to attenuate higher flows has resulted in higher peaks and more extreme runoff events. Though no data exist, subbasin planners believe that local hydrology has been altered, generating a “flashier” hydrograph with higher peaks and lower baseflows. Extreme events are more likely to scour spawning gravels and reduce bank storage that would have been available to ameliorate low flows.

The upper two-thirds of the Klickitat subbasin are forested, and most of that lies within the Yakama Reservation. On the Reservation, logging operations, including the construction and use of logging roads, are the principal activities affecting the upper Klickitat subbasin. Streams in the forested portion of the subbasin, both on and off the Reservation, have suffered from past and current forest practices, including timber harvest and road construction in riparian areas, poor design and maintenance of roads and crossings, skidding on steep slopes and upstream channels, off-season use of wet roads with resulting erosion, and facilitation of overgrazing by providing cattle access over logging roads to riparian areas. Most of these problems are continuing.

In the upper subbasin, an unpaved major haul road follows the upper Klickitat River from RM 66 to RM 78. Within this section, the road is directly in the floodplain for 40 percent of its length, cutting off side channels and river meanders.

Cattle and sheep grazing impacts, while decreasing in recent years, still adversely affect stream morphology, channel stability, and riparian cover on a smaller but more concentrated scale. The upper Klickitat River flows through McCormick Meadow in the tribally designated Primitive Area, which has been heavily grazed for many years. Aerial photographs reveal that the river channel through the meadow and others nearby have been seriously damaged during 60 years or more of cattle use. In spite of its remoteness, this section of river is now poor habitat for resident or anadromous fish. Sheep grazing on a Washington Department of Natural Resources (WDNR) allotment within Tract "C" of the Reservation has degraded riparian and in-channel habitat, and threatens stream and wetland meadow function in the upper Diamond Fork basin. Active lateral and vertical channel instability in conjunction with off-channel headcutting threaten to further degrade fish habitat.

Active debris flows and glacial outwash from the east slope of Mt. Adams result in high mainstem suspended sediment during summer months that colors the Klickitat River from the West Fork to the Columbia River 63 miles downstream. This adversely affects natural production for all species that spawn in the mainstem Klickitat below the Big Muddy confluence.

The East Prong, West Prong, and mainstem Little Klickitat River, as well as Butler Creek, a major tributary of the Little Klickitat River, are listed as impaired under section 303d of the Clean Water Act (Brock and Stohr 2000). Eight reaches on these water bodies violate thermal water quality standards. Six other reaches, including two on the Little Klickitat, as well as reaches on Blockhouse, Bloodgood, Bowman, and Mill creeks, are considered impaired due to low instream flows (Brock and Stohr 2000). Temperature conditions in the Little Klickitat are believed to create a thermal barrier that prevents or severely limits use by anadromous stocks, particularly steelhead, in most years (YN unpublished data).

Dewatering is a major problem on most of the tributaries in the lower subbasin. Knight Canyon, Dillacort, Wheeler, Swale, Canyon Creek, Beeks Canyon, and Dead Canyon creeks all dry up either partly or completely in most years. Top-to-bottom perennial surface flow may not have existed historically on many of these streams. This is likely true of alluvial fan reaches that create seasonal passage barriers to adult and juvenile passage (usually June to November). The only two lower subbasin tributaries that maintain continuous or nearly continuous surface flow are Logging Camp Canyon and Snyder Canyon creeks. The apparent reason for the discrepancy appears to be three-fold. First, mean annual precipitation for watersheds west of the mainstem Klickitat River (Logging Camp, Snyder, Beeks, Dead Canyon) is generally greater than watersheds to the east (Dillacort, Wheeler, Swale, Canyon). Thus, the difference is at least partly natural. Secondly, the Logging Camp and Snyder creek watersheds probably have a greater proportion of their headwater meadows and wetlands intact. This maintenance of hydrologic connectivity is probably why these two streams appear to have less alteration of channel morphology and more persistent surface flow. Thirdly, though we do not have data that document the effect, streams to the east of the river appear to have experienced a greater level of residential development. Since groundwater is the primary baseflow source, this would place a proportionately greater burden on streams east of the river (less annual precipitation coupled with greater demand).

The Yakama Nation Fisheries Program (YNFP) currently monitors water temperature at 37 different locations and stream flow at 13 sites throughout the Klickitat basin.

3.3.3 Relationship of implementation strategies to current Klickitat subbasin habitat conditions

The Northwest Power and Conservation Council's 2000 Fish and Wildlife Program asks that Columbia Basin implementation strategies assess the suitability of proposed actions against the habitat conditions in the subbasin (NPPC 2000). The 2000 Program provides the following table to define habitat conditions.

Criteria			Examples of strategies	
Habitat condition	Description	Biological potential of target species	Habitat strategy	Possible artificial production strategy
Intact	Ecological functions and habitat structure largely intact	High	Preserve	No artificial production
		Low	Preserve	Limited supplementation
Restorable	Potentially restorable to intact status through conventional techniques and approaches	High	Restore to intact	Interim supplementation
		Low	Restore to intact	Limited supplementation
Compromised	Ecological function or habitat structure substantially diminished	High	Moderate restore	Limited supplementation
		Low	Moderate restore	Supplementation
Eliminated	Habitat fundamentally altered or blocked without feasible option	High	Substitute	Replacement hatchery
		Low	Substitute	Replacement hatchery

Source: NPPC 2000.

Using these definitions, YN and WDFW staff assessed habitat quality in the Klickitat basin and proposed strategies for four of the target species. Their assessment is summarized below.

Species: Spring Chinook

Habitat Condition: Restorable—Potentially restorable to intact status through conventional techniques and approaches.

Biological potential of target species: Moderate

Discussion: The draft Klickitat Subbasin Summary (Sharp 2000) and Section 3.3.2 of this Master Plan describe degraded habitat conditions and diminished passage opportunities for spring chinook in the Klickitat subbasin due to human activities over the last several decades. Chapter 4 of this Master Plan describes strategies designed to increase passage opportunities, and Chapter 10 addresses actions designed to improve overall habitat conditions in the subbasin. In this context, YN and WDFW planners believe that the supplementation strategies described in Chapter 5 are consistent with Council criteria; and that all of these strategies (passage, habitat, and supplementation) will work in concert to increase spring chinook natural production and distribution throughout a larger area of the subbasin.

Species: Steelhead

Habitat Condition: Compromised—Ecological function or habitat structure substantially diminished.

Biological potential of target species: Moderate

Discussion: The Klickitat steelhead population is listed as Threatened under the ESA, with an overall decline in natural productivity cited as one of the primary reasons for the listing. YN and WDFW managers believe that the supplementation strategies described in Chapter 6 are warranted, if not mandated, by the ESA status of this species. These strategies are consistent with Council criteria and will work in concert with habitat improvement strategies (Chapter 10) to increase natural production and distribution of steelhead throughout a larger area of the Klickitat subbasin.

Species: Coho and Fall Chinook

Habitat Condition: Intact—Ecological functions and habitat structure largely intact.

Biological potential of target species: Low to Moderate

Discussion: Although habitat for coho and fall chinook is essentially intact and these species are thought to have used the Klickitat River to a certain degree, they were not known to inhabit the basin historically. Therefore, as described in Chapters 7 and 8 of this Master Plan, strategies for coho and fall chinook are designed primarily to maintain existing harvest augmentation programs. These programs essentially are required under existing *U.S. v. Oregon* agreements and regional mitigation obligations. The strategies described in Chapters 7 and 8 are consistent with Council criteria and will work to continue to provide substantial harvest opportunities to treaty and non-treaty fisheries in the ocean, lower Columbia River, Bonneville Pool, and Klickitat subbasin fishing areas. Although some natural reproduction is expected, it would not be the focus of the YKFP program in the foreseeable future.

Chapter 4. Multi-Species Proposed Actions and Risks

This chapter explains the list of objectives and strategies from section 2.1 that affect more than one species in the basin, by detailing the rationale and methods for accomplishing each objective and strategy, and the environmental risks associated with those methods.

Overall Goal: Protect, restore, and enhance fish species and habitats in the Klickitat basin, while implementing agreements under *U.S. v. Oregon*.

The federal government and Columbia Basin state governments decided long ago that certain hatcheries would be used to mitigate for lost fish production due to construction of the federal power system on the Columbia and Snake rivers. These mitigation obligations are embodied in laws and programs such as the Mitchell Act, the John Day mitigation program, and the Lower Snake River Compensation program. In the Klickitat basin, much of the mitigation effort is governed by agreements under *U.S. v. Oregon*, with production centered at Klickitat Hatchery (see section 1.3 and Appendix D).

Section 2.1 of this master plan outlines the underlying issues that suggest the need to change certain facilities and practices associated with production at the hatchery. In light of these issues, the **YKFP proposes to focus supplementation and natural production efforts on spring chinook and steelhead, while maintaining a focus on harvest augmentation for fall chinook and coho**. In doing so, the project would increase production of spring chinook and steelhead at the Klickitat Hatchery and eliminate in-basin production of coho. In-basin fall chinook production levels would remain the same, but half the production would be transferred to a proposed new facility at Wahkiacus. The program proposes further improvements to existing facilities that would increase the ability of spring chinook and steelhead to access high quality habitat, thus improving natural production; and that would allow collection of spring chinook and steelhead broodstock to meet supplementation goals for those two species.

4.1 Objective MS1 Methods and Risks

Objective MS1. Focus spring chinook and steelhead programs on supplementation; focus coho and fall chinook programs on harvest augmentation.

> **Strategy MS1a.** Increase production of spring chinook and steelhead at Klickitat Hatchery by eliminating in-basin hatchery production of coho and transferring half the fall chinook production to the lower Klickitat River.

Method: Beginning in 2006, decrease coho smolt production at Klickitat Hatchery by one million smolts. That year, increase production of spring chinook at the hatchery from 600,000 to 800,000 smolts; and implement production of 200,000 steelhead using local stock. In 2007, transfer half the fall chinook production (2 million) from Klickitat Hatchery to a proposed new facility at Wahkiacus, lower in the basin. Table 7 shows the proposed production numbers for each species.

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Rationale: The reasons for proposing these numbers are discussed in the species-specific chapters (5, 6, 7, and 8; and in section 4.2, Strategy MS2f).

Table 7. Transition plan summary for production of target species at the Klickitat Hatchery

Klickitat Hatchery Production	Current to 2005	2006	2007	2008	2009	2010
Coho	1,000,000	0	0	0	0	0
Spring chinook	800,000	800,000	800,000	800,000	800,000	800,000
Steelhead	200,000[1]	200,000	200,000	200,000	200,000	200,000
Fall chinook	4,000,000	4,000,000	2,000,000	2,000,000	2,000,000	2,000,000

1. These are Wells Hatchery steelhead eyed eggs transferred to Klickitat Hatchery for incubation and early rearing and then transferred to Ringold Hatchery for final rearing to smolt size and release.

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Deleted: 1. These are Wells Hatchery steelhead eyed eggs transferred to Klickitat Hatchery for incubation and early rearing and then transferred to Ringold Hatchery for final rearing to smolt size and release.¶

Deleted: Table 6. Transition plan summary for production of target species at the Klickitat Hatchery¶ Klickitat Hatchery Productior ... [2]

Risks: Because fall chinook production would be maintained in-basin (although at a different facility), risks of changing production numbers at Klickitat Hatchery are primarily to the coho program. Project staff are confident that in-basin acclimation of one million coho smolts can maintain the current average annual coho harvest of 14,000. However, coho smolt survival will be tested and direct stream releases of an additional 2.5 million coho fry will continue for several years to ensure the harvest goal can be met. See Chapter 7 for details.

Spring chinook would be reared in Pond 25 at the hatchery, which currently is used to rear coho. Because coho reared in Pond 25 had serious disease problems, spring chinook rearing there would be approached cautiously. Fry would be reared on spring water through the summer before being placed in the pond (Ferguson and Sharp 2002).

Strategy MS1b. To meet coho harvest objectives, rely on releases of coho smolts reared out-of-basin and acclimated in the lower Klickitat.

Methods and Risks: See section 4.2, Strategy MS2f, and section 7.2.

Strategy MS1c. Maintain current production numbers and harvest levels for fall chinook, but change the location of half the production.

Methods and Risks: See section 4.2, Strategy MS2f and Chapter 8.

4.2 Objective MS2 Methods and Risks

Objective MS2. Develop new facilities to meet supplementation, survival, monitoring, and natural production goals for the target species.

Strategy MS2a. Install adult trapping, video monitoring, and PIT tag detection facilities at Castile Falls by 2006.

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Rationale: A trap at Castile Falls would allow collection of natural-origin spring chinook and steelhead broodstock that are locally adapted to the upper Klickitat basin. The trap also would allow the sampling of returning fish for biological characteristics and marks. Installation of video and PIT detection equipment in the modified fishway would improve enumeration of natural- and hatchery-origin recruits returning to the upper basin.

Method: Passage improvements at Castile Falls 4/5 and 10/11 fishways are currently under construction (see Appendix B). Under BPA project #1995-068-00, engineering designs have been completed and the following items identified for future add-ons to the fishway exit at Castile Falls #10/11:

- Adult trap (aluminum picket weir style)
- Adult enumeration (video monitoring, PIT tags)

Risks: It is anticipated that there will be minimal disturbance, as these improvements do not require any major on-site construction activity. The trap is a pre-fabricated structure that can be lowered into the existing fishway exit (Figure 8).

Incidental Take: Steelhead have been observed only occasionally passing above Castile Falls. Inventory work to date suggests that bull trout do not populate areas above Castile Falls. The fishway will be partially de-watered during the installation process, which is expected to take less than eight hours. Therefore, the maximum harm to any listed fish in the area would be a temporary delay in passing above Castile Falls, and the expected take is zero.

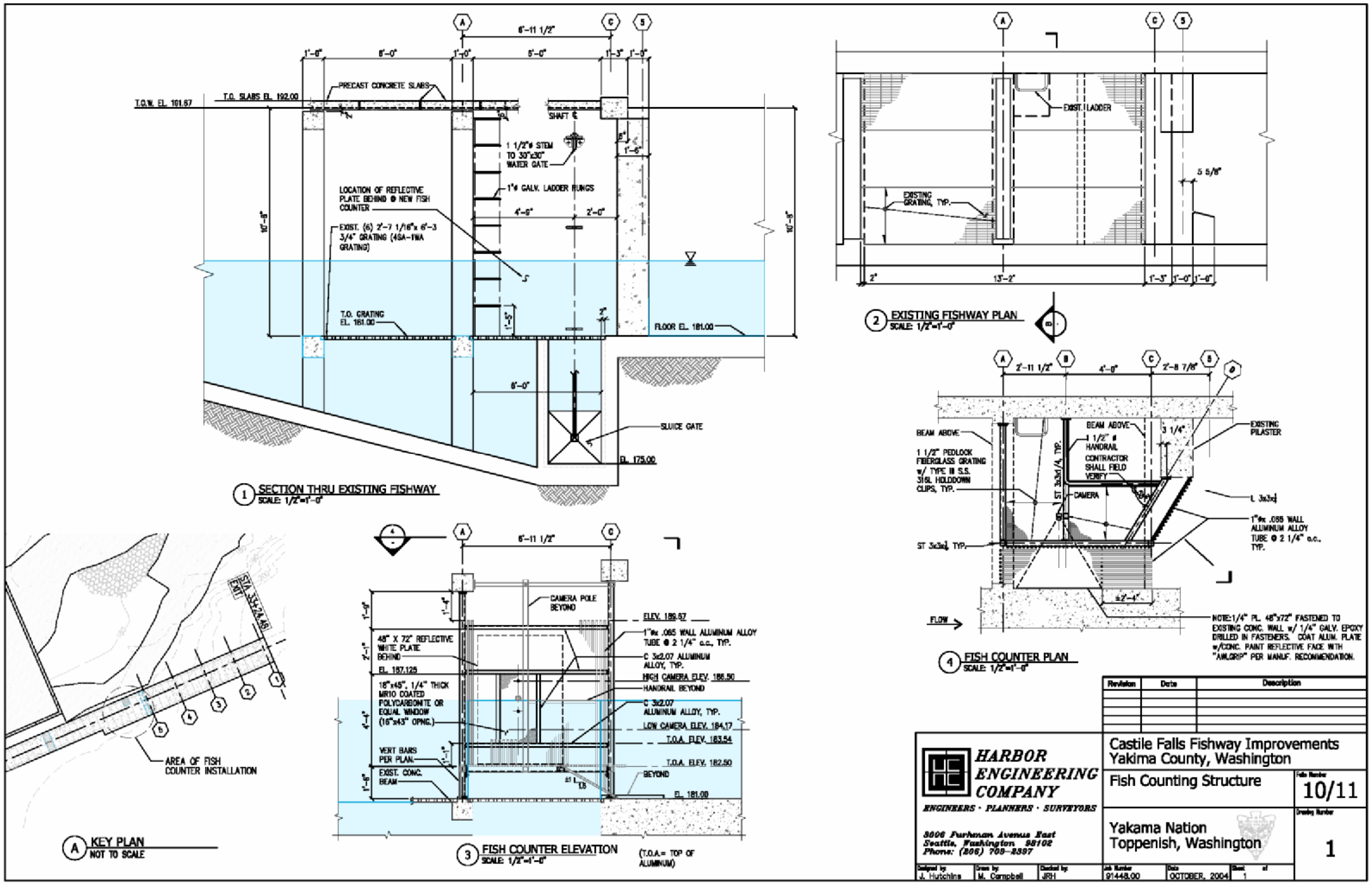

Figure 8. Trap and Fish Counter at Castile Falls

Strategy MS2b. Improve passage at Lyle Falls No. 5 fishway by 2006.

Rationale: Lyle Falls is a series of five falls from four to seventeen feet high. They begin approximately one mile above the mouth of the Klickitat River and extend upriver another half mile. Before initial efforts were made to improve passage, Lyle Falls was considered impassable during low water in the summer and early fall, preventing fall chinook and coho from effectively colonizing the Klickitat subbasin. In 1952, Washington Department of Fisheries, using Mitchell Act funds, removed rock and began construction on two fishways at the falls; Lyle Falls Numbers 1 through 4 were initially blasted to provide passage. Subsequently it was determined that passage at Falls No. 2 was still inadequate, so in 1955, a concrete vertical slot fishway approximately 25 feet long was constructed.

After installation, the fishway at Falls No. 2 was inundated with gravels and no longer operated. The natural Falls No. 2 has since migrated downstream of the fishway. Currently, the falls do not block anadromous fish.

Falls No. 5 covers a distance of approximately 150 feet. It is the most serious obstruction of the series of five lower river falls. Water surface elevation measurements indicate a total height of 17 feet at low flow, with slightly less height at higher flows.

The Lyle Falls No. 5 fishway that bypasses the natural falls was constructed between 1952 and 1955. It is an 80-foot, reinforced concrete, vertical slot-type fishway (13 slotted baffles) with an off-ladder adult trap constructed to collect broodstock for the Klickitat Hatchery. The fishway entrance consists of three vertical slots (two currently in use), the depth of which can be adjusted with timber stoplogs. A siphon-type auxiliary water supply system is designed to provide additional attraction flow into the ladder entrance. A surface-water right for 250 cubic feet per second (cfs) for fish ladders and propagation, with a priority date of 1947, is associated with this fishway.

Excessive drop occurs through the lower slotted baffles, indicating that the river channel downstream has eroded to make tailwater elevations lower than those for which the fishway was originally designed. Excess bedload accumulations have been observed in the exit channel over the years, and debris accumulations have restricted the baffle slots. The auxiliary water system requires priming, is difficult to maintain, and does not function at this time.

The fishway does not meet current passage criteria (WDFW 2002). With the proposed improvements, the fishway would meet current design criteria, provide for increased attraction flow, and provide year-round passage for all salmonids.

Method: Improvements would include:

- a directional orifice at the entrance,
- additional baffles to meet design criteria,
- increased attraction flow,
- a 180-foot extension of the fishway exit to bypass the aggraded reach, and
- addition of adult PIT tag detection equipment in the fishway.

Construction also will include the addition of an adult trap and video monitoring (see Strategy MS2c). The hydraulic conditions report and a project manual and specifications provide detailed descriptions of construction activities associated with these strategies (Harbor Engineering Co. 2004a and 2004b). The proposed improvements are shown in Figure 9.

Risks: Risks from the reconstruction of the Lyle Falls fishway are associated primarily with the period of construction. Increased noise and vibration from blasting of the basalt bedrock and related construction activities could negatively affect adult migration. To minimize effects on migration, a work window (June 15 to September 30) for in-channel construction work will be strictly adhered to. (See NOAA Fisheries consultation letter for the Wahkiacus facility in Appendix C.)

Improved passage efficiency could negatively affect the tribal dip net fishery at the falls by allowing fish to pass through the area more quickly, reducing harvest potential.

Incidental Take: The fishway will be de-watered during construction, leaving adult and juvenile fish to pass via natural routes over the falls. All fish present in the fishway during the de-watering process will be immediately transferred to the river. Both adult and juvenile steelhead and bull trout could be present during the anticipated in-channel work window of June 15 to September 30.

<u>Juvenile steelhead</u>: Juvenile steelhead out-migration timing identified from rotary screw trap operation shows that 85% have passed Lyle Falls by June 1. Expected impacts are potential harassment and/or handling of fish in the fishway during de-watering, or delayed passage (e.g., if fish are “spooked” by activities and choose to hold upstream of the falls).

<u>Juvenile bull trout</u>: To date no juvenile bull trout have been caught in any rotary screw trap in the Klickitat basin over an extensive spatial sampling effort spanning multiple years. We do not expect to observe any juvenile bull trout in the fishway during construction activities; therefore, the only expected impacts are potential delays in passage.

<u>Adult steelhead</u>: Approximately 95% of the adult summer steelhead migration occurs between June 15 and September 30 and will be subject to impacts. (Bonneville Dam counts were used as a surrogate, as Lyle Falls has no capability to count fish at this time). Of these fish, it is estimated that only 20% pass by way of the existing fishway (B. Sharp/YN and Tom Burns/WDFW, personal communication). Dewatering of the fishway will provide additional flow to the falls, thereby improving natural passage conditions via Lyle Falls. Expected impacts are potential harassment and/or handling of fish in the fishway during de-watering, or delayed passage (e.g., if fish are “spooked” by activities and choose to hold downstream of the falls). Therefore, we expect fewer than 19% of the adult steelhead return to be affected, with no direct mortalities as a result of construction activities.

<u>Adult bull trout</u>: Anecdotal information from a number of tribal fishers at Lyle Falls suggests that bull trout have rarely if ever been captured at Lyle Falls by these fishers. Under existing BPA Contract #200306500 (*Determine the Origin, Movements and Relative Abundance of Bull Trout in Bonneville Reservoir)*, WDFW and the YN will operate the existing Lyle Falls fishway in an effort to collect fluvial bull trout entering the Klickitat River. Information will be updated accordingly.

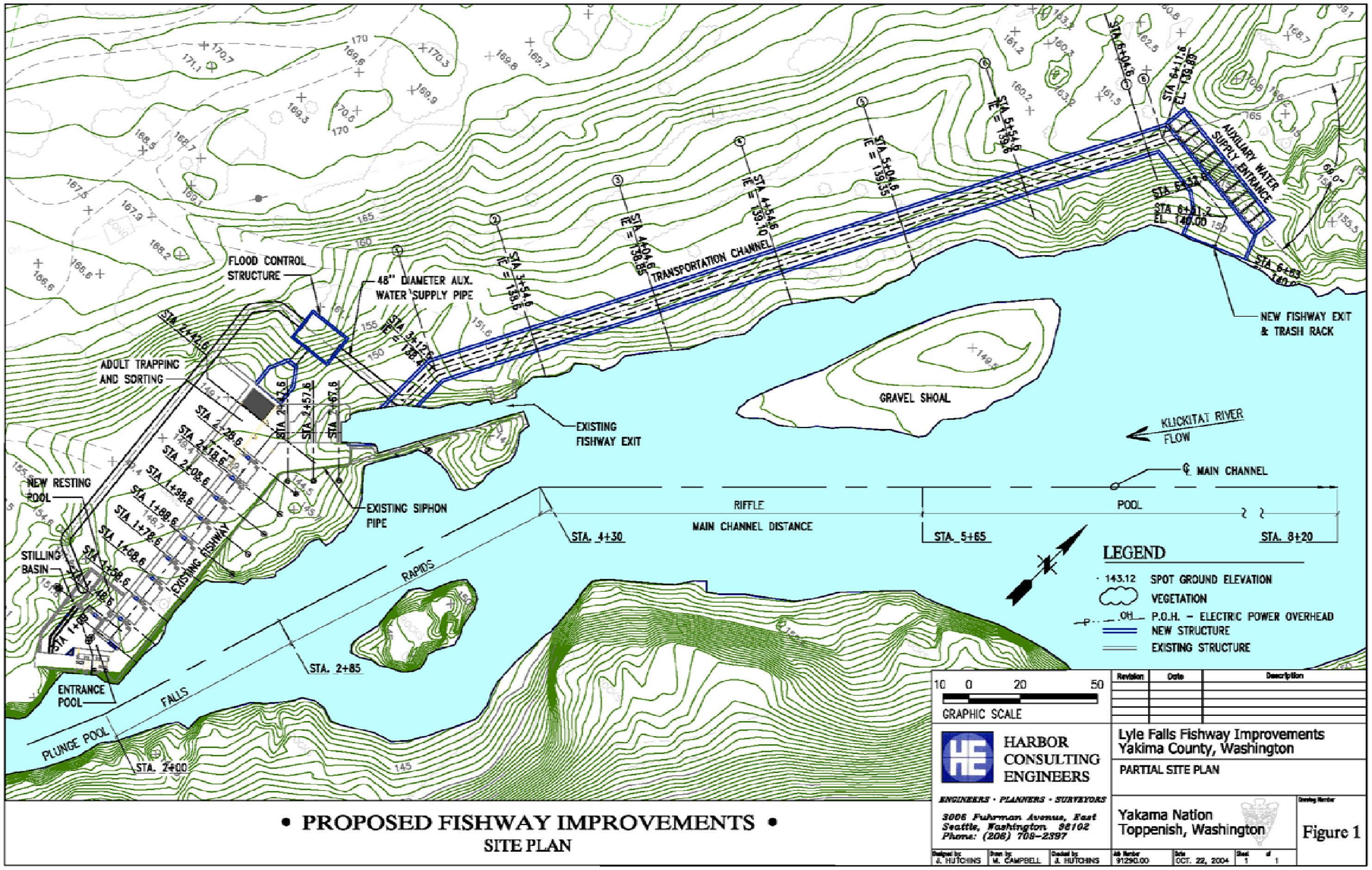

Figure 9. Lyle Falls Fishway Improvements

Strategy MS2c. Install adult trapping and video monitoring at Lyle Falls No. 5 fishway by 2006.

Rationale: A trap at Lyle Falls is needed both for spring chinook and steelhead broodstock collection and for monitoring and evaluation efforts.

Klickitat River spring chinook broodstock were collected for several years at Lyle Falls No. 5 Fishway, until sufficient hatchery fish returned directly to the Klickitat Hatchery after it was constructed. While the fishway and trap provided the initial ability to collect spring chinook broodstock, the design proved inadequate to pass fish over a wide range of flows. Passage improvements proposed in this section (see Strategy MS2b), combined with an adult trap, would allow for collection of spring chinook and steelhead broodstock low in the basin, thus ensuring capture of a representative sample from the entire run and maintenance of genetic diversity. The trap also would allow the sampling of returning fish for biological characteristics and marks.

A video monitoring system would enable escapement monitoring, provide run-timing information, and improve enumeration of natural- and hatchery-origin recruits returning to the basin. It could also determine the presence/absence of a fluvial bull trout population.

Method: See Strategy MS2b.

Risks: See Strategy MS2b. Effects of using the trap are described under broodstock collection strategies for each species.

Incidental Take: This strategy will be implemented concurrently with Strategy MS2b. Incidental take is discussed under that strategy.

Strategy MS2d. Use mobile rotary traps or incline traps at key tributary locations to monitor life history characteristics and basin productivity.

Method: Tentative locations include Little Klickitat River, White Creek and Diamond Fork Creek at their confluences with the Klickitat River. Development of anchor points on the adjacent stream banks to secure the trap could disturb a small amount of soil. If needed, off-road parking with a work-up area for field workers could be developed.

Risks: Risks depend on the amount of physical disturbance. Effects of using traps will be assessed in the future with site-specific NEPA review.

Incidental Take: NOAA & USFWS will be consulted prior to implementation of any new trapping activities. Work will not proceed until permits (Section 10) are issued.

Strategy MS2e. By 2006, develop acclimation sites for spring chinook and steelhead in the upper Klickitat basin.

Rationale: YN's experience in other basins (e.g., Yakima Basin spring chinook and coho) demonstrates that acclimating hatchery-produced fish in natural rearing areas results in adults returning to those same waters to spawn (Dunnigan et al. 2002; Sampson and Fast 2000). The literature provides biological rationale for believing that acclimation can help improve survival and reduce stray rates (Isaksson et al. 1978; Johnson et al. 1990; Cuenco et al. 1993; Whitesel et al. 1994).

Castile Falls modifications (see Appendix B) will open approximately 35 miles of spring chinook and steelhead spawning and rearing habitat in the upper Klickitat. Acclimating spring chinook and steelhead smolts in this habitat is expected to encourage adults to spawn in this part of the basin.

Method: The feasibility of using various kinds of acclimation facilities was evaluated (Appendix F). Options included use of:

- Existing ponds
- Constructed ponds in steam channel
- Constructed ponds adjacent to stream channel
- Portable, constructed rearing units
- Truck-mounted, portable rearing units
- Constructed concrete raceways
- Net enclosures
- Stream plants with short-term acclimation

The McCreedy Creek Acclimation Pond is proposed for further in-depth study as the primary location and water source for a juvenile fish acclimation site for rearing 200,000 spring chinook and 200,000 summer steelhead. Initial study indicates water quality and volume would be adequate for rearing these fish.

The site, along Klickitat River Road, is a forested meadow with a gentle slope towards the Klickitat River. A multi-plate corrugated metal culvert carries McCreedy Creek under the road.

The creek rises steeply above the road and falls quickly below the scour hole resulting from the culvert. The requirements for fish passage and the need for stream restoration make this reach an ideal location to combine stream restoration with construction of a screened intake. Table 8 summarizes site specifications.

Table 8. Acclimation site rearing specifications

	Number of Fish	Fish Size (#/lb)	Total Weight (lbs)	Water Needed (gpm)	Water Needed (cfs)	Space Needed (cft)	Area 4' Depth (sft)	Area 4' Depth (acres)	Pond Width (ft)	Pond Length (ft)	Vol Density (lbs/cft)	Flow Density (lbs/gpm)
SPRING CHINOOK												
	200,000	15	13,333	2,222	4.9	66,667	16,667	0.38	75	224	0.20	6.00
STEELHEAD												
	200,000	8	25,000	3,125	6.9	62,500	15,625	0.36	72	217	0.40	8.00
TOTAL SITE REQUIREMENTS												
	400,000		38,333	5,347	11.9	129,167	32,292	0.74				

Two separate ponds are proposed on the site, one for steelhead, one for spring chinook (see Figure F-9, Appendix F). A total of 200,000 steelhead smolts would be reared and released from this acclimation site. Steelhead smolts will be released at approximately eight fish per pound. Based upon the recommended volume density 0.40 pounds per cubic foot and a flow density of 8 pounds per gallon per minute, a pond size of 16,000 square feet is proposed, with an average water depth of 4 feet. A water supply of 7 cfs is required and available from McCreedy Creek.

A total of 200,000 spring chinook smolts would be reared to 15 fish per pound. Based upon the recommended volume density of 0.20 pounds per cubic foot and a flow density of 6.0 pounds per gallon per minute, a pond size of 17,000 square feet is proposed with an average water depth of four feet. A water supply of 5 cfs is required and available from McCreedy Creek. For the two ponds, a combined flow of 12 cfs will be withdrawn from McCreedy Creek during the acclimation season.

Each earthen pond will be constructed with a 10-foot-wide crushed rock surface access road for fish culture and maintenance purposes. A 4-foot-high perimeter fence is also proposed. A 5-foot high chain link material would be used to allow one foot of material below ground to resist animal predators. Poles will be placed for draping overhead netting to prevent bird predation.

Supply water will be discharged from a horizontal header which will promote plug flow through the pond. The pond drains will be screened and will use stoplog weir construction to maintain pond depth and facilitate volitional migration of juveniles at release time.

Pond drain lines will be oversized to facilitate juvenile safe passage to McCreedy Creek and the Klickitat River. Pond water will be discharged as near as possible to the point of withdrawal to minimize in-stream impacts.

Construction of a bridge and downstream "vee" shaped weirs, or sills, will improve fish passage conditions near the McCreedy intake Incorporated into the stream sills will be a full-width concrete slab and right bank screened water collection box.

Seasonally placed stoplogs will be used during the rearing period, approximately 14 weeks in the spring. Placed approximately 2 feet high, the stoplogs will produce an intake pool sufficient to screen about 12 cfs, meeting agency screening criteria. Fish passage will be maintained using a pool and weir fish ladder.

During the rearing season, an on-site fish culturist will reside in a self-contained mobile residence with a cargo container for equipment and fish food storage. These features will be removed once fish leave the rearing ponds.

Risks: As described above, the site is designed to enhance fish passage and minimize impacts to the stream from pond discharge. Ground-disturbing activities in and near streams can adversely affect water quality, habitat for various avian and terrestrial species, and any cultural resources or ESA-listed plants that might be in the area. An environmental analysis and permit process would be completed before construction of this or another site.

Incidental Take:

Figure 10 shows the simultaneous release timing proposed for the two species.

Figure 10. Release Timing for Spring Chinook (CHS) and Steelhead (SHS)

FEBRUARY				MARCH				APRIL				MAY				JUNE			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
						CHS													
						SHS													

Notes:

CHS are now released from the hatchery at the end of March to make room for fall chinook (later releases would be preferred if the option were available).

Skamania summer steelhead are now planted in the Klickitat on or after April 15.

During construction any salmonids present in the work area will be guided back to the natural stream or removed from the work area using NOAA fisheries electro-fishing (http://www.nwr.noaa.gov/1salmon/salmesa/pubs/electrog.pdf) and YN water code protocols. It is anticipated that this process will affect only juveniles. Since activities will be similar, it is expected that informal consultations like those with NOAA Fisheries for the Wahkiacus acclimation facility (NOAA tracking number I/NWR/2003/00530) will suffice for this acclimation site as well (see letter reproduced in Appendix C).

Strategy MS2f. By 2007, develop the Wahkiacus Hatchery and Acclimation Facility.

Rationale: Development of this facility in the lower Klickitat River (RM 17) would help accomplish several objectives in the Klickitat basin anadromous fishery program.

- The proposed acclimation facilities for coho are expected to increase coho survival so that fewer coho smolts would need to be released in the basin (see section 7.2, Strategy C2a).
- The proposed incubation and rearing facilities for fall chinook would free capacity at the Klickitat Hatchery to accommodate the increased production of spring chinook and steelhead proposed for that facility in this plan, without jeopardizing harvest augmentation goals for fall chinook (see section 8.1, Strategy FC1a).
- The proposed facility would provide additional options for rearing and release of steelhead (either as an acclimation site or for developing a kelt reconditioning program).

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Method: Mitchell Act funds were used to provide basic feasibility studies and engineering designs for this facility. The Wahkiacus Hatchery and Acclimation Facility (WHAF) is just downstream from the mouth of Swale Creek at RM 17, at an elevation of 512 - 525 feet. It is in the floodplain of Swale Creek and the Klickitat River.

The facility is designed to acclimate up to 1,000,000 coho smolts, to rear and release up to 2,000,000 fall chinook, and to serve as the Klickitat watershed regional fisheries office. Coho releases are planned for the end of April at a size of 15 fish per pound. Fall chinook will be 80 per pound at release in mid-June.

The main constructed components on the site will be eight earthen acclimation ponds of various sizes, a concrete intake structure for Klickitat River water, a hatchery building, a back-up power supply, an effluent settling pond, and a discharge/fish trap. An existing house has been converted to a regional fisheries office and several outbuildings are used for storage. Appendix C includes engineering drawings of the site, ponds, and intake structure, as well as more detailed descriptions of the site characteristics and proposed development.

Risks: The site could be subject to flooding. A flood impact evaluation study was done by Harbor Engineering (2003), which is summarized in section VIII of Appendix C. The Harbor Engineering study concluded that the acclimation facilities "will not impact river flood hydraulics."

Floods will impact the WHAF, however, because 100-year-flood elevations are higher than pond berms. Damage to the ponds due to floods may require periodic removal of settled flood debris and reconstruction of pond berms. This damage is not expected to be frequent, and repair costs likely will not be high.

The main water supply for the site will be surface water from the Klickitat River. A large river water intake on the site is proposed. This location meets several, but not all, of the requirements for a high quality intake. The channel is stable at the location, but a deep scour pool does not exist. Stability is provided by Klickitat River bridge abutments which confine the channel in a fixed position. The water depth at the proposed intake location, however, is moderate. The absence of a deep pool may impact the operation of the intake during severe low flow conditions. Since these conditions are unlikely during the spring acclimation period, low flow limitations likely would affect only potential future late summer rearing programs.

Klickitat water quality in the area is acceptable for spring acclimation, although high turbidity may impact feeding activity and growth. If future rearing programs include rearing at other times of the year, low winter temperatures may cause intake ice formation problems, and high summer temperatures may add to stress-related disease problems. Use of ground water can reduce these problems and would provide incubation water for fall chinook. Ground water with artesian pressure exists under the site and is planned to be developed (see section I, Appendix C).

Other environmental effects, such as risks to terrestrial, avian, and aquatic species; to archaeological and historical resources; or to wetlands, have not yet been assessed. Section II of Appendix C outlines the environmental and permitting processes that would need to be completed before the site is developed.

Objective MS3. Comply with independent science recommendations for collecting and reporting the data and statistics critical to measuring overall project success.

> **Strategy MS3a.** Refer to Appendix G for a summary of strategies for collecting and reporting data for monitoring and evaluation purposes.

Methods and Risks: Risks of various data collection methods are discussed under the relevant activity for each species.

Chapter 5. Spring Chinook Proposed Actions and Risks

Overall Goal. While improving the fitness of the target stock, increase the number of returning spring chinook adults that result from both artificial and natural production (Ferguson and Sharp 2002), which will serve to increase harvest. Consistent with the regional goal of doubling salmon returns (NPPC 1994), the goal is to at least double the annual river mouth return, harvest, and escapement from current levels.

The overall goal for spring chinook, as well as the objectives and strategies, were developed in recognition of the importance of spring chinook to the Yakama Nation. The Lyle Falls dipnet fishery has been important to Indian people since before the arrival of the first white settlers. With the inundation of Celilo Falls, it holds special significance as the one remaining site where Yakama fishers have the opportunity to fish year-round using traditional dipnet and jumpnet gears. The Klickitat provides one of the few opportunities for spring chinook harvest by tribal members while other Columbia Basin spring chinook stocks remain at low levels of abundance (Sharp 2000).

The objectives and strategies also recognize that, because spring chinook were present historically in the Klickitat basin, habitat improvements and increases in hatchery production using supplementation/recovery strategies have the potential to increase spring chinook natural production and distribution throughout a larger area. Ongoing activities described in Appendix B will improve access to available habitat in the upper Klickitat subbasin. Other passage and habitat improvements proposed in Chapter 10 would increase the amount of available habitat. Increasing the number of spring chinook released, improving the quality of fish released, and releasing them from natural rearing areas are expected to result in increased returns to fisheries and to natural escapement areas.

The spring chinook program in the Klickitat basin currently depends upon artificial production at the Klickitat Hatchery. The proposals to change broodstock collection methods and locations are designed to meet the goal of making hatchery releases more compatible with the natural environment, thereby enhancing natural production and increasing the contribution of natural-origin adult recruits (NORs) to the fisheries. YN biologists believe that, historically, spring chinook were able to negotiate Castile Falls and use habitat in the upper basin (see section 3.1.1). Proposed broodstock collection facilities at Lyle Falls would provide broodstock collection opportunities throughout their run, whereas now, only those that return to the hatchery are collected. Proposed new facilities at Castile Falls would allow collection of naturally produced fish that have adapted to the conditions in the upper basin, which theoretically could increase natural production in the upper reaches of the river. Advocates of hatchery reform recommend using naturally produced fish as broodstock whenever possible to minimize risks (e.g., Ford 1999).

The monitoring program proposed in Objectives SC3-SC6 will enable the project to determine if it is meeting the overall goal.

5.1 Objective SC1 Methods and Risks

Objective SC1. Increase spring chinook returns, harvest, and natural escapement as follows:

Total Run: The short-term (10- to 25-year) goal is to increase the number of spring chinook returning to the Klickitat basin to an average of 5,000 to 10,000 fish annually (compared to the recent average of 1,900), recognizing the cyclic nature of ocean and freshwater conditions and productivity. The longer-term goal is to increase the number of spring chinook returning to the Klickitat basin to an average of 20,000 fish annually, consistent with the goals established in *Wy-Kan-Ush-Mi Wa-Kish-Wit* (CRITFC 1995 and 2000).

Harvest: Harvest would be managed consistent with guidelines established in *U.S. v. Oregon* agreements. It is expected that in-basin harvest rates would continue to average about 35-40% annually and would rarely exceed 50%.

Natural Escapement: In most years, more than 50% of the spring chinook return would be available for natural escapement; however, some of these fish would be used for broodstock.

Rationale: YN expects to significantly increase the number of spring chinook returning to the Klickitat basin, based on an increase in release numbers from 0.6 million to 0.8 million (strategies SC1a and SC1b), modification of brood collection, spawning, rearing, and release protocols (strategies SC2a and SC2b), and habitat enhancement measures (strategies H1a through H4b). On average, for the 1984 through 1997 brood years, age-2 fish comprised 31.1% of the aggregate spring chinook production. Attempts to minimize precocialism (Strategy SC2c), plus off-site acclimation of smolts intended for natural production (Strategy SC1b) should also serve to increase adult returns.

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YN recognizes that harvest levels in Columbia and Klickitat River fisheries could be considered inconsistent with the goal of increasing returns to the Klickitat River and rebuilding the naturally spawning population. It is expected that the actions proposed in this Master Plan will increase the number of returning spring chinook and hence harvest opportunities both within and outside of the Klickitat basin.

YN anticipates an increased level of WDFW and tribal harvest monitoring (Strategy SC6a) and that all available data will be reviewed in-season and used to adjust fisheries if and when warranted. Adult PIT detections at Bonneville Dam (and eventually at the Lyle Falls facility) will improve our ability to monitor the marked (hatchery) and unmarked (wild/natural) portions of the return and make in-season management decisions. In addition, YN believes that the Klickitat basin may be able to sustain somewhat higher harvest rates than other subbasins above Bonneville Dam. For example, Klickitat River fish need only survive passage at one mainstem dam, and there are far fewer irrigation activities in the Klickitat subbasin compared to subbasins such as the Yakima, Umatilla, or Snake.

Strategy SC1a. Beginning in approximately 2006, increase the production goal for spring chinook at Klickitat Hatchery from 600,000 to 800,000 smolts, using capacity made available by reductions in hatchery coho production.

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Rationale: The current average annual return of spring chinook to the Klickitat basin is estimated to be fewer than 2,000 fish (Table 1). Spring chinook in the Klickitat basin are considered a depressed stock (WDF & WDW 1993) and are a priority species for both the Yakama Nation and the State of Washington. Increasing the quantity and quality of spring chinook production in the Klickitat basin is consistent with tribal, state, and regional goals for salmon recovery.

Method: Beginning in 2006, decrease Klickitat Hatchery coho production by 1 million smolts to free up additional spawning and rearing capacity for the increased spring chinook production. Spring chinook would be reared in Pond 25, where coho were reared. Its primary water supply is from the Klickitat River. The existing river intake does not meet current WDFW/NOAA screening requirements. Therefore, this pond requires screening upgrades as well as sediment settling capability. Water intakes will be augmented with nearby spring water, which will require some additional development to increase delivery of water from these springs.

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Risks: Risks to the coho program due to the reduction in coho releases are addressed in section 7.1. Because coho reared in Pond 25 had serious disease problems, spring chinook rearing there would be approached cautiously. Fry would be reared on spring water through the summer before being placed in the pond (Ferguson and Sharp 2002). See Chapter 4, section 4.1.

Incidental Take: The potential for incidental take would be associated with proposed changes in spring chinook broodstock collection and release protocols. See strategies SC1b and SC2a.

Strategy SC1b. By 2006, begin releases of acclimated spring chinook smolts as follows:

- 200,000 from acclimation sites in the upper Klickitat basin
- 600,000 from the on-station acclimation pond at Klickitat Hatchery.

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Rationale: Releasing acclimated spring chinook in the upper basin would begin distributing these fish in habitat recently made available upstream of Castile Falls, and could increase the natural production potential for spring chinook In addition, such releases could begin to reestablish a tribal dipnet fishery at Castile Falls.

Method: Table 9 shows the proposed release plan for Klickitat Hatchery spring chinook. All releases would be smolts, except for the continuation of existing releases of 200,000 fry through 2005. The natural-origin brood fish would be released from the proposed new acclimation sites in the upper Klickitat basin, expected to be completed by 2006 (see section 4.2, Strategy MS2e). It is anticipated that the on-station release of 600,000 spring chinook will continue to be 100% marked with a primary goal of maintaining selective fisheries. The off-station release of 200,000 spring chinook would be targeted for natural production enhancement, with marking strategies selected appropriately for monitoring and evaluation of returning adults. Smolts produced from hatchery-origin and natural-origin broodstock will each have unique marks so they can be differentiated (see strategies SC2a and SC2b).

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Spring chinook would be acclimated from mid-February through the end of March (six weeks), and then volitionally released through April. All fish would be forced out of acclimation site ponds no later than May 31.

Table 9. Klickitat Hatchery spring chinook smolt release plan

Klickitat Watershed Releases	Current to 2005	2006	2007	2008	2009	2010
Klickitat hatchery production	800,000	800,000	800,000	800,000	800,000	800,000
On-station releases	600,000	600,000	600,000	600,000	600,000	600,000
Upper basin acclimation site releases	200,000 fry[1]	200,000	200,000	200,000	200,000	200,000
Size[2]	10-15 fpp	10-15 fpp	10-15 fpp	10-15 fpp	TBD	TBD
Pounds	50,000	64,000	64,000	64,000	TBD	TBD

[1] The existing program (proposed through 2005) calls for 200,000 fry to be released directly into the river above Castile Falls in May.

[2] The project proposes to test differences in survival and impacts of smaller sized smolts. Release size in out years will be determined on completion of studies. See Section 5.3, Strategy 3b.

Risks: Increasing the number of spring chinook smolts released carries risks associated with survival, ecological interactions, and genetics. The strategies described under objectives SC3, SC4, and SC5 discuss methods for monitoring and evaluating these risks. Adaptive management will be used as necessary to modify the hatchery program and protocols if and when monitoring and evaluation data suggest survival, ecological interactions, and/or genetic parameters are outside of acceptable boundaries. Parameters for evaluating these risks will rely heavily on work already done in the Yakima basin. Tribal and state geneticists will meet as necessary to further develop genetic sampling rates, protocols, and evaluation measures.

Incidental Take: Impacts to juvenile steelhead and bull trout may take the form of:

- increased competition for available habitat and resources,
- increased predator presence due to increased numbers of prey juveniles in the waters, or
- increased risk of disease transfer.

Estimates of the amount of take depend on further assessment of ecological interactions (see section 5.4, Strategy SC4a, Tables 15 and 16).

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5.2 Objective SC2 Methods and Risks

Objective SC2. Implement methods to improve the fitness of the spring chinook population.

> **Strategy SC2a.** Transition from hatchery-origin broodstock to natural-origin broodstock, so that by 2010, the vast majority (approaching 100%) of releases would be the progeny of at least one natural-origin parent.
>
> **Strategy SC2b.** Implement strategies and protocols for broodstock collection, spawning, rearing, and release that are consistent with the strategies and protocols developed under the YKFP for spring chinook in the Yakima River basin.

Rationale: Current literature and reviews of artificial propagation recommend the use of locally adapted natural-origin fish as the most appropriate broodstock source for hatchery programs (e.g., Ford 1999). In addition, steelhead research in the Hood River using local, natural-origin, representative broodstock, shows increased reproductive success over traditional (multiple generations in the hatchery, out-of-basin origin) hatchery fish spawning in the wild (Blouin 2003). Many years and an intensive amount of scientific effort went into the planning and design of the YKFP Cle Elum Supplementation and Research Facility (CESRF) to develop strategies and protocols for spring chinook supplementation that use the best available science to minimize risks. It is appropriate to leverage these efforts in the Klickitat basin.

Method: Consistent with the goal of transitioning the program to a natural/integrated population, YN proposes to change broodstock collection and production protocols as follows, beginning in 2006:

- All broodstock, including both natural-origin recruit (NOR) and hatchery-origin recruit (HOR) fish, will be collected at the Lyle Falls and Castile Falls facilities (section 4.2, Strategies MS2a and MS2c).
- Broodstock will be collected randomly from the entire run.
- All NOR females will be spawned only with NOR males. To the maximum extent possible, HOR females will also be spawned with NOR males. However, until NOR returns increase, it might not be possible to spawn 100% of the HOR females collected for broodstock with NOR males. Therefore, in early years, some HOR females may be spawned with HOR males.
- Only NOR by NOR and HOR by NOR crosses will be targeted for planting in natural rearing areas. YN will limit natural-area planting to NOR by NOR fish as soon as sufficient numbers of NOR broodstock can be collected at either Lyle or Castile to meet the 200,000 smolt release goal for natural production areas.
- All HOR by HOR crosses will be released from the hatchery.
- All progeny of fish spawned in the hatchery, including HOR by HOR, HOR by NOR, and NOR by NOR crosses, will be diagnostically marked to allow differentiation by cross-type. If funding precludes 100% marking of all fish, funding will be distributed such that all HOR by HOR crosses are 100% marked, and other crosses are marked sufficiently for monitoring and evaluation purposes.
- All returning fish that are not taken for broodstock and are not harvested will be allowed to spawn naturally.

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- All hatchery-origin fish returning to the current hatchery swim-in collection pond will either be trucked and released into the upper basin above Castile Falls to seed this habitat, or will be used for tribal ceremonial/subsistence purposes. The latter is considered most desirable in order to remove multi-generation hatchery-origin fish from the gene pool as quickly as possible.

Given these protocols and assumptions about trapping efficiencies and survival to release, YN expects the annual release to average approximately 500,000 hatchery-origin crosses (either HOR by HOR or HOR by NOR) and 300,000 natural-origin crosses (NOR by NOR), for a total release averaging approximately 800,000 smolts (Table 10). YN expects to implement these new protocols beginning with broodstock collection in 2006. Since Klickitat spring chinook return predominantly as age-4 fish, YN expects that by 2010 these protocols will result in annual returns where approximately 37.5% of the fish are of 100% natural-origin ancestry and many of the remaining 62.5% of the return have at least one natural-origin parent. The proportion of natural-origin fish should improve over time as multi-generation hatchery-origin fish are bred out of the population and more of the releases are from 100% natural-origin crosses.

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Table 10. Klickitat Hatchery spring chinook brood collection and egg-to-smolt survival assumptions

	HOR	NOR
Average return[1]	1418	522
Collection efficiency[2]	0.40	0.40
Collection proportion	0.625	1.00
Female proportion[3]	0.60	0.60
Live eggs/female[3]	3100	3300
Pre-spawn survival[3]	0.86	0.86
BKD loss[3]	0.04	0.04
Live egg take	544,376	341,323
Egg-smolt survival[3]	0.93	0.93
Smolt release	506,270	317,430

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1. 1977-2003 average annual return of adult age 4, 5, or 6 fish (Table 2).
2. Approximately 40% of the fish arriving at Lyle Falls are expected to pass by way of the improved fishway and trapping facility.
3. Based on data from the Cle Elum Supplementation and Research Facility for brood years 1997-2003.

Production protocols for fish to be released at acclimation sites in the upper basin

At Lyle Falls, YN would randomly collect the proportion of broodstock needed to make egg take (similar to collection at Roza Dam for the CESRF program). Broodstock are collected throughout the run in a "bell-shaped curve" (i.e., more collected in the middle). Beginning in 2006, all adults returning from the Klickitat Hatchery will be 100% externally marked, allowing hatchery- and natural-origin adult recruits to be visibly distinguished at Lyle Falls; it is anticipated that adipose clip marks and/or a coded wire tag will be used to identify hatchery returning adults. No more than 50% of the natural return will be collected for broodstock. In fact, given the expected efficiency of the Lyle Falls fishway and trap, a maximum of only 40% of the natural-origin return will be collected for broodstock. However, given the number of adults needed to meet the 200,000 upper basin acclimation site release goal with 100% natural-origin crosses, it is likely that all natural-origin fish passing upstream by way of the Lyle Falls facility will be taken for broodstock for the first several years of this new regime. Escapement to the natural spawning grounds after broodstock collection and fisheries is expected to average at least 400 fish per year, with at least 25% of them natural-origin. The latest EDT models suggest that an escapement of approximately 450 spring chinook (approximately 300 fish below Castile Falls and 150 fish above Castile Falls) is sufficient to fully seed presently available habitat.

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Comment [N1]: Appendix referred to earlier?

As natural production numbers are bolstered in the upper basin, it is envisioned that broodstock collection for the upper acclimation site(s) would shift to the Castile Falls trap. This would occur after many generations, so that naturally produced fish selected for broodstock would have a history of many years of spawning in the wild. Upper Klickitat basin fish would be held separately from other fish during the spawning and rearing phase and would be differentially marked.

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Spawning protocols (e.g., factorial mating) similar to those in use at the CESRF will be instituted (for more information, see Fast 2002). Fish will be reared in existing raceways using spring water until they are of sufficient size for marking and transportation to the acclimation site(s). These natural-origin progeny will be transferred to acclimation/release sites above Castile Falls.

Production protocols for fish to be released on-station

To the maximum extent possible, hatchery-origin females would be spawned with natural-origin males. Hatchery-origin progeny will be reared, uniquely marked at 100% mark rate (with HOR by HOR and HOR by NOR fish marked differentially), and released from the existing Pond 25 at the hatchery.

Risks: During collection of spring chinook broodstock at the new Lyle trap, non-target species might be temporarily trapped. Listed bull trout and steelhead, as well as adults from the two production stocks (fall chinook and coho), could be inadvertently collected. The Lyle facility is designed with a bypass channel where non-target fish can be passed upstream swiftly and with minimal stress.

At Lyle Falls, the existing and improved ladder/adult trap is adjacent to a natural falls, which is passable to spring chinook. It is estimated that 20% of the spring chinook use the ladder currently. With improvements (i.e., increased attraction flow and ladder efficiency), an estimated 40% of the spring chinook will use the ladder, so broodstock collection goals might not always be met. There are no plans to modify the falls, forcing all fish into the ladder.

Incidental Take: Collection of adult spring chinook broodstock is expected to occur at Lyle Falls between the months of March and June and at Castile Falls from June 1 through August 31. Operation of the Lyle and Castile Falls adult traps are not expected to impact juvenile salmon. Impacts to adult steelhead and bull trout may occur if they are present in the trapping chamber during periods of spring chinook broodstock collection. Impacts will be due to increased stress from handling, sampling, and delayed passage. Fishway improvements are designed to increase usage and trapping efficiencies; therefore existing conditions will underestimate take.

Lyle Falls

Adult steelhead: Approximately 40% of the adult migration occurs between March 1 and July 31 and will be subject to impacts. (Bonneville Dam counts were used as a surrogate, as Lyle Falls currently has no ability to count fish.) Of these fish, it is estimated that only 20% pass by way of the existing fishway (B. Sharp/YN and Tom Burns/WDFW, personal communication). Impacts will be due to increased stress from handling, sampling, and delayed passage. Therefore, we expect fewer than 8% of the adult steelhead return to be affected, with no direct mortalities as a result of these activities.

Adult bull trout: Anecdotal information from a number of tribal fishers at Lyle Falls suggests that bull trout have rarely if ever been captured at Lyle Falls by these fishers (James Kiona, YN, personal communication). Under BPA Project #200306500 (*Determine the Origin, Movements and Relative Abundance of Bull Trout in Bonneville Reservoir*), beginning in May 2004, WDFW and the YN will operate the existing Lyle Falls fishway in an effort to collect fluvial bull trout entering the Klickitat River.[6] This will give us further information about temporal overlap of the adult spring chinook and bull trout migrations. Information on bull trout impacts due to operation of the trap for spring chinook brood collection will be updated accordingly.

Castile Falls

Adult steelhead: Due to a long history of passage problems associated with the improperly constructed and maintained fishway, very limited steelhead escapement has occurred above Castile Falls (estimated at 20 adults annually). Of the estimated total, 60% of the adult migration occurs between June 1 and August 31 and will be subject to impacts. Of these fish, it is estimated that only 20% pass by way of the existing fishway (B. Sharp/YN and Tom Burns/WDFW, personal communication). Impacts will be due to increased stress from handling and delayed passage. Therefore, we expect fewer than 15% of the adult steelhead return to be affected, with no direct mortalities as a result of these activities.

Adult bull trout: Extensive survey work conducted by WDFW and YN under BPA Project #200306500 (*Determine the Origin, Movements and Relative Abundance of Bull Trout in Bonneville Reservoir*) showed no bull trout above Castile Falls. Bull trout are present approximately one mile downstream of Castile Falls. Information will be updated as study results indicate.

Strategy SC2c. Beginning with the 2002 brood, reduce the size of smolts at release to more closely match the size of natural migrants.

Rationale: Reducing the size of hatchery smolts could reduce the chance that hatchery-origin fish might out-compete natural-origin spring chinook smolts for available food resources. Preliminary data from the CESRF program indicate that reduced smolt size could result in a reduced incidence of precocialism as well (Larsen et al. 2004).

Method: An incubation water chiller would be installed at Klickitat Hatchery, which would delay ponding of spring chinook fry, resulting in smaller, healthy smolts (Ferguson and Sharp 2002).

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[6] For this work, WDFW has a Scientific Research and Take Authorization (NOAA – Project WA2004-1590). It identifies an expected take of 400 MCR steelhead and an indirect mortality of 8.

Survival differences and impacts of smaller smolt sizes are being tested. Beginning with the 2002 brood, spring chinook smolts are being reared for a targeted release size of 10 (control) to 15 (treatment) fish per pound. Fish will be stocked in separate ponds and marked uniquely for evaluation purposes. See section 5.3, Strategy SC3b.

Risks: The risks of releasing fish at smaller sizes are related primarily to the survival of the experimental fish. Smaller smolts are less likely than larger ones to prey on or out-compete other species.

Incidental Take: No adverse impacts to steelhead or bull trout are anticipated as a result of this strategy.

5.3 Objective SC3 Methods and Risks

Objective SC3. Monitor and evaluate survival, life history, and habitat use.

Appendix G summarizes data to be collected on these topics and the methods to be used.

Strategy SC3a. Use existing rotary traps and manual PIT tag detection (hand-held portable scanners) to document juvenile emergence timing, out-migration timing, and age composition; and to estimate overall basin productivity (by treatment group).

Rationale: Monitoring of juvenile characteristics and survival is an essential component of this program.

Method: Rotary traps, in combination with manual PIT tag detection, would be used as follows:

- Lyle Falls Trap (RM 2.5): 8-foot diameter cone. Operated year round, 24 hours/day, checked at least once a day. Currently, this trap is used to assess all natural production and hatchery smolt releases. Beginning in 2006, it will be used to assess all natural production, out-migration timing of release groups, and in-river survival.
- Hatchery Trap (RM 42.5): 5-foot diameter cone. Operated year round, 24 hours/day, checked frequently. Currently the trap is used to assess natural production above the hatchery and production from the hatchery fry thinning release. Beginning in 2006, it would be used to assess all natural production, out-migration timing of release groups, and in-river survival.
- Upper Trap (RM 66): 5-foot diameter cone. Operated seasonally (mid-May through November), 24 hours/day, checked frequently. Currently it is used to assess the portion of natural production occurring above Castile Falls and production from the hatchery fry thinning release. Beginning in 2006, it would be used to assess upper basin natural production, out-migration timing of release groups, and in-river survivals.

Basin productivity could be estimated as follows:

- Adult returns would be distinguished at Lyle Falls by mark-type. Different marks will denote different hatchery treatments, e.g., released from hatchery or from acclimation site; or marked (hatchery) fish could be distinguished from unmarked (wild/natural) fish.
- Natural spawning escapement by treatment type could be estimated using Lyle adult passage and harvest data.

- Numbers of adults used for broodstock is known.
- When juvenile mark information is collected via operation of the rotary traps, if the trap efficiency is known, the number of juveniles produced by the various adults (natural escapement-unmarked, hatchery release-marktype1, or acclimation release-marktype2) can be calculated.

Risks: The primary effect of trapping is migration delay and stress from handling. Predicted effects on fish at each trap site are discussed below. Effects of operation of these traps originally were assessed under NEPA in a Supplement Analysis to the Yakima Fisheries Project EIS (BPA 1999).

Lyle Falls Trap: The 8-foot rotary screw-trap was deployed immediately upstream of the Lyle Falls complex on November 11, 2002. The trap is being fished Monday through Friday. The trap is catching roughly a dozen salmonids daily; more than 80% are naturally produced coho from hatchery stock. Other species noted include lamprey, chinook, steelhead, whitefish, and long-nose and speckled dace. The YN continues to refine flow/entrainment relationships.

Hatchery Trap: The 5-foot rotary screw-trap at the WDFW Klickitat Hatchery consistently captures chinook and coho fry and smolts, with the occasional rainbow/steelhead.

Upper Trap: The 5-foot rotary screw-trap at the RM 66 consistently captures chinook, *O. mykiss*, and brook trout.

All traps are clearly marked with warning signs that indicate safe passage routes around obstructions for approaching recreational users.

Incidental Take:

Steelhead: The Klickitat basin is in the Middle Columbia ESU for summer and winter steelhead (ESA-listed as Threatened). Both stocks are present in the basin. All three rotary screw traps collect wild steelhead smolts, parr and 0-age fish. However, due to the limited passage of steelhead above Castile Falls, few steelhead juveniles are caught in the upper trap. Potential effects of the traps on steelhead originally were assessed in a Biological Assessment (BA) submitted to NMFS on May 29, 1999 (BPA et al. 1999a). With improved passage at Castile (expected beginning in 2006 when modifications to the facility are fully implemented), trap operations will be reviewed for ESA compliance. The primary effect on the steelhead is migration delay and stress from handling. Tables 11 – 13 show estimated take of listed wild steelhead.

Bull trout: Bull trout (ESA-listed as Threatened) occupy the Klickitat basin. They have been observed in the mainstem Klickitat from the base of Castile Falls (RM 64) to the river's confluence at Bonneville Dam pool. No adult or juvenile bull trout have ever been caught in any of the traps. Years of observations above Castile Falls suggest that bull trout do not make it over the falls or through the fishways. The bull trout stronghold is the West Fork system. The West Fork enters the mainstem Klickitat at RM 63.1. Effects of the three traps on bull trout originally were assessed in a BA submitted to USFWS in March 1999 (BPA et al. 1999b). USFWS provided a Biological Opinion in a letter dated May 14, 1999.

Table 11. Wild steelhead take at Lyle Falls Trap

Juvenile Wild Steelhead Catch by Month Lyle Falls Trap - 2003			
Month	Catch Estimate	Cumulative Count	Cumulative Percent
January	7	7	0.4%
February	21	28	1.6%
March	44	72	4.1%
April	303	375	21.1%
May	790	1165	65.7%
June	56	1221	68.8%
July	31	1252	70.6%
August	83	1335	75.3%
September	109	1444	81.4%
October	93	1537	86.6%
November	144	1681	94.8%
December	93	1774	100.0%

Table 12. Wild steelhead take at Hatchery Trap

Juvenile Wild Steelhead Catch by Month Hatchery Trap - 2003			
Month	Catch Estimate	Cumulative Count	Cumulative Percent
January	6	6	2.5%
February	8	14	5.7%
March	15	29	11.8%
April	27	56	22.8%
May	44	100	41.0%
June	22	122	50.1%
July	4	126	51.7%
August	4	130	53.3%
September	15	145	59.5%
October	7	153	62.5%
November	86	238	97.5%
December	6	244	100.0%

Table 13. Wild steelhead take at Castile Falls Trap

Juvenile Wild Steelhead Catch by Month Castile Falls Trap - 2002			
Month	Catch Estimate	Cumulative Count	Cumulative Percent
January	N/A	N/A	N/A
February	N/A	N/A	N/A
March	N/A	N/A	N/A
April	N/A	N/A	N/A
May	6	6	4.3%
June	12	18	12.9%
July	62	80	57.6%
August	25	105	75.5%
September	26	131	94.2%
October	8	139	100.0%
November	N/A	N/A	N/A
December	N/A	N/A	N/A

N/A means "Not available"; the trap is not operated during this timeframe.

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Strategy SC3b. Use coded wire tags and PIT tags to assess differences in survival (smolt-smolt and smolt-adult) among sizes of fish released and acclimation/release locations.

Rationale: These studies are key to determining the success of the project at establishing higher rates of natural production in more areas of the subbasin.

Method: A sub-sample of releases will be PIT tagged and up to 100% of releases will be coded-wire tagged. The actual number of fish to be tagged will be determined from statistical power analyses. All release data for tagged fish will be submitted to the regional PTAGIS (PIT) and RMIS (CWT) databases. A sub-sample of fish appearing in downstream juvenile trapping operations will be interrogated for presence of PIT tags and/or CWT tagging locations, as will a sub-sample of adult fish returning through the Lyle and Castile fishways and trapping operations. These data will be recorded and stored in project databases and all relevant data will be submitted to the regional PTAGIS (PIT) and RMIS (CWT) databases. PIT detections at Bonneville Dam and other relevant locations will be monitored on a regular basis. Survival (smolt-smolt and smolt-adult) will be assessed by comparing the number of tag detections at a given site and life-stage per tagged smolts released for each given release and treatment type. For a general description of methods, see Sampson and Fast 2000.

Risks: There is some risk that fish may die due to tagging and sampling operations. However, ongoing studies in the Columbia Basin suggest that mortality due to tagging operations is very low. For example, data on spring chinook tagging in the Yakima basin suggest that mortalities due to tagging operations are on the order of 0.5-1.0% of the total fish tagged for both PIT and CWT tags (Sampson and Fast 2000). Sampling of juvenile fish generally will be done during screw trap operations. Adult fish will be sampled at Lyle Falls and Castile Falls, in a manner similar or identical to that at the Roza trap on the Yakima River. Adult mortalities due to sampling operations at this facility have been essentially zero over 7 years of operation (M. Johnston/YN, personal communication).

Incidental Take: No impacts to steelhead or bull trout are expected from spring chinook tagging operations. Impacts from sampling operations are discussed under strategy SC3a.

Strategy SC3c. Continue to conduct spawner surveys throughout the Klickitat basin.

Rationale: These studies are key to determining the success of the project at establishing higher rates of natural production in more areas of the subbasin.

Method: Foot/boat surveys to count redds would be conducted each week during the spawning period (mid-August through the end of September).

Risks: These surveys pose little or no risk to fish.

Incidental Take: It is possible that a boat passing overhead could frighten a fish from its hiding place, causing it to be caught and eaten by a predator. However, the short amount of time a boat would spend in any reach, and the surveyors' training to observe only, make it unlikely that the surveys would cause injury to or significantly disrupt normal behavior of listed fish as described in the NMFS definition of "harass" (NMFS 1996). No direct impacts to steelhead or bull trout are expected from spring chinook spawning ground survey operations.

Strategy SC3d. Use radio telemetry, mark-recapture, and/or run reconstruction to determine passage and entrainment rates at Lyle and Castile Falls and to track natural spawners to their spawning grounds.

Rationale: Radio tracking the number of fish that use the fishway/ladder versus the number that jump the falls allows much better documentation of annual fish counts and escapement than present methods, which rely on harvest and escapement estimates (e.g., hatchery returns, redd counts, etc.) to derive an estimate of river mouth run size. Note that fish may need to be tagged at Bonneville Dam or in the Klickitat River below Lyle Falls in order to determine the proportions of fish which migrate the falls versus those using the improved Lyle fishway (entrainment rate). Radio tagging can also help determine if fish are returning to the vicinity of acclimation sites, which would help document the success in reaching one of the project's major objectives—to increase natural escapement.

Method: A portion of the Klickitat River-bound fish returning upstream would be radio-tagged. It is possible that University of Idaho fish tagged at Bonneville Dam (and identified as Klickitat-origin fish by way of PIT tag) could be used in conjunction with tagging fish collected below Lyle Falls (via electro-fishing) and releasing them downstream as a means to determine fishway passage versus total passage. The actual number of fish radio-tagged would likely vary from year to year depending on budgetary constraints and availability of usable tags and radio frequencies. The trap would be operated throughout the duration of the spring chinook run (typically late March or early April through July).

Radio transmitters would be inserted through the mouth into the stomach. Tagged fish would be held in a recovery tank 4-10 hours in order to evaluate tag regurgitation. Fish less than 350 mm fork length (FL) would not be tagged in order to minimize tag regurgitation and physical injury to fish. After recovery, tagged fish would be released approximately 0.8 kilometers (0.5 miles) upstream and/or downstream (to monitor passage and entrainment rates) of the facility.

YN would use tags manufactured by Advanced Telemetry Systems, Inc. Each tag will have a unique bandwidth pulse that provides an individual identification code. Surveillance for released tags would be conducted at several fixed locations (Lyle and Castile Falls and the acclimation sites) as well as with mobile tracking antennae. YN would use telemetry receivers (Lotek and/or NOAA Fisheries-recommended equipment) for both fixed site and mobile monitoring activities. Trackers would rely primarily on upstream movement and visual observations as indicators of live fish. Tags will be recovered from dead fish whenever possible.

However, the use of radio telemetry to the degree described here could prove cost-prohibitive, making "after the fact" run reconstruction the only viable means of estimating Lyle Falls fishway passage rates. In this case, estimates would be made over several years as Lyle trap sample data are cross-correlated with known factors such as flows, adult returns to the hatchery, and spawning ground survey data. An alternate technique might be to use mark-recapture methods (e.g., marking all fish passing upstream via the Lyle Falls fishway and sampling facility) with subsequent recapture data from the spawning grounds for expansions.

Risks: There is some risk that fish may die due to tagging operations. Bjornn et al. (1998) postulated a maximum mortality rate due to tagging operations of 3-5% for studies of fish that were radio tagged at Ice Harbor or John Day dams and tracked to spawning grounds in the Snake River in 1991-1993.

Incidental Take: Incidental take could occur during trapping operations to radio-tag the spring chinook. Traps would be operated during the same period as broodstock collection, or under existing permits (e.g., University of Idaho tagging operation at Bonneville Dam—see Strategy SC2a), so spring chinook tagging would cause no additional take beyond that occurring during those efforts.

Strategy SC3e. Implement automated data tracking systems in use at Cle Elum and Prosser hatcheries.

Rationale: The system would facilitate survival analyses of fish at the Klickitat Hatchery through spawning, incubation, rearing, and release. Given the volume of data to be collected and analyzed for M&E purposes, an automated data collection and reporting system is considered a necessary component of this operation.

Method: Existing data systems have been constructed in Microsoft Access for data capture, storage and retrieval and are in use in YKFP projects in the Yakima River basin. The Klickitat data manager will work with the YKFP data manager to modify these data systems for use in conjunction with Klickitat basin supplementation activities. It is anticipated that these systems will be online and available prior to the beginning of any broodstock collection at Lyle and/or Castile Falls.

These systems capture information such as date of passage or spawning, PIT tag code (if already present or inserted into fish), radio tag channel and code (if already present or inserted into fish), length and weight of fish, fecundity data (from female egg samples taken at spawn time), rearing locations of progeny (from incubation trays to rearing ponds to acclimation site release ponds), mark information (e.g., adipose presence/absence, CWT presence/absence, elastomer eye tag presence and color), and much more.

Risks: Manual (paper) backup systems will be in place to ensure that, in the event of power and/or hardware or software problems, data still can be collected and that fish are not held for an inappropriate period of time. Automated data will be backed up on a regular basis and maintained at the Wahkiacus field office where the Klickitat data manager is stationed.

Incidental Take: No impacts to steelhead or bull trout are expected from use of automated tracking systems.

5.4 Objective SC4 Methods and Risks

Objective SC4. Monitor and evaluate ecological interactions.

Strategy SC4a. Use findings from Yakima and upper Columbia Basin studies in conjunction with information from risk assessments to target ecological interactions studies in the Klickitat basin.

Rationale: The YKFP’s program is designed to enhance target stocks while keeping ecological interactions to a minimum (see section 1.2). Much work on ecological interactions has been done in other basins that might be applicable to conditions and species in the Klickitat basin. On the other hand, some conditions or species in the Klickitat might require more or different studies. The proposed risk assessments will help define the monitoring needs in the Klickitat basin.

Method: Biologists with expertise in the Klickitat subbasin would conduct a risk assessment of the impacts of spring chinook supplementation activity on non-target species (non-target taxa [NTT]). The assessment would use methodology developed by WDFW biologists Todd Pearsons and Bill Hopley (Pearsons and Hopley 1999). Table 14 is the template for such assessments provided by Pearsons and Hopley.

Using the results from this assessment and a review of relevant literature from the Yakima basin and elsewhere, YN would work with scientists with knowledge and experience of the Klickitat basin to determine whether work needs to be done in the Klickitat to monitor and evaluate impacts to other fish species due to predation, competition, or other ecological interactions with supplemented spring chinook. Studies would target only those areas where the risk is determined to be moderate to high and existing data from studies in other basins are determined to be inapplicable.

Risks: A preliminary evaluation of ecological interactions risks is shown in Tables 15 and 16.

Incidental Take: Impacts to steelhead or bull trout could occur during electro-fishing operations or other monitoring activities, should the results of this strategy warrant the implementation of additional ecological interactions work in the Klickitat. If such studies are proposed, appropriate consultation would be undertaken and estimates of take levels would be made.

Table 14. Template for assessing ecological risks to NTT of fish stocking programs [7]

Proposed Stocking Program: Target taxon________________________ Size at release _________________

Date of release________________ Number and location ____

		Overlap[a]		Interaction Strength[b]			
NTT[c]	Status[d]/Impact	Type 1 Life Stage	Type 2 Life Stage	Type 1 Interaction	Type 2 Interaction	Risk[e]	Uncertainty[f]
Example of species or stock	D/10%	Fry	All	C, P, B, D, N	C, P, B, D, N, S	74%	16%

a *Type 1*: spatial and temporal overlap between NTT and released hatchery salmonids, residuals, and returning adults.

Type 2: spatial and temporal overlap between NTT and all life history stages of naturally produced offspring of returning hatchery adults.

Life stage—fry, parr, smolt, adult (salmonids); age 0, juvenile, adults (other species) or all if overlap occurs for all life stages or none if no overlap occurs.

b Ecological interactions that could occur between stocked anadromous salmonids and NTT.

Negative interactions

C (competition)—the presence of hatchery salmonids limiting the availability of resources that NTT would use in the absence of hatchery salmonids. This occurs when stocked salmonids and NTT use common resources, the supply of which is short (i.e., exploitative or indirect competition); or if the resources are not in short supply, competition occurs when hatchery salmonids limit access of NTT that are seeking a desired resource (i.e., interference or direct competition; Birch 1957).

P (predation)—the direct consumption of NTT by hatchery salmonids (direct predation; *Pd*) or the increase in predation by other predator species resulting from the presence of hatchery salmonids (indirect predation; *Pi*). Indirect predation can occur through the following mechanisms: (1) Hatchery salmonids displace NTT from preferred habitat, making NTT more vulnerable to predators; or (2) the increased abundance of hatchery salmonids attracts predators, causes predators to switch prey, or increases population densities of predators, which can increase consumption of NTT, particularly if NTT are preferred.

B (behavioral anomalies)—the presence and behavior of hatchery salmonids alter the natural behavior of NTT. For example, migrating hatchery salmonids may cause premature migration of NTT (e.g., pied-piper effect; Hillman and Mullan 1989) or may cause NTT to become less active (McMichael et al., in press).

D (pathogenic interactions)—the transfer of a pathogen from hatchery salmonids to NTT (direct pathogenic interaction) or the increased susceptibility of NTT to pathogens (indirect pathogenic interaction).

M (nutrient mining)—the carcasses of fish that would normally reproduce naturally are collected for hatchery broodstock and are not distributed back into the natural environment or are distributed inappropriately. This results in a loss of nutrients/food that would ordinarily be available to NTT.

Beneficial interactions

N (nutrient enrichment)—increase in nutrients available to NTT because of an increase in marine-derived nutrients from greater salmonid returns (e.g., salmon carcasses).

F (prey)—increased availability of prey for piscivorous NTT.

S (predator swamping)—the survival of NTT is enhanced due to swamping of predators by hatchery fish.

c *NTT*—highly valued non-target taxa.

d *Status*: H=healthy, D=depressed, T=Threatened (ESA), C=critical (or other status descriptors). Impact—acceptable impact level to the NTT (e.g., 10% impact to abundance, distribution, and size structure).

e *Risk*: probability (0%–100%) of failing to meet an objective for NTT; 0% corresponds to impossibility of failing, and 100% corresponds to surety that an objective will be exceeded.

f *Uncertainty*: scientific uncertainty of risk assessment due to lack of information or variability of ecological interaction outcomes; calculated as the standard deviation of the risks.

[7] Source: Pearsons and Hopley 1999. The template is slightly edited from the published version to make definitions easier to find and to reflect terms used by participants in this project's risk assessment. The authors provided an example of one NTT relative to a hypothetical stocking program.

Table 15. Risk assessment for spring chinook releases in Klickitat subbasin above Castile Falls

Comment [N2]: Why are these tables highlighted?

NTT	Status[1]/Impact	Type 1 Life Stage	Type 1 Interaction[2]	Type 2 Life Stage	Type 2 Interaction[2]	Risk	Uncertainty
Steelhead[3, 4, 5]	T/0%	Egg		Egg		40.00	17.41
		Fry	D, M, N	Fry	C, D, M, N, F		
		Parr	C, B, D, M, N, S	Parr	C, B, D, M, N		
		Smolt	C, Pi, B, D, M, N, S	Smolt	C, Pi, B, D, M, N		
		Adult	C, D	Adult	C, D		
Resident rainbow	SD/40%	Egg	C	Egg	C	6.00	1.76
		Fry	Pd, D	Fry	C, Pd, Pi, D, F		
		Parr	C, B, D, S	Parr	C, Pi, B, D		
		Smolt		Smolt			
		Adult	C, D, F	Adult	C, D		
Spring chinook[5, 6]	D/10%	Egg		Egg	Pd	11.00	1.82
		Fry	Pd, D	Fry	C, Pd, Pi, D		
		Parr	Pd, D	Parr	Pd, D		
		Smolt	C, Pi, B, D	Smolt	C, Pi, B, D		
		Adult	C	Adult	C		

1. Status: H = Healthy, SD = Somewhat Depressed, D = Depressed, T = Threatened (ESA), C = Critical
2. See Table 14 for definitions of interactions
3. Disease is major concern
4. Level of nutrient mining depends on broodstock carcass pathogen levels and carcass stocking policy
5. Competition for limited holding habitat in summer
6. Adult effects on parr

Table 16. Risk assessment for spring chinook releases in Klickitat subbasin below Castile Falls

NTT	Status[1]/Impact	Type 1 Life Stage	Type 1 Interaction[2]	Type 2 Life Stage	Type 2 Interaction[2]	Risk	Uncertainty
Steelhead[3, 4, 5]	T/0%	Egg		Egg		41	16.30
		Fry	D, M, N	Fry	C, D, M, N, F		
		Parr	C, B, D, M, N, S	Parr	C, B, D, M, N		
		Smolt	C, Pi, B, D, M, N, S	Smolt	C, Pi, B, D, M, N		
		Adult	C, D	Adult	C, D		
Resident rainbow	SD/40%	Egg	C	Egg	C	7	1.21
		Fry	Pd, D	Fry	C, Pd, Pi, D, F		
		Parr	C, B, D, S	Parr	C, Pi, B, D		
		Smolt		Smolt			
		Adult	C, D, F	Adult	C, D		
Spring chinook[5, 6]	D/10%	Egg		Egg	Pd	15	0.80
		Fry	Pd, D	Fry	C, Pd, Pi, D		
		Parr	Pd, D	Parr	Pd, D		
		Smolt	C, Pi, B, D	Smolt	C, Pi, B, D		
		Adult	C	Adult	C		
Bull Trout	T/0%	Egg		Egg	C	19	10.07
		Fry	D, M, N	Fry	D, M, N		
		Parr	C, Pi, D, M, N	Parr	C, Pi, D, M, N		
		Adult	D,F	Adult	D,F		
Lamprey	D/0%	Egg		Egg		5	4.56
		Ammocoete	M, N	Ammocoete	Pd, M, N		
		Outmigrant	M, N	Outmigrant	M, N		
		Adult	M, N	Adult	M, N		

1. Status: H = Healthy, SD = Somewhat Depressed, D = Depressed, T = Threatened (ESA), C = Critical
2. See Table 14 for definitions of interactions
3. Disease is major concern
4. Level of nutrient mining depends on broodstock carcass pathogen levels and carcass stocking policy
5. Competition for limited holding habitat in summer
6. Adult effects on parr

5.5 Objective SC5 Methods and Risks

Objective SC5. Monitor and evaluate the genetic changes in the spring chinook population, both hatchery and naturally produced.

> **Strategy SC5a.** Collect DNA samples and morphometric data from fish passing through the Lyle Falls and Castile Falls traps. Use findings from Yakima and other Columbia Basin studies in conjunction with information from these samples to target genetic studies in the Klickitat basin. Convene meetings of tribal and state geneticists as necessary to further develop sampling rates, protocols, and evaluation measures.

Rationale: The YKFP's program is designed to enhance target stocks while minimizing genetic risks (see section 1.2). The genetic risks of using artificially propagated fish to enhance natural populations are well described (e.g., Ford 1999). The YKFP has already developed methods, protocols, and guidelines to monitor and manage these risks (Busack et al. 1997). It is not cost-effective to duplicate in the Klickitat work that is already being done on the genetic risks of supplementation in the Yakima and other Columbia subbasins.

Method: Collect genetic data (via DNA samples) and morphometric data from all fish collected for broodstock at Lyle and Castile Falls. The intent is to collect the data necessary to monitor and evaluate changes to the population over time. These data will be analyzed routinely. Additional studies specific to the Klickitat basin may be recommended based on the results of these analyses when compared to results from other related work in the Yakima or other Columbia subbasins.

Risks: The hatchery broodstock collection, spawning, and rearing protocols proposed in this plan are designed to minimize genetic risks due to supplementation activities (see Busack et al. 1997). Consistent with the philosophy of adaptive management, technical staff may recommend changes in hatchery practices to appropriate policy makers if the data suggest that changes are warranted.

Incidental Take: See strategy SC2a for expected impacts during sampling operations at the Lyle and Castile Falls traps.

5.6 Objective SC6 Methods and Risks

Objective SC6. Monitor in-basin and Columbia River harvest of Klickitat-origin spring chinook.

> **Strategy SC6a.** Increase tribal and sport fishery monitoring and bio-sampling rates as necessary to maintain a minimum 20% sampling rate.

Rationale: Complete and accurate harvest monitoring and reporting is mandated by a variety of laws, treaties, and fishery management agreements. As such, it is a priority for both the YN and WDFW. Accurate documentation of total in-basin harvest by species as well as the stock composition (total catch by mark type) is important in determining the success of the proposed spring chinook supplementation project in meeting one of the major aspects of the program's overall goal—to increase harvest.

Method: YN would employ additional personnel (as necessary) so that fisheries are sampled at a minimum rate of 20% and adequate data are collected to document the harvest. The WDFW and the YN employ technicians and a biologist to monitor and evaluate in-basin harvest in the respective sport and tribal fisheries. Harvest monitoring typically consists of on-the-water surveys and/or fisher interviews to collect catch data and to record mark/tag presence information from harvested fish. Survey data are expanded for time, area, and effort using standard methods to derive estimates of total in-basin harvest by fishery type (sport and tribal) and catch type (hatchery or wild denoted by mark presence/absence). Harvest estimates do not include any incidental mortality (e.g., post-release mortality of unmarked (NOR) spring chinook in a selective sport fishery, etc.). If these data are deemed critical to future analyses, estimates from the literature can be used.

Deleted: mortalities

Risks: Only spring chinook harvested in the in-basin fisheries would be sampled for the purposes identified in this master plan. Since all sampled fish will be dead, no risks are expected due to this activity.

Incidental Take: No incidental take of listed species is expected from harvest monitoring activities.

Strategy SC6b. Update and maintain all Klickitat-related databases with historical and current harvest data.

Rationale: See Strategy SC6a.

Method: YN would use adult return estimates from Lyle Falls trapping/sampling operations, harvest data, age composition information (derived from PIT detections and scale samples), and mark sampling information to produce and maintain tables documenting annual returns of hatchery- and natural-origin spring chinook as well as adult-to-adult survival rates over time. YN also would maintain data tables on the number, location, and other relevant data for all hatchery-reared fish releases. YN would use historical data sets from WDFW, *U.S. v. Oregon* Technical Advisory Committee, and other agencies to make sure these data sets are as complete and accurate as possible.

Risks: None.

Incidental Take: None.

Strategy SC6c. Use run reconstruction methods developed for Yakima Basin spring chinook to reconstruct Klickitat run and harvest to the Columbia River mouth.

Rationale: See Strategy SC6a.

Method: Standard run reconstruction techniques would be employed to derive reasonable estimates of harvest from the Columbia River mouth to the Klickitat River mouth for spring chinook. Data from databases maintained by the *U.S. v. Oregon* Technical Advisory Committee would be used to obtain harvest rate estimates for the aggregate Klickitat River spring chinook population and to estimate passage losses through Bonneville reservoir. These data, combined with the Lyle Falls counts and estimated harvest below Lyle Falls, would be used to derive a Columbia River mouth run-size estimate and Columbia River mainstem harvest estimate for Klickitat spring chinook. These data will be updated annually.

Estimates of harvest of hatchery-reared spring chinook by release location for out-of-basin fisheries would be made using Lyle Falls sampling proportions. For in-basin fisheries, these estimates would be made using in-basin harvest sampling data. An analysis of harvest data by rearing-treatment/release location would be made using available PIT tag detection data maintained in the regional PTAGIS database. Beginning with the 2002 adult spring migration, adult PIT tag detection facilities at all ladders at Bonneville Dams were operational. These facilities are expected to achieve nearly 100% efficiency in adult PIT tag detection. In addition, returning hatchery-reared spring chinook would be mark-sampled at Castile Falls; any PIT detections there (and at Lyle Falls) will be submitted to PTAGIS.

Risks: None.

Incidental Take: None.

Strategy SC6d. Use the regional mark information system (RMIS) to monitor CWT recoveries of Klickitat spring chinook in marine and freshwater fisheries coast-wide.

Rationale: Based on available CWT information, harvest managers have long assumed that Columbia River spring chinook are not harvested in any abundance in marine fisheries as the timing of their ocean migration does not overlap either spatially or temporally with the occurrence of marine fisheries. Monitoring these databases will help determine if this assumption is true for Klickitat basin spring chinook. Monitoring CWT recoveries will also help to estimate the level of harvest of Klickitat spring chinook in fisheries outside of the Klickitat basin.

Method: Two other databases are available to retrieve data to complement the data that are derived using run reconstruction. The Regional Mark Information System (RMIS) would be queried regularly for any CWT recoveries of YKFP releases in ocean or Columbia River mainstem fisheries. In addition, the commercial fish ticket database maintained by Washington and Oregon would be queried for recoveries of Klickitat River fish in non-Indian and Treaty Indian commercial fisheries in the Columbia River. YKFP staff would query the RMIS database regularly to determine harvest in marine and freshwater fisheries.

Risks: None.

Incidental Take: None.

Chapter 6. Steelhead Proposed Actions and Risks

6.1 Objective S1 Methods and Risks

Objective S1. Rebuild natural populations of steelhead in the Klickitat subbasin.

Table 17 summarizes the proposed plan to transition from a non-local stock to a Klickitat stock of summer steelhead. Winter steelhead need more study, as discussed in Strategy S1d.

Table 17. Transition plan summary for summer steelhead production in the Klickitat subbasin

Klickitat Watershed Releases	Current to 2005	2006	2007	2008	2009	2010
Klickitat stock produced, acclimated, and released in the basin	200,000[1]	200,000	200,000	200,000	200,000	200,000
Produced at other hatcheries, scatter planted, Skamania stock	120,000[2]	0	0	0	0	0

1. These are Wells Hatchery steelhead eyed eggs transferred to Klickitat Hatchery for incubation and early rearing and then transferred to Ringold Hatchery for finish rearing to smolt stage and release.
2. To minimize fishery impacts, termination of the 120K Skamania release may be delayed one or more years until local stock production can fully replace these out-of-basin smolts.

Strategy S1a. Use supplementation to enhance the summer-run steelhead stock.

Rationale: The Klickitat steelhead population is listed as Threatened under ESA. Table 2 (section 3.1.2) shows that Klickitat steelhead remain generally depressed. By transitioning to local broodstock, and with improved spawning and rearing protocols (e.g., use of acclimation sites, etc.), survival to returning adult, as well as the local adaptation of the natural population, is expected to improve.

Methods:

- Beginning in 2006, eliminate rearing of Ringold Hatchery releases and implement a summer steelhead production program of 200,000 fish at Klickitat Hatchery, using part of the capacity made available by reductions in hatchery coho production (see Chapter 4, section 4.1).
- Begin to develop a locally adapted broodstock.

Broodstock would be collected at Lyle Falls. Even if the fishway improvements are not completed by 2006, the existing structure at Lyle Falls as well as existing agreements among fisheries managers would allow some limited broodstock collection.

Broodstock would be collected beginning in May and would continue on a year-round or nearly year-round basis. They would be collected in a random manner throughout the run from fish passing via the fishway (similar to collection of spring chinook at Roza Dam for the CESRF program). Since Skamania releases are 100% externally marked, hatchery- and natural-origin adult recruits can be visibly distinguished at Lyle Falls. Only natural-origin recruits will be used for broodstock, and no more than 50% of the natural return will be collected for broodstock. At current trapping efficiency (estimated by WDFW and YN biologists to be approximately 40%), in most years every natural-origin steelhead migrating through the Lyle Falls fishway would need to be taken for broodstock (approximately 250 fish annually) to maintain a release goal of 200,000 smolts. Using the data in Table 2 and assuming:

- 27% of the annual return is wild (section 3.1.2),
- 40% trapping efficiency,
- 50% of the return are females,
- each female has approximately 2,000 viable eggs, and
- 80% egg-to-smolt survival,

YN expect to meet the 200,000 smolt release goal in approximately 56% of the years. Given that the run size estimates in Table 2 are most likely minimum estimates, this expectation is also most likely a minimum. In other words, the 200,000 smolt release goal will very likely be met more than 56% of the time.

However, maintaining a wild/natural, local broodstock population will take priority over the release goal. All fish taken for broodstock will be PIT tagged so that collection data (e.g., time of passage) will be known at spawning time. This will also allow analyses of information such as transfer and holding survival rates, morphological changes, etc.

Winter-run stock will be distinguished using scale pattern analysis, DNA sample results (if available), and time of passage at Lyle Falls.[8] Any adults determined to be winter run will be released back to the river.

Spawning is expected to occur generally from February through May, driven by the maturity of the fish. Fish will be sorted every two weeks to check for ripeness. All fish will be live-spawned (using air or saline spawning techniques) so that spawners can be reconditioned as kelts. All kelts will be PIT-tagged, with approximately 50% released to the river for natural reconditioning and the remaining 50% of the kelts held for reconditioning at the hatchery (provided that O&M funding and water availability do not preclude this strategy). A variety of release locations will be tested and PIT tags will allow analysis of survival of downstream and upstream migrants at Bonneville Dam. Spawning protocols (e.g., factorial mating) similar to those in use at the CESRF will be instituted (for additional information, see Fast 2002). Fish will be reared in existing raceways using spring water until they are of sufficient size for marking and transportation to the acclimation site(s). All fish will be reared with a goal of mimicking in size and condition factor their wild counterparts, to the extent practical.

Risks: During steelhead broodstock collection at the new Lyle trap, non-target species may be temporarily trapped. It will be possible to inadvertently collect listed bull trout, as well as adults from the two production stocks (fall chinook and coho). The Lyle facility is designed with a bypass channel where non-target fish can be passed upstream swiftly and with minimal stress.

Incidental Take: Collection of adult steelhead broodstock is expected to occur at Lyle Falls essentially year-round. As noted above, every natural-origin adult steelhead passing upstream

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[8] Meetings of tribal and state geneticists will be convened as necessary to further develop sampling rates, protocols, and evaluation measures.

through the Lyle Falls fishway would be collected and transported to the hatchery as potential broodstock. Winter-run stock will be distinguished using scale pattern analysis, DNA sample results (if available), and time of passage at Lyle Falls. Any adults determined to be winter run will be released back to the river.

Impacts to adult bull trout may occur if they are present in the trapping chamber during periods of steelhead broodstock collection. Impacts to bull trout will be due to increased stress from handling, sampling, and delayed passage. Anecdotal information from a number of tribal fishers at Lyle Falls suggests that bull trout have rarely if ever been captured at Lyle Falls by these fishers. For BPA Project #200306500 (*Determine the Origin, Movements and Relative Abundance of Bull Trout in Bonneville Reservoir*), WDFW and the YN will operate the existing Lyle Falls fishway in an effort to collect fluvial bull trout entering the Klickitat River. Information will be updated accordingly.

Consultation with NOAA Fisheries and USFWS would be undertaken, and a Biological Assessment of risks to steelhead and bull trout would be prepared, before the proposed tasks are implemented.

Strategy S1b. Beginning in 2006, release summer steelhead from new acclimation sites above Castile Falls.

Rationale: YN's experience in other basins (e.g., Yakima basin spring chinook and coho) demonstrates that acclimating hatchery produced fish in natural rearing areas results in adult fish returning to those waters. The literature provides biological rationale for believing that acclimation can contribute to improved survival and increased return numbers (Cuenco et al. 1993).

Modification of the Castile Falls Fishway (RM 64), which is expected by October 2004, will open approximately 35 miles of spawning and rearing habitat in the upper Klickitat. Acclimating smolts in this habitat is expected to encourage adults to spawn in this part of the basin.

Methods:

Release strategies will consist of some or all of the following:

- Rear fish to a size equal to age-one wild smolts at time of spring release.
- Release as two-year-old smolts. Existing data indicate that approximately 64% of wild/natural smolts are age-2 juvenile migrants.
- Scatter release as summer parr.

Deleted: with development of additional water (untapped springs available) and space at the Klickitat Hatchery

Hatchery-produced summer steelhead smolts will be released from one or two acclimation sites above Castile Falls (see section 4.2, Strategy 2e and Appendix F). Fish are expected to be held in the acclimation sites for a period of 6-8 weeks, at which time fish will be volitionally released. Volitional release is expected to begin in mid-April, and all fish would be forced out of acclimation ponds no later than June 30.

Deleted: up to four

Risks:

- Age-1 release carries the risk that some fish will migrate one year earlier than they might have been pre-disposed to do. Standard hatchery practices typically use an age-1 release strategy and rear the fish to an unnaturally large size, making them much more likely to immediately migrate to the ocean. Since existing data indicate that the majority of steelhead in the Klickitat basin are age-2 migrants, the proposed supplementation program would rear age-1 releases to a much more natural size-at-release using temperature and feed modulation. It is hoped that this strategy will allow these fish to remain in the freshwater system for an additional year after release if they choose.

These fish would experience a survival benefit from spending their first year in the hatchery. However, the benefit could be negated by increased mortality in the wild during their second year of freshwater residence, if they are not as fit to compete for food and space and avoid predators as naturally spawned juveniles. A “semi-natural rearing treatment,” based on YKFP experience with spring chinook at Cle Elum Hatchery, may be employed at Klickitat Hatchery to prepare age-1 releases to survive in the wild.

- Age-2 release carries the risk that some fish “should” have migrated as age-1 and may now residualize. Ecological interactions risks (e.g., predation, competition, residualization, etc.) associated with age-2 releases will be addressed when the ecological interactions assessment is completed (see preliminary assessment under Objective S2). Any genetic risks associated with age-2 releases are expected to be minimal because these fish will be the progeny of natural, native populations.
- Parr release carries the risk of no measurable gain in survival over simply allowing the parents of these progeny to reproduce in the wild.
- Any release of hatchery fish risks transfer of disease to wild populations. All appropriate hatchery guidelines to minimize disease and transfer to other populations will be followed.
- Broodstock collection at Lyle Falls, which is low in the basin, could lead to collection of “dip-ins” from other populations for broodstock. Therefore, DNA samples will be taken from all brood fish and analyzed. “Dip-ins” from other populations will be identified and excluded from the spawning population. These fish will be tagged and then released into the Columbia River upstream of the mouth of the Klickitat. The tagging method will allow identification of the fish as non-native to the Klickitat should they again pass the Lyle Falls fishway. Tribal and state geneticists will meet as necessary to further develop sampling rates, protocols, and evaluation measures.

Incidental Take: Impacts to juvenile steelhead and bull trout may take the form of: a) increased competition for available habitat and resources; b) increased predator presence due to increased numbers of prey juveniles in the waters; or c) increased risk of disease transfer. Estimates of the amount of take depend on the completion of the ecological interactions assessment.

Strategy S1c. Beginning in approximately 2006, eliminate scatter-plant releases of 120,000 Skamania stock steelhead smolts in the Klickitat subbasin.

Rationale: These releases are inconsistent with regional recommendations on hatchery reform. Since they are an out-of-basin stock, the releases also are inconsistent with the objective of rebuilding natural populations of Klickitat basin steelhead.

Method: Discontinue releases beginning in approximately 2006. The last returns of adults from Skamania steelhead releases (last release in spring 2005) are expected in 2006 (1-salt), 2007 (2-

salt), and possibly 2008 (3-salt). These fish will be allowed to pass upstream for harvest or to spawn naturally. The alternative of 100% elimination at Lyle Falls is considered infeasible (since not all fish can be expected to pass via the fishway), and politically unacceptable (e.g., against tribal policy, contrary to WDFW obligation to sport fishers). To minimize fishery impacts, termination of the Skamania release may be phased gradually over one or more years to ensure that local stock production can fully replace these out-of-basin smolts.

Risks: The Skamania stock was founded with at least some Klickitat basin steelhead as a subset of the founding hatchery population. Returning Skamania stock adult steelhead probably have spawned naturally in the Klickitat basin for at least the past 40 years, so adverse effects on the genetic health of the natural population are not expected.

The YN and WDFW will work cooperatively to assure that the risk to the state summer steelhead sport fishery from elimination of Skamania stock scatter plants is minimized. We expect that careful implementation of the strategies discussed in this section will serve to maintain or increase the numbers of harvestable steelhead available to all fisheries while also maintaining consistency with the ESA and current hatchery reform recommendations.

Incidental Take: None.

Strategy S1d. Collect data to test the feasibility of using supplementation to enhance the winter-run steelhead population in the Klickitat basin.

Rationale: The winter portion of the Klickitat run is part of the ESA-listed (Threatened) Mid-Columbia ESU and therefore warrants measures to enhance the population. The Columbia River tribes continue to maintain that all wild/natural salmon and steelhead populations need to be enhanced to levels that support meaningful tribal and non-tribal harvest in all years. However, little is known about the present status of winter-run steelhead in the Klickitat. Limited data from early 1990s surveys conducted to test population genetics suggest that approximately 15% of the aggregate return is from winter-run fish. This analysis was based on scale analysis and visual estimates of brightness from the sampled fish. More information is needed before a responsible supplementation effort can be designed and implemented.

Method: Collect and analyze data on the status of winter-run steelhead in the Klickitat basin:

- Basin carrying capacity, using EDT and ongoing habitat surveys.
- Passage timing, abundance, and other biological data (e.g., lengths, weight, age-composition, etc.), as well as DNA and scale samples, collected from all steelhead passing through the Lyle Falls facility. DNA analysis will be used to determine the portion of the aggregate run that is summer and winter run. Tribal and state geneticists will meet as necessary to further develop sampling rates, protocols, and evaluation measures.
- Ability of personnel to adequately distinguish summer and winter run fish at Lyle Falls.
- Temporal and spatial distribution of summer and winter run fish, using radio telemetry.
- Summer and winter run spawning and rearing habitats.

If warranted, studies will be conducted at the hatchery to determine if the hatchery infrastructure is sufficient to accommodate/segregate separate summer and winter run steelhead populations through the holding, spawning, and rearing processes.

Risks and Incidental Take: Biological sampling, DNA sampling, and radio telemetry are tasks that meet the definition of take as defined in ESA. Consultation with NOAA Fisheries and a Biological Assessment of the risks to steelhead would be completed before the proposed tasks are implemented. The potential for take from sampling operations is discussed under Strategy S1a.

> **Strategy S1e.** Investigate feasibility of using the Wahkiacus Hatchery and Acclimation Facility (WHAF) for steelhead rearing and release either as an acclimation site or for kelt reconditioning.

Rationale: Klickitat steelhead are part of the ESA-listed mid-Columbia ESU. All possible options for increasing survival and natural production should be explored. A WHAF rearing and release option would be primarily for the purpose of improving natural production of winter steelhead and exploiting tributary habitats in the lower Klickitat Basin.

Deleted: winter steelhead for

Methods: Determine whether smolt acclimation or a kelt reconditioning program is more feasible. Investigate ability to integrate the preferred activity with existing requirements as defined for coho (strategy C2a) and fall chinook (strategy FC2a). Define any additional infrastructure requirements to the WHAF. If determined to be feasible, develop an implementation plan.

Comment [N3]: This does not say what methods will be used to determine feasibility. Will this be solely a literature search or paper analysis?

Risks and Incidental Take: Since these are feasibility investigations only at this stage, no risks or incidental take of listed species are expected.

6.2 Objective S2 Methods and Risks

Objective S2. Monitor and evaluate ecological interactions.

> **Strategy S2a.** Use findings from Yakima and upper Columbia Basin studies in conjunction with information from risk assessments to target ecological interactions studies in the Klickitat basin.

Rationale: The YKFP's program is designed to enhance target stocks while keeping ecological interactions to a minimum (see section 1.2). Much work on ecological interactions has been done in other basins that might be applicable to conditions and species in the Klickitat basin. On the other hand, some conditions or species in the Klickitat might require more or different studies. The proposed risk assessments will help define the monitoring needs in the Klickitat.

Method and Risks: YN staff conducted a preliminary risk assessment of steelhead releases above and below Castile Falls, as shown in Tables 18 and 19. The method used is similar to that described in section 5.4.

Table 18. Risk assessment of summer steelhead releases above Castile Falls

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NTT	Status[1]/Impact	Type 1 Life Stage	Type 1 Interaction[2]	Type 2 Life Stage	Type 2 Interaction[2]	Risk	Uncertainty
Steelhead[3]	T/0%	Egg	C	Egg	C	66	10.07
		Fry	Pd, D	Fry	C, Pd, Pi, D, F		
		Parr	C, B, D, S	Parr	C, Pi, B, D		
		Smolt	C, Pi, D, S	Smolt	C, Pi, D		
		Adult	C, D, F	Adult	C, D		
Resident rainbow	SD/40%	Egg	C	Egg	C	9	4.16
		Fry	Pd, D	Fry	C, Pd, Pi, D, F		
		Parr	C, B, D, S	Parr	C, Pi, B, D		
		Smolt		Smolt			
		Adult	C, D, F	Adult	C, D		
Spring chinook[4, 5]	D/10%	Egg		Egg	Pd	14	4.91
		Fry	Pd, D	Fry	C, Pd, Pi, D		
		Parr	Pd, D	Parr	Pd, D		
		Smolt	C, Pi, B, D	Smolt	C, Pi, B, D		
		Adult	C	Adult	C		

1. Status: H = Healthy, SD = Somewhat Depressed, D = Depressed, T = Threatened (ESA), C = Critical
2. See Table 14 for definitions of interactions (Deleted: 1)
3. Disease is a major concern (Deleted: 2)
4. Adult effects on parr (Deleted: 3)
5. Competition for limited holding habitat in summer (Deleted: 4)

Table 19. Risk assessment of summer steelhead releases below Castile Falls

NTT	Status[1]/Impact	Type 1 Life Stage	Type 1 Interaction[2]	Type 2 Life Stage	Type 2 Interaction[2]	Risk	Uncertainty
Steelhead[3, 4]	T/0%	Egg	C	Egg	C	32.00	11.02
		Fry	Pd, D	Fry	C, Pd, Pi, D, F		
		Parr	C, B, D, S	Parr	C, Pi, B, D		
		Smolt	C, Pi, D, S	Smolt	C, Pi, D		
		Adult	C, D, F	Adult	C, D		
Resident rainbow	SD/40%	Egg	C	Egg	C	4.00	1.73
		Fry	Pd, D	Fry	C, Pd, Pi, D, F		
		Parr	C, B, D, S	Parr	C, Pi, B, D		
		Smolt		Smolt			
		Adult	C, D, F	Adult	C, D		
Spring chinook[5, 6]	D/10%	Egg		Egg	Pd	7.00	3.02
		Fry	Pd, D	Fry	C, Pd, Pi, D		
		Parr	Pd, D	Parr	Pd, D		
		Smolt	C, Pi, B, D	Smolt	C, Pi, B, D		
		Adult	C	Adult	C		
Bull Trout	T/0%	Egg		Egg	Pd	20.00	8.32
		Fry	Pd, D	Fry	C, Pd, Pi, D		
		Parr	Pd, D	Parr	Pd, D, F		
		Adult	D, F	Adult	D, F		
Lamprey	D/0%	Egg		Egg		4.00	2.89
		Ammocoete	Pd	Ammocoete	Pd		
		Outmigrant	Pd	Outmigrant	Pd		
		Adult		Adult			

General comments:
This table assesses the below-Castile effects of the presence of steelhead released above Castile and their progeny. Tributaries were considered a part of their larger geographic region for this analysis. Effects in important tributaries (e.g., White Cr.) are likely to be from Type 2 interactions.

1. Status: H = Healthy, SD = Somewhat Depressed, D = Depressed, T = Threatened (ESA), C = Critical
2. See Table 14 for definitions of interactions (Deleted: 1)
3. In general, effects likely will be dissipated below Castile (Deleted: 2)
4. Possible increases in effects due to Type 2 spawning adult steelhead below Castile, but site fidelity to release sites above Castile could limit increases in effects (Deleted: 3)
5. Adult effects on parr (Deleted: 4)
6. Competition for limited holding habitat in summer (Deleted: 5)

Incidental Take: Impacts to steelhead or bull trout could occur during electro-fishing operations or other monitoring activities, should the results of this strategy warrant the implementation of additional ecological interactions work in the Klickitat. If such studies are proposed, appropriate consultation would be undertaken and estimates of take levels would be made.

Chapter 7. Coho Proposed Actions and Risks

Overall Goal: Focus the Klickitat coho program on harvest augmentation, with a combined annual average harvest (ocean, Columbia River, and Klickitat basin) of approximately 14,000 coho, while releasing in-basin production capacity for priority species (spring chinook and steelhead).

This goal recognizes the economic and cultural importance of coho to the Yakama Nation but also that, due to habitat conditions, coho have not successfully occupied the Klickitat subbasin in significant numbers and are not likely to do so in the future. It is consistent with the current *U.S. v. Oregon* coho program, which is solely for harvest augmentation.

7.1 Objective C1 Methods and Risks

Objective C1. Reduce efforts to establish a natural run of coho in the Klickitat subbasin.

> **Strategy C1a**. Beginning in approximately 2006, eliminate production of approximately one million coho at Klickitat Hatchery, and phase out direct stream releases of coho in the Klickitat subbasin if harvest goals can be met with acclimated smolts.

Rationale: No coho have returned to the Klickitat Hatchery since 1988 (ODFW/WDFW 2002). The Klickitat basin historically was not colonized by coho. Difficult passage conditions at Lyle Falls for late returning adults and limited quality rearing habitat for coho in the high gradient tributaries and mainstem reaches characteristic of the lower Klickitat basin provide little opportunity to effectively establish a native run in the subbasin. It is believed that the capacity of the Klickitat Hatchery can be better used to achieve the goals stated for other species in this Master Plan. Moving coho production from the Klickitat Hatchery will free water and space for priority supplementation stocks (i.e., steelhead and spring chinook).

Method: The current coho program calls for an annual release of approximately 3.5 million smolts. Hatchery production is comprised primarily of late-run stock transferred from lower Columbia River hatcheries. Of the total, one million are transferred as either eyed eggs or pre-smolts to the Klickitat Hatchery for on-station rearing and release. The remaining 2.5 million smolts are transported from Washougal Hatchery, with the majority released directly into the Klickitat River between RM 10.3 and 17.1. Table 20 shows how YN proposes to transition from the current program for coho production in the Klickitat basin.

Table 20. Transition plan summary for coho production in the Klickitat basin

Klickitat Watershed Releases	Current to 2005	2006	2007	2008	2009	2010
Produced and released at Klickitat Hatchery	1.0 mill.	0	0	0	0	0
U.S. v. OR fish produced at other hatcheries, scatter planted	2.5 mill.	2.5 mill.	2.5 mill.	2.5 mill.	0[1]	0[1]
U.S. v. OR fish produced at other hatcheries and released from new acclimation site(s) in the lower Klickitat watershed		1.0 mill.	1.0 mill.	1.0 mill.	1.0 mill.	1.0 mill.

[1] Eliminate this release only if harvest goals can be met with WHAF acclimated release of 1.0 million smolts.

Risks: Risks of reducing in-basin production and phasing out scatter plants are to the coho harvest, which, as stated above, is important to tribal and other fisheries. Production levels are the subject of difficult-to-negotiate agreements under *U.S. v. Oregon*. YN does not wish to propose actions that will be inconsistent with those agreements. To ensure that the harvest will not be threatened, scatter-plant releases will continue through at least 2008, and the survival of acclimated and scatter-planted coho will be monitored to document whether harvest goals are being met with acclimated smolts (see Strategies C4a and C4b). If the program is successful at maintaining harvest goals with the acclimated smolts, then YN would work with *U.S. v. Oregon* parties to investigate alternative locations in the Columbia River system above Bonneville Dam for the remaining 2.5 million *U.S. v. Oregon* coho currently programmed for the Klickitat (see Strategy C3b).

YN expects adult contributions from the in-basin acclimation of one million smolts to improve significantly for two reasons. One is that releasing smolts at the Wahkiacus facility reduces the Klickitat river migration by 26 miles, which will reduce river smolt losses. For example, in the Wenatchee watershed, a 35-mile migration route has been shown to result in a coho smolt loss averaging 35% (Greg Ferguson, personal communication). The other rationale is that the low density acclimation planned for the Wahkiacus site will improve smolt survival. Studies show that rearing in a low density environment increases survival (Fuss and Byrne 2002; Banks 1992). Acclimation in such an environment is also expected to improve adult returns.

Incidental Take: Coho releases under existing *U.S. v. Oregon* production agreements are covered under existing biological assessments and opinions (NMFS 1999b).

Strategy C1b. Install an adult trap at the outfall of the Wahkiacus acclimation site.

Rationale: The acclimation site is relatively low in the basin (RM 17) and would be used to trap returning coho adults to minimize interactions between priority species such as spring chinook and steelhead and naturally spawning coho and their progeny.

Method: As identified in the Wahkiacus Hatchery & Acclimation Facility Preliminary Design Report (section VI, Appendix C) a 12-foot ladder leading to a 1,250 square-foot earthen holding pond would be constructed from the effluent (i.e., return flow) from the acclimation pond(s).

Risks: Trapping operations are expected to occur October 1 through November 30 annually. There is a risk that non-target species may be collected in this trap.

Incidental Take: Although precise numbers are not known, YN biologists estimate several hundred adult steelhead and several hundred juvenile steelhead may be in the vicinity of the Wahkiacus outfall between October and November. It is likely that fewer than 50 bull trout would be in the vicinity during this period.

7.2 Objective C2 Methods and Risks

Objective C2. Maximize survival of coho releases to ensure continuation of substantial returns of coho to Columbia and Klickitat river fisheries.

> **Strategy C2a.** Develop a new acclimation site (Wahkiacus) for coho in the lower Klickitat subbasin.

Rationale: Because the number of coho released in the Klickitat basin would be substantially reduced given the change in priorities proposed in this Master Plan (see Objective C1, Strategy C1a), it is important to maximize survival of the remaining coho releases. The literature provides biological rationale for believing that acclimation can contribute to improved survival and increased return numbers (Cuenco et al. 1993). YN's experience in the Yakima and mid-Columbia basins shows improved survival for acclimated coho (Dunnigan et al. 2002, Dunnigan 2001).

Method: Between 1993 and 1995, WDFW staff, using Mitchell Act funds, acclimated 250,000 coho annually at the Champion Mill Pond (RM 14.1). This facility was damaged beyond repair by a flood in 1996, so YKFP staff proposes the Wahkiacus Hatchery & Acclimation Facility (WHAF) at RM 17 as the location to develop an acclimation site capable of acclimating one million out-of-basin (Washougal Hatchery) *U.S. v. Oregon* coho. Funds for the design of a coho acclimation site were made available through a one-time appropriation from Congress to repair Mitchell Act facilities damaged in the 1996 floods; construction funding is needed.

A detailed description of the engineering design, flood conveyance study, and construction activities associated with development of the Wahkiacus Hatchery & Acclimation Facility is presented in Appendix C.

Risks: Some risks at this site have been evaluated (see section 4.2, Strategy MS2f and Appendix C). Additional environmental assessment work probably will be needed.

Incidental Take: On May 13, 2003, NOAA Fisheries issued a memorandum from Rob Jones (Chief of the Propagation, Tributary Fisheries, and Recovery Branch) entitled: *An Informal Consultation and EFH Consultation Regarding the Construction of the Wahkiacus Acclimation Facility, Klickitat County, Washington* (tracking number I/NWR/2003/00530). Based on the design and construction information provided in the engineer's report, NOAA Fisheries made a determination that "*construction activities associated with the Wahkiacus Acclimation Facility may affect, but are not likely to adversely affect, listed MCR steelhead.*"

As stipulated in NOAA Fisheries' findings, to minimize effects on steelhead and fluvial bull trout migration, a work window (June 15 to September 30) for in-channel construction work would be strictly adhered to (see text of letter in section X, Appendix C).

Strategy C2b. Beginning in 2006, release one million coho smolts (transferred from facilities in the Lower Columbia Basin) from acclimation site(s) in the lower Klickitat subbasin.

Rationale: See rationale for Strategy C2a.

Method: Broodstock would continue to be collected and spawned at Washougal Hatchery. Fish would be transported as pre-smolts. Approximately one million fish will be moved to the Wahkiacus Hatchery & Acclimation Facility, held for approximately 6-8 weeks, and volitionally released beginning in mid-March.

Risks: It is anticipated that the reduction in proposed releases combined with acclimation would reduce any negative impacts to ESA-listed species that might be occurring under the existing program. However, a risk assessment similar to that proposed for spring chinook would be conducted (see Strategy C4d).

Incidental Take: Take associated with coho releases under existing *U.S. v. Oregon* production agreements are covered under existing biological assessments and opinions (NMFS 1999b).

7.3 Objective C3 Methods and Risks

Objective C3. Maintain a combined average annual harvest (ocean, Columbia River, and Klickitat basin) of approximately 14,000 coho.

Strategy C3a. Continue direct stream releases of coho pre-smolts until studies show that acclimated smolt releases can meet harvest goals.

Rationale: In light of mandates and agreements on harvest levels specified under *U.S. v. Oregon*, the project must ensure that coho harvest is not threatened by the proposed actions.

Method: Continue direct stream releases of 2.5 million coho pre-smolts transferred from Washougal Hatchery. They would be released at the Wahkiacus bridge immediately adjacent to the outlet of the acclimation site. These direct stream releases would occur through at least 2008 (see Table 20). The methods proposed to test differences in survival between acclimated and direct-stream released coho are described in Strategies C4a and C4b.

Risks: The primary risk would be the potential for negative interactions with other species, particularly listed or sensitive species. As this strategy essentially continues an existing program, adverse effects would not increase over any that might currently be taking place. If the program studies show, as is expected, that acclimated smolts can meet harvest goals, then the direct stream releases would be eliminated, and any existing risks to other species would also be reduced. See also **Risks** under Strategy C1a.

Incidental Take: Take associated with coho releases under existing *U.S. v. Oregon* production agreements are covered under existing biological assessments and opinions (NMFS 1999b).

Strategy C3b. If the 1 million acclimated smolt releases meet harvest goals, investigate alternative locations in the Columbia Basin above Bonneville Dam for release of the 2.5 million *U.S. v. Oregon* coho currently programmed for the Klickitat subbasin that are scatter planted directly into the river.

Rationale: Production and release numbers of *U.S. v. Oregon* fish are the subject of lengthy and politically sensitive negotiations. All these fish are extremely important to the parties; it is highly unlikely that they would want their numbers in the Columbia River Basin reduced.

Method: Complete studies outlined in Strategies C4a and C4b. If harvest goals can be sustained with acclimated fish, work with *U.S. v. Oregon* parties to investigate alternative release locations for 2.5 million coho. The tribal production plan currently under consideration in *U.S. v. Oregon* negotiations envisions new coho production releases in upriver areas such as the Grand Ronde basin. YN staff support the "re-programming" of these Klickitat River coho to the Grand Ronde and/or other potential release locations above Bonneville Dam.

Risks: These investigations would pose no environmental or project risks, although negotiations might be long and difficult. Risks of alternative release locations would be evaluated as part of the negotiations, and before any alternative locations were used. See **Risks** under Strategy C1a.

Incidental Take: It is expected that any change in coho releases under existing *U.S. v. Oregon* production agreements would be evaluated under biological assessments and opinions covering that program.

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7.4 Objective C4 Methods and Risks

Objective C4. Monitor and evaluate factors that will help to determine whether goals and objectives are being achieved.

Strategy C4a. Monitor and evaluate survival of acclimated and direct-stream-released coho.

Rationale: This activity is necessary to inform decisions relative to strategies C3a and C3b discussed in section 7.3.

Method: The following method is proposed to test at the 5% confidence level, with a power of 90%, whether the acclimation pond survival exceeds river-release survival by 50%.

There would be four replicates per treatment (four acclimation ponds and four sets of river releases). A minimum of 5,000 PIT tags would be used for each of the two treatments (minimum of 10,000 for two treatments combined). If there are in fact four replicates per treatment, then there would be 1,250 PIT tags per replicate.

River releases would be extended over the main period of out-migration and the releases would be partitioned over time into replicates. For example, in the case of four replicates, if river releases are extended over a six-week period, then river releases made over the first 1.5 weeks could be considered to be the first replicate, those made over the second 1.5 weeks would be the second replicate, and so forth.

Risks: There would be a low potential for smolt mortality from handling of the fish and insertion of the PIT tags (see section 5.3).

Incidental Take: No adverse impacts to listed species are expected from this strategy.

Strategy C4b. Monitor and evaluate harvest numbers of acclimated and direct-stream-released coho.

Rationale and Method: See section 5.6. The different treatments (acclimated and direct-stream release) would be differentially marked so that their relative contribution to harvest could be determined.

Risks: There should be no risk to ESA-listed fish from this activity as only coho would need to be mark-sampled. The risks associated with harvest monitoring for other species are discussed in separate sections of this plan.

Incidental Take: No adverse impacts to listed species are expected from this strategy.

Strategy C4c. Conduct spawning surveys in the Klickitat basin to determine location and amount of natural coho spawning.

Rationale: This activity is necessary to quantify the extent of coho natural production in the Klickitat and to determine the spatial and temporal overlap of natural coho spawning with other species of concern. Results of these surveys would be used to help determine the need for ecological interaction studies in the Klickitat basin and/or modifications to the Klickitat's coho program. For example, if under the revised coho program, surveys detect significant and recurring evidence of successful natural spawning and natural production of coho in the basin, a review and potential modification of coho strategies would be warranted.

Method: Foot/boat surveys to count redds would be conducted each week during the spawning period (mid-November through mid-February).

Risks: These surveys pose little or no risk to fish or the environment.

Incidental Take: It is possible that a boat passing overhead could frighten a fish from its hiding place, causing it to be caught and eaten by a predator. However, the short amount of time a boat would spend in any reach, and the surveyors' training to observe only, make it unlikely that the surveys would cause injury to or significantly disrupt normal behavior of listed fish as described in the NMFS definition of "harass" (NMFS 1996). No direct impacts to steelhead or bull trout are expected from coho spawning ground survey operations.

Strategy C4d. Use findings from Yakima and upper Columbia Basin studies in conjunction with information from risk assessments to target ecological interactions studies in the Klickitat basin.

Rationale: This activity is necessary to determine whether, and to what extent, coho interact with other species of concern.

Method: See the method proposed for the spring chinook program, section 5.4.

Risks: A preliminary evaluation of ecological interactions risks is shown in Table 21, based on the template reproduced in section 5.4 (Table 14).

Table 21. Risk assessment of coho releases in Klickitat subbasin below Castile Falls

NTT	Status[1]/Impact	Type 1 Life Stage	Type 1 Interaction[2]	Type 2 Life Stage	Type 2 Interaction[2]	Risk	Uncertainty
Steelhead	T/0%	Egg	C	Egg	C, Pd	17.22	4.19
		Fry	Pd, Pi, D, N, S	Fry	C, Pd, Pi, D, N, S		
		Parr	C, Pi, B, D, N, S	Parr	C, Pi, B, D, N, S		
		Smolt	C, Pi, B, D, N, S	Smolt	C, Pi, B, D, N, S		
		Adult	C, D	Adult	C, D		
Resident rainbow	SD/40%	Egg		Egg	Pd	5.17	2.75
		Fry	Pd, Pi, D, N, S	Fry	C, Pd, Pi, D, N, S		
		Parr	C, Pi, B, D, N, S	Parr	C, Pi, B, D, N, S		
		Adult	C, D	Adult	C, D		
Spring chinook	D/10%	Egg	C	Egg	C	10.33	6.60
		Fry	Pd, D, N, S	Fry	Pd, D, N, S		
		Parr	C, Pi, D, N, S	Parr	C, Pi, D, N, S		
		Smolt	C, Pi, B, D, N, S	Smolt	C, Pi, B, D, N, S		
		Adult	C, D	Adult	C, D		
Bull Trout	T/0%	Egg	C, Pd	Egg	C, Pd	10.00	2.00
		Fry		Fry	C, Pd, Pi, D, M, N, S		
		Parr	C, D, N	Parr	C, Pi, D, M, N, S		
		Adult	D, F	Adult	C, D, F		
Lamprey	D/0%	Egg		Egg		1.00	0.00
		Ammocoete	N	Ammocoete	Pd, N		
		Outmigrant	N	Outmigrant	N		
		Adult	N	Adult	N		

1. Status: H = Healthy, SD = Somewhat Depressed, D = Depressed, T = Threatened (ESA), C = Critical
2. See Table 14 for definitions of interactions

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Incidental Take: Impacts to steelhead or bull trout could occur during electro-fishing operations or other monitoring activities, should the results of this strategy warrant the implementation of additional ecological interactions work in the Klickitat. If such studies are proposed, appropriate consultation would be undertaken and estimates of take levels would be made.

Strategy C4e. Use the regional mark information system (RMIS) to monitor CWT recoveries of Klickitat coho releases in marine and freshwater fisheries coast-wide.

Rationale: This activity is necessary (in conjunction with strategies C4a and C4b) to determine whether the overall objective of maintaining an average annual harvest (ocean, Columbia River, and Klickitat basin) of approximately 14,000 coho is being achieved.

Method and Risks: See section 5.6.

Incidental Take: None.

Chapter 8. Fall Chinook Proposed Actions and Risks

Overall Goal: Maintain the Klickitat fall chinook program for harvest augmentation, with a combined annual average harvest (ocean, Columbia River, and Klickitat basin) of 14,000 fish.

8.1 Objective FC1 Methods and Risks

Objective FC1. Leave current production numbers unchanged at 4 million.

Rationale: Numerous reports (e.g., IFWF 2003) have been published in recent years detailing the economic benefits of salmon fisheries. Using the data in these reports, YN calculates that the direct and indirect economic benefit of a program that provides over 14,000 salmon to marine and freshwater commercial and recreational fisheries throughout the Pacific Northwest exceeds (and perhaps far exceeds) one million dollars annually. The vast majority of these economic benefits accrue to smaller communities, many of them in presently economically depressed areas along the Columbia River and in Klickitat County.

A number of recent reports also have discussed the benefits that decomposing salmon carcasses provide in the way of nutrient enhancement. Without an abundant escapement of salmon (or other artificial means of providing equivalent nutrients), cohorts of juvenile salmon may experience density-dependent mortality at population sizes far below historical levels, and recovery of imperiled populations may proceed at a much slower rate (Achord et al. 2003). The escaping fall chinook resulting from this program provide nutrient enhancement to the Klickitat basin to the likely benefit of all fish and wildlife in the subbasin, including ESA-listed steelhead and bull trout populations.

Additionally, the importance of these fish to the sustenance, livelihood, and culture of the Yakama people cannot be overstated (CRITFC 1995). All of these benefits help to meet regional objectives of enhancing fisheries consistent with treaty, legal, and NPCC fish and wildlife program obligations.

Strategy FC1a. Maintain production of 4 million URB (Priest Rapids Hatchery) fall chinook in the Klickitat subbasin. Shift half the production from Klickitat Hatchery to Wahkiacus Hatchery & Acclimation Facility (WHAF).

Rationale: Development of a YKFP supplementation program for spring chinook and steelhead at Klickitat Hatchery will require a “freeing up” of water and space. Transferring half the fall chinook production from Klickitat Hatchery to Wahkiacus accomplishes the spring chinook and steelhead goal and allows for proper rearing densities (Oshie and Ferguson 1998).

Method: Upriver bright fall chinook are transferred as eyed eggs from other Columbia Basin hatcheries (e.g., Priest Rapids, Little White Salmon, etc.). All fish currently are incubated and reared at Klickitat Hatchery and released as sub-yearling smolts. By 2007, fully construct the Wahkiacus facility at RM 17 and secure ground water requirements for hatching and early incubation of 2 million fall chinook. A surface water permit for 20 cfs (non-consumptive) has been issued for a portion of the final acclimation (Washington State Department of Ecology #S4-34554P).

In 2007, it is proposed that half the Klickitat fall chinook production (2 million) be hatched and reared to release at Wahkiacus (see production summary in Table 22). Hatching and rearing protocols probably would be similar to those at Klickitat Hatchery but could change somewhat due to site conditions and water temperatures. See Appendix C for a brief description of incubation and rearing plans at Wahkiacus.

Table 22. Fall chinook production in Klickitat basin

Klickitat Hatchery (KH) Production	**Current to 2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Number produced and released at KH	4.0 mill.	4.0 mill.	2.0 mill.	2.0 mill.	2.0 mill.	2.0 mill.
Size (fpp)	70	70	70	70	70	70
Pounds	57,100	57,100	28,550	28,550	28,550	28,550
Wahkiacus (WHAF) Production						
Number produced and released at WHAF			2.0 mill.	2.0 mill.	2.0 mill.	2.0 mill.
Size (fpp)			70	70	70	70
Pounds			28,550	28,550	28,550	28,550

Risks and Incidental Take: Risks of development of the WHAF are discussed in section 4.2, Strategy MS2f, and in Appendix C. Although Klickitat basin releases of fall chinook have been evaluated in an existing biological opinion (NMFS 1999b), further NEPA and ESA analysis of WHAF development, and of changing the location of part of the fall chinook production, might be required before the facility is constructed.

8.2 Objective FC2 Methods and Risks

Objective FC2. Distribute fall chinook spawning throughout the lower Klickitat subbasin.

> **Strategy FC2a.** By 2007, release half the current 4 million fall chinook production from the Wahkiacus facility in the lower Klickitat subbasin.

Rationale: Currently, fall chinook natural spawning is concentrated downstream of the Klickitat Hatchery (RM 42.3) between RM 43 and RM 20, where considerable superimposition of redds (fall chinook and coho) is observed. YN biologists expect that, by hatching and rearing to release half the current production on a mix of groundwater and surface water from the Wahkiacus facility, spawning would be more evenly distributed throughout the 43 miles of river, contributing to an increase in natural production. An increase in natural production would help achieve the program’s overall goal by augmenting harvest opportunities. Natural production would also provide a source for future development of a local broodstock if desired.

Method: Release protocols probably would be similar to those at Klickitat Hatchery but could change somewhat due to site conditions and water temperatures. See Appendix C for a brief description.

Risks: Shifting half the fall chinook releases to WHAF will not result in risks in addition to those already expected since spatial overlap with sensitive species mostly occurs in the upper watershed. The Klickitat Hatchery releases already are covered under existing environmental and biological assessments and opinions (NMFS 1999b). However, YN staff conducted a preliminary risk assessment as shown in Table 23, based on the template shown in Table 14 (section 5.4). Further NEPA analysis might be needed.

Table 23. Risk assessment of fall chinook releases below Castile Falls

NTT	Status/Impact	Type 1 Life Stage	Type 1 Interaction[2]	Type 2 Life Stage	Type 2 Interaction[2]	Risk	Uncertainty
Steelhead	T/0%	Egg		Egg		15.00	10.00
		Fry	D, N	Fry	D, N		
		Parr	B, D, N, S	Parr	B, D, N, S		
		Smolt	B, D, N, S	Smolt	B, D, N, S		
		Adult	C, F, D	Adult	C, F, D		
Resident rainbow	SD/40%	Egg	D, N	Egg	D, N	6.00	5.29
		Fry	B, D, N, S	Fry	B, D, N, S		
		Parr	B, D, N, S	Parr	B, D, N, S		
		Adult	F, D	Adult	F, D		
Spring chinook	D/10%	Egg	C, Pd	Egg	C, Pd	12.50	2.50
		Fry	D, N, S	Fry	C, Pi, D, N, S		
		Parr	C, Pi, B, D, N, S	Parr	C, Pi, B, D, N, S		
		Smolt	C, Pi, B, D, N, S	Smolt	C, Pi, B, D, N, S		
		Adult	C,D	Adult	C,D		
Bull trout	T/0%	Egg		Egg		3.50	3.97
		Fry		Fry			
		Parr		Parr			
		Adult	F, D	Adult	F, D		
Lamprey	D/0%	Egg		Egg		0.00	0.00
		Ammocoete	N	Ammocoete	N		
		Outmigrant	N	Outmigrant	N		
		Adult	N	Adult	N		

1. Status: H = Healthy, SD = Somewhat Depressed, D = Depressed, T = Threatened (ESA), C = Critical
2. See Table 14 for definitions of interactions

Incidental Take: Risks of development of the WHAF are discussed in section 4.2, Strategy MS2f, and in Appendix C. Although Klickitat basin releases of fall chinook have been evaluated in an existing biological opinion (NMFS 1999b), further ESA analysis of WHAF development, and of changing the location of part of the fall chinook production, might be required before the facility is constructed.

8.3 Objective FC3 Methods and Risks

Objective FC3. Monitor and evaluate factors that will help to determine whether goals and objectives are being achieved.

Strategy FC3a. Monitor and evaluate survival.

Rationale: This activity is necessary (in conjunction with strategy FC3b) to determine whether the overall objective of maintaining an average combined annual harvest (ocean, Columbia River, and Klickitat basin) of approximately 14,000 fall chinook is being achieved.

Method: Use adult return estimates from Lyle Falls trapping/sampling operations, harvest data, age composition information (derived from scale samples), and spawning ground survey information to produce and maintain tables documenting annual returns of fall chinook as well as adult-to-adult survival rates over time. Also maintain data tables on the number, location, and other relevant data for all hatchery-reared fish releases. YN would use historical data sets from WDFW, *U.S. v. Oregon* Technical Advisory Committee, and other agencies to make sure these data sets are as complete and accurate as possible.

Risks: Risks are those associated with operation of the Lyle Falls facility, harvest monitoring, and spawner surveys. These risks are discussed in other sections of this plan.

Strategy FC3b. Monitor and evaluate harvest numbers.

Rationale and Method: See Strategy FC3a and section 5.6.

Risks and Incidental Take: There should be no risk to ESA-listed fish from this activity as only fall chinook would need to be sampled. The risks associated with harvest monitoring for other species are discussed in separate sections of this plan.

Strategy FC3c. Conduct spawning surveys in the Klickitat subbasin to determine location and amount of natural spawning.

Rationale: This activity is necessary to quantify the extent of fall chinook natural production in the Klickitat and to determine the spatial and temporal overlap of natural fall chinook spawning with other species of concern.

Method: Foot/boat surveys to count redds would be conducted each week during the spawning period (mid-September through November). These survey results would be related to historic information to determine if spatial distribution of fall chinook spawning is achieved.

Risks: These surveys pose little or no risk to fish or the environment.

Incidental Take: It is possible that a boat passing overhead could frighten a fish from its hiding place, causing it to be caught and eaten by a predator. However, the short amount of time a boat would spend in any reach, and the surveyors' training to observe only, make it unlikely that the surveys would cause injury to or significantly disrupt normal behavior of listed fish as described in the NMFS definition of "harass" (NMFS 1996). No direct impacts to steelhead or bull trout are expected from fall chinook spawning ground survey operations.

Strategy FC3d. Use the regional mark information system (RMIS) to monitor CWT recoveries of Klickitat fall chinook releases in marine and freshwater fisheries coast-wide.

Rationale: This activity is necessary (in conjunction with strategies FC3a-3c) to determine whether the overall objective of maintaining an average annual harvest (ocean, Columbia River, and Klickitat basin) of approximately 14,000 fall chinook is being achieved.

Method and Risks: See section 5.6.

Incidental Take: None.

Chapter 9. Lamprey Proposed Actions and Risks

Overall Goal: Rebuild the lamprey population in the Klickitat basin to a self-sustaining level that is capable of supporting harvest.

9.1 Objective L1 Methods and Risks

Objective L1. Determine feasibility of rebuilding lamprey populations in the Klickitat basin.

> **Strategy L1a**. Develop baseline data on current existing lamprey population levels, distribution, limiting factors, and potential carrying capacity for the Klickitat basin.

Rationale: Recent interest in restoring declining lamprey populations to the Columbia River Basin has resulted in the formation of several work groups. These groups are developing plans for evaluating current populations and activities that will lead to the rebuilding of those populations. There have been petitions for listing of this species under the Endangered Species Act. The U.S Fish and Wildlife Service has the ESA responsibility for lamprey (lamprey spend more than fifty percent of their life cycle in fresh water) and has taken the lead on this effort.

Numerous activities have been listed as causes for the decline of lamprey. Upstream passage success of adult lampreys is often less than fifty percent at manmade barriers such as mainstem Columbia hydropower dams. Channelization has also reduced available habitat in tributaries for juvenile lamprey ammocoetes. Recent research has indicated that upstream passage success can be improved by minor modifications in salmon ladders. Tributary habitat projects can potentially improve survival of ammocoetes.

Lamprey is an important species to the Yakama people as a food source. Rebuilding lamprey populations to harvestable levels will benefit the Yakama Nation.

Method: Work with the lamprey recovery teams to develop research objectives and plans for evaluating current lamprey populations and to determine the feasibility of rebuilding these populations to sustainable levels that can support harvest.

Risks: Little is known of the potential risks of lamprey restoration.

Chapter 10. Proposed Habitat Actions and Risks

Overall Goal: Restore, enhance, and protect stream habitat and watershed conditions in the Klickitat subbasin, emphasizing actions that benefit native fish populations.

Klickitat subbasin habitat activities focus on the Klickitat River and its tributaries that provide or affect native fish habitat. Currently, activities emphasize restoration, enhancement, and protection of watersheds supporting anadromous fish production, particularly steelhead (ESA-listed as Threatened) and spring chinook. Assessment, restoration, and enhancement work conducted in the West Fork system would target bull trout, also listed as Threatened.

Restoration and enhancement activities would focus on stream and watershed processes. Activities would include removing or mitigating watershed disturbances, as well as improving habitat conditions directly. In addition to benefiting target species, habitat improvements would benefit fall chinook and coho salmon, resident rainbow trout, and cutthroat trout. Future work is expected to address sea-run and resident forms of cutthroat trout as well as Pacific lamprey directly. Many terrestrial and amphibian wildlife species would benefit from habitat enhancements as well. Protection activities would complement restoration efforts within the subbasin by securing refugia and preventing degradation. Since 90% of the off-reservation project area is in private ownership, maximum effectiveness will be accomplished via cooperation with state, federal, tribal, and private entities.

BPA and NOAA Fisheries analyzed the effects of potential BPA-funded habitat improvement actions on listed anadromous fish in the Columbia River basin. NOAA Fisheries' findings are documented in a Biological Opinion dated August 1, 2003 (BPA & NOAA Fisheries 2003). The Opinion specifies a pre-project review process, as well as terms and conditions that various kinds of habitat improvement projects must meet. If, after pre-project review, BPA-funded habitat improvement projects would result in impacts within the range analyzed in the Biological Opinion, and if the terms and conditions in the Biological Opinion can be met, the projects would require no further consultation with NOAA Fisheries. Consultation with U.S. Fish and Wildlife Service could still be required if listed species under their jurisdiction are present in the project area.

Table 24 lists the kinds of habitat improvement analyzed in the Biological Opinion and the number that corresponds to the habitat improvement strategies proposed in sections 10.1 – 10.4 of this Master Plan.

Table 24. Relation of habitat improvement activities addressed in Biological Opinion to Klickitat Master Plan strategies

BIOLOGICAL OPINION ACTION/ACTIVITY CATEGORY	MASTER PLAN STRATEGY
1. Planning and Habitat Protection Actions	
Stream Channel, Floodplain, and Uplands Surveys/ Installation of Stream Monitoring Devices	H1a, H2d, H3a-f, H4a-b
Fee-Title or Easement Acquisition and/or Leasing of Land and/or Water	H3a
2. Small Scale Instream Habitat Actions	
Streambank Protection using Bioengineering Methods	H3f
Install Habitat-Forming Natural Material Instream Structures	H3f
Improve Secondary Channel Habitats	H3c
Riparian and Wetland Habitat Creation, Rehabilitation, and Enhancement	H3d
Fish Passage Activities	H3c
3. Livestock Impact Reduction	
Construct Fencing for Grazing Control	H3e
Install Off-Channel Watering Facilities	H3e
Harden Fords for Livestock Crossings of Streams	H3e
4. Control of Soil Erosion from Upland Farming	
Implement Upland Conservation Buffers	H3e
Implement Conservation Cropping Systems	H3e
Soil Stabilization *via* Planting and Seeding	H3e
Implement Erosion Control Practices	H3e
5. Irrigation and water delivery/ management actions	
Convert Delivery System to Drip or Sprinkler Irrigation	
Convert Water Conveyance from Open Ditch to Pipeline or Line Leaking Ditches	
Convert from Instream Diversions to Groundwater Wells for Primary Water Source	
Install New or Upgrade/Maintain Existing Fish Screens	
Remove, Consolidate, or Improve Irrigation Diversion Dams	
Install or Replace Return Flow Cooling Systems	
6. Native Plant Community Protection and Establishment	
Vegetation Planting	H3b
Vegetation Management by Physical Control	H3b
Vegetation Management by Herbicide Use	H3b

Table 24 (continued)

7. Road Actions	
Road Maintenance	H3e
Bridge, Culvert, and Ford Maintenance, Removal or Replacement	H3c
Road Decommissioning	H3e
8. Special Actions	
Install/Develop Wildlife Structures	

(adapted from Table 1-2, BPA and NOAA Fisheries 2003)

10.1 Objective H1 Methods and Risks

Objective H1. Assess habitat conditions and evaluate the need for restoration, enhancement, and/or protective measures.

Strategy H1a. Inventory existing habitat conditions.

Method: Inventory selected watershed and reach-based habitat parameters throughout the subbasin. Activities would include collection of data on large woody debris, substrate, habitat features, streamflow, temperature, water quality, geomorphology, and fish passage conditions. Manage and analyze data to facilitate evaluation of status and trends in habitat conditions.

Risks: No risk is anticipated with data collection and management.

Strategy H1b. Assess historic habitat conditions.

Method: Compile available historic information to describe baseline conditions. Activities would include reviewing historic survey documents, U.S. Geological Survey streamflow data, historic photographs, and personal interviews.

Risks: No risk is anticipated with compilation of historic information.

Strategy H1c. Evaluate existing habitat conditions.

Method: Compare current conditions with historic conditions to evaluate degree of departure. Compare current conditions with known required conditions based on best available science to evaluate current habitat suitability and needs for restoration, enhancement, and/or protection.

Risks: No risk is anticipated with comparisons of current and historic conditions.

10.2 Objective H2 Methods and Risks

Objective H2. Identify, prioritize, and plan actions that address needs identified in Objective H1.

Strategy H2a. Establish geographic priorities.

Method: Use known current and/or historic distribution and abundance of target species to identify priority watersheds and/or reaches.

Risks: No risk is anticipated with identification of geographic priorities.

Strategy H2b. Identify needed restoration, enhancement, and/or protective actions.

Method: Based on evaluation of habitat conditions, develop a list of actions required to address habitat needs in priority watersheds and reaches.

Risks: No risk is anticipated with identification of needed actions.

Strategy H2c. Prioritize restoration, enhancement, and/or protective actions.

Method: Determine the relative importance of needed actions and prioritize them based on the role of a given watershed or reach in overall subbasin-wide abundance of target species. Contributions of a given reach or watershed to life history diversity and productivity may also guide prioritization.

Risks: No risk is anticipated with prioritization of needed actions.

Strategy H2d. Plan and design projects to address prioritized needs.

Method: Solicit and obtain landowner permission, where appropriate. If necessary, conduct a project-specific feasibility study. Obtain necessary funding. Develop a design to address identified needs. If necessary, prepare permit applications and solicit review from appropriate regulatory entities. Modify design as necessary based on regulatory feedback. Solicit bids from consultants and/or contractors as required.

Risk: No risk is anticipated with prioritization of needed actions.

10.3 Objective H3 Methods and Risks

Objective H3. Implement projects that address needs identified in Objective H2.

Activities would result in on-the-ground benefits to target populations. Stream habitat conditions would be restored or enhanced by undertaking site-specific and/or watershed-scale activities that mitigate or resolve historic, present, and/or future adverse land-use effects. Activities in this heading can be generally described as contributing to one or more of the following functions: protection of existing quality habitat, prevention of further deterioration of degraded habitats, or restoration or enhancement of degraded habitats.

Strategy H3a. Implement protective measures for high quality habitats and prevent further degradation of impacted habitats.

Method: Protect land parcels via fee-title or easement acquisition, cooperative agreements, leasing of land and/or water, and/or participation in land-use planning processes. This activity would protect existing habitat for fish and wildlife by preventing or conditioning development or degradation, increasing habitat connectivity, and/or increasing streamflow to: (1) improve water quality, (2) improve fish production, and (3) restore riparian and wetland functions.

Risks: These activities have no direct adverse effects on the environment.

Strategy H3b. Restore or enhance vegetation conditions.

Method: Native trees, shrubs, herbaceous plants, and aquatic macrophytes would be planted to help stabilize soils, provide cover, and out-compete noxious weeds. Plant materials will be obtained from suitable sources to maximize the likelihood that plants are adapted to local climate and soil chemistry. Planting may involve cutting, digging, grubbing roots, scalping sod, ripping or tilling soil, and/or removing existing vegetation. Surface treatments could include application of straw, woody debris, wood chips, fertilizer, mulch, or soil to enhance plant survival. Control of undesired vegetation may involve physical and/or chemical treatments. Protective measures may be taken to reduce susceptibility of woody plantings to animal depredation. Work may entail use of heavy equipment, power tools, and/or hand tools.

Risks: Re-vegetation would be undertaken because the long-term benefits outweigh short-term environmental risks. Initial vegetation clearing could contribute to erosion and sedimentation. Heavy equipment use, if necessary, could also be associated with soil compaction and fuel spills. Effects of herbicides are unlikely to cause outright mortality. Conservation measures will be applied, as appropriate, to reduce risks. A pre-project review of effects would be conducted before projects are implemented.

Strategy H3c. Repair or replace artificial fish passage obstructions.

Method: Remove, replace, or modify human-made changes to a point or stream reach that cause velocities and/or outfall drops to obstruct fish passage. Specific activities may include removal, replacement, or modification of culverts, modification or removal of permanent or intermittent dams, modification of areas of dispersed streamflow that impede passage, modification of obsolete fish passage or collection facilities, and maintenance to ensure proper function. Such activities would likely require use of heavy equipment, power tools, and/or hand tools.

Risks: Correcting fish passage obstructions would be undertaken because the long-term benefits outweigh short-term environmental risks. Environmental risks include fine sediment introduction, reduction of riparian vegetation or woody debris, temporary turbidity increases, soil compaction, streambed disturbance, fuel or other spills, stress to fish from capture and release from isolated work areas, noise, and changes in local water quality and/or quantity. Conservation measures will be applied, as appropriate, to reduce adverse effects. A pre-project review of effects would be conducted before projects are implemented.

Strategy H3d. Restore or enhance riparian and wetland habitat conditions and connectivity.

Method: Riparian and wetland conditions would be restored or enhanced to improve both fisheries and wildlife habitat as well as physical and chemical wetland and floodplain functions. Specific activities may include removal or setback of levees, dikes, berms, weirs, floodplain roads, or other structures that artificially regulate water levels; reshaping of streambanks as necessary to reestablish vegetation; excavating pools, ponds, or side-channels; removing inappropriate structural bank protections and other engineered or created structures; and re-contouring off-stream areas. Such activities would likely require use of heavy equipment, power tools, and/or hand tools.

Risks: Improving riparian and wetland habitats would be undertaken because the long-term benefits outweigh short-term environmental risks. Short-term environmental risks include fine sediment introduction, reduction of riparian vegetation, soil compaction, fuel or other spills, stress to fish from capture and release from isolated work areas, noise, and changes in local water quality and/or quantity. Conservation measures will be applied, as appropriate, to reduce adverse effects. A pre-project review of effects would be conducted before projects are implemented.

Strategy H3e. Remove or mitigate sources of habitat degradation.

Method: Habitat conditions at any given point in the stream continuum are a function of the interaction between site characteristics and the contributing watershed. This strategy would remove or mitigate management actions contributing to either watershed or site-specific degradation. Specific activities would include actions that control livestock grazing, reduce erosion and runoff from agricultural and forest lands, and address road-related effects. Livestock control actions could include fence construction, installation of off-channel water sources, and/or hardening stream crossings. Erosion and runoff control could include the use of buffers, conservation cropping, re-vegetation, or other measures (e.g., sediment and water detention basins, straw bales, coir logs, etc.). Road-related actions could include decommissioning, gating, relocation, and/or maintenance of surface and drainage characteristics. Such activities would likely require use of heavy equipment, power tools, and/or hand tools.

Risks: Removal of degradation sources would be undertaken because the long-term benefits outweigh short-term environmental risks. Most of the actions would occur in uplands away from stream channels, but short-term environmental risks include soil compaction, local changes in streamflow (associated with off-channel watering), fuel or other spills, and fine sediment introduction (associated with road relocation or obliteration). Conservation measures will be applied, as appropriate, to reduce adverse effects. A pre-project review of effects would be conducted before projects are implemented.

Strategy H3f. Restore or enhance channel and floodplain complexity.

Method: Reduction of channel complexity associated with past land-use activities has resulted in decreased large woody debris, riparian cover, channel length, and increases in bank erosion, incision, and water temperature. This strategy would restore or enhance in-channel habitat and function lost to management-related simplification. Specific activities would include deformable soil reinforcement (vegetation and/or fabric), bank reshaping, slope grading, floodplain and channel roughness additions, floodplain flow spreaders, flow redirection structures, and in-channel habitat structures. Such activities would likely require use of heavy equipment, power tools, and/or hand tools.

Risks: Restoring or enhancing channel and floodplain complexity would be undertaken because the long-term benefits outweigh short-term environmental risks. Short-term environmental risks include fine sediment introduction, reduction of riparian vegetation, soil compaction, fuel or other spills, stress to fish from capture and release from isolated work areas, noise, and changes in local water quality and/or quantity. Conservation measures will be applied, as appropriate, to reduce adverse effects. A pre-project review of effects would be conducted before projects are implemented.

10.4 Objective H4 Methods and Risks

Objective H4. Monitor habitat conditions, and evaluate project effectiveness and further need for restoration, enhancement, and/or protective measures at site-specific and subbasin scales.

Strategy H4a. Monitor and evaluate indicators of basin-wide habitat conditions.

Methods: Monitor streamflow and temperature at fixed locations throughout the basin, to facilitate evaluation of basin-wide response to restoration activities and to identify further needs at a watershed-scale.

Risks: No risk is anticipated with monitoring and evaluation of basin-wide habitat conditions.

Strategy H4b. Monitor and evaluate site-specific stream habitat conditions.

Methods: To facilitate evaluation of reach- or site-based conditions and to identify further needs, the following habitat parameters will be monitored: large woody debris, habitat units, substrate, canopy cover, and channel morphology. Some reaches will be monitored to evaluate effectiveness of restoration and enhancement projects, while others will be monitored to document untreated habitat trends.

Risks: No risk is anticipated with monitoring and evaluation of site-specific habitat conditions.

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Appendix A. Cost Estimates

CONTENTS

I. Introduction

1.1 PURPOSE OF THE DRAFT COST ESTIMATE

Funding of the measures proposed in the KLICKITAT SUBBASIN ANADROMOUS FISHERY MASTER PLAN will come from several sources. Funding agencies require that cost estimates be made at several stages in the project planning process. For example, the Northwest Power and Conservation Council (NPCC) has developed a three-step review for new projects funded through the Columbia River Basin Fish and Wildlife Program. Step one is conceptual planning, represented by a master plan. The master plan must include a cost estimate accurate to +/- 35 to 50%. Other support sources, such as NOAA through Mitchell Act mandates, also evaluate financial plans.

1.2 METHODS USED

Various resources were used in estimating the master plan operating and construction costs. References to those sources are provided at the end of the report. Facility operating costs are based on the current cost structure for the Klickitat Hatchery (KH). Monitoring and evaluation estimates make use of the cost of the current Yakama Nation effort. The Lyle falls and most of the Klickitat Hatchery improvement information was developed in previous engineering studies. The Wahkiacus Hatchery & Acclimation Facility (WAF) and upstream acclimation site (UAS) estimates were completed using current conceptual designs. Costs for developing similar facilities and construction estimating guides were used in pricing the facilities.

1.3 WATERSHED FISH PRODUCTION PLAN

The proposed fish production plan is described in detail in the Klickitat Subbasin Anadromous Fishery Master Plan. A summary of the plan is shown below (Table A-1). The master plan emphasizes the supplementation of local stocks of spring chinook and steelhead, which depends on construction of a fish ladder and trap at Lyle falls for broodstock collection. Both species will be reared at the KH and are released from the hatchery and upstream acclimation sites. The main goal of coho and fall chinook production will remain harvest augmentation. They will be reared at both the Klickitat Hatchery and the Wahkiacus Hatchery & Acclimation Facility, with releases from both sites.

Table A-1. Fish Production Plan (in thousands of fish)

Species	Rear	Rel.	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*
Spring chinook -15/lb	KH	KH	0	0	600	600	600	600	600	600	600	600	600
Spring chinook -12.5/lb	KH	KH	600	600	0	0	0	0	0	0	0	0	0
Spring chinook -15/lb	KH	MAS	0	0	200	200	200	200	200	200	200	200	200
TOTAL SPRING CHINOOK			*600*	*600*	*800*	*800*	*800*	*800*	*800*	*800*	*800*	*800*	*800*
Fall chinook - 70/lb	KH	KH	4,000	4,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Fall chinook - 70/lb	WAF	WAF	0	0	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
TOTAL FALL CHINOOK			*4,000*	*4,000*	*4,000*	*4,000*	*4,000*	*4,000*	*4,000*	*4,000*	*4,000*	*4,000*	*4,000*
Summer steelhead - 1 yr	KH	MAS	0	0	200	200	200	200	200	200	200	200	200
TOTAL STEELHEAD			*0*	*0*	*200*	*200*	*200*	*200*	*200*	*200*	*200*	*200*	*200*
Coho - 15/lb	KH	KH	1,000	1,000	0	0	0	0	0	0	0	0	0
Coho - 15/lb	WAF	WAF	0	0	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
TOTAL COHO			*1,000*	*1,000*	*1,000*	*1,000*	*1,000*	*1,000*	*1,000*	*1,000*	*1,000*	*1,000*	*1,000*

1.4 SCHEDULE

The timing of the capital expenses and of the changes in the production plan depend on the funding agency review process and permit sequencing. This plan assumes that these processes are fast tracked, allowing major project construction to occur in 2005 and 2006 and the major fish production changes proposed in the master plan to take place in 2007. A sample project schedule for the Wahkiacus Hatchery & Acclimation Facility is included in Appendix C, section III. It demonstrates the review and permitting processes required of all the major construction projects planned for the subbasin.

Deleted: Table A-1. Fish production plan¶

FISH PRODUCTION (thousands of fish)

Species	Rear
Spring chinook -15/lb	KH
Spring chinook -12.5/lb	KH
Spring chinook -15/lb	KH
TOTAL SPRING CHINOOK	
Fall chinook - 70/lb	KH
Fall chinook - 70/lb	WAF
TOTAL FALL CHINOOK	
Summer steelhead - 1 yr	KH
TOTAL STEELHEAD	
Coho - 15/lb	KH
Coho - 15/lb	WAF
TOTAL COHO	

2. Summary of Cost Estimates

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
OPERATING COSTS											
OPERATING COSTS											
Klickitat Hatchery[1]	632,420	651,393	670,934	691,062	711,794	733,148	755,143	777,797	801,131	825,165	849,920
McCreedy Acclimation	0	0	82,812	85,296	87,855	90,491	93,206	96,002	98,882	101,848	104,904
Wahkiacus AF	0	0	231,750	238,703	245,864	253,239	260,837	268,662	276,722	285,023	293,574
Ladder Maintenance	20,600	21,218	21,855	22,510	23,185	23,881	24,597	25,335	26,095	26,878	27,685
Monitoring and Eval.	745,720	768,092	791,134	814,868	839,314	864,494	890,429	917,142	944,656	972,995	1,002,185
TOTAL OP. COSTS	1,398,740	1,440,702	1,798,485	1,852,440	1,908,013	1,965,253	2,024,211	2,084,937	2,147,485	2,211,910	2,278,267
RUNNING TOTAL	**1,398,740**	**2,839,442**	**4,637,927**	**6,490,367**	**8,398,380**	**10,363,634**	**12,387,845**	**14,472,782**	**16,620,268**	**18,832,178**	**21,110,445**
CAPITAL COSTS											
Lyle Ladder and Trap	1,421,400	1,464,042	0	0	0	0	0	0	0	0	0
Hatchery Improvements	819,880	2,285,570	0	0	0	0	0	0	0	0	0
McCreedy Acclimation	0	1,171,691	0	0	0	0	0	0	0	0	0
Wahkiacus AF	967,541	939,360	0	0	0	0	0	0	0	0	0
TOTAL CAP. COSTS	**3,208,821**	**5,860,663**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
RUNNING TOTAL	**3,208,821**	**9,069,484**	**9,069,484**	**9,069,484**	**9,069,484**	**9,069,484**	**9,069,484**	**9,069,484**	**9,069,484**	**9,069,484**	**9,069,484**
TOTAL COSTS	**4,608,000**	**7,301,000**	**1,798,000**	**1,852,000**	**1,908,000**	**1,965,000**	**2,024,000**	**2,085,000**	**2,147,000**	**2,212,000**	**2,278,000**
RUNNING TOTAL	**4,608,000**	**11,909,000**	**13,707,000**	**15,559,000**	**17,467,000**	**19,432,000**	**21,456,000**	**23,541,000**	**25,688,000**	**27,900,000**	**30,178,000**

1. Annually, $566,000 of this amount has been from Mitchell Act funds.

Note: Costs are inflated at 3% per year.

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OPERATING COSTS
OPERATING COSTS
Klickitat Hatchery[1]
Upstream Acclimatio
Wahkiacus HAF
Ladder Maintenance
Monitoring and Eval.
TOTAL OP. COSTS
RUNNING TOTAL
CAPITAL COSTS
Lyle Ladder and Trap
Hatchery Improveme
Upstream Acclimatio
Wahkiacus HAF
TOTAL CAP. COSTS
RUNNING TOTAL
TOTAL COSTS
RUNNING TOTAL
Notes:
All costs are in 2C
Assume a 3% infl

3. Operating Costs

KLICKITAT HATCHERY

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Staff	6	6	6	6	6	6	6	6	6	6	6	6		
DIRECT OPERATING COSTS													**TOTAL**	% of Total
Labor	$21,000	$21,000	$21,000	$21,000	$21,000	$21,000	$21,000	$21,000	$21,000	$21,000	$21,000	$21,000	$ 252,000	41%
Goods and Services													$ 50,000	8%
Fish food													$ 68,916	11%
Equipment													$ 5,000	1%
SUPPORT SERVICES														
Maintenance, Repairs													$ 100,000	16%
Pathology													$ 36,000	6%
SUBTOTAL													**$ 511,916**	
General and Admin.													$ 102,383	
TOTAL													**$ 614,000**	

VALUES USED IN THE COST ESTIMATES

Labor rate	$ 3,500	$/mo.	(rate includes benefits)
Fish food	$ 0.60	$/lb	
Conversion rate	1.3	lb feed/lb fish	
Pounds reared	88354	lbs	

MCCREEDY ACCLIMATION SITE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
			Acclimation											
Staff	0	0	3	3	3	0	0	0	0	0	0	0		
DIRECT OPERATING COSTS													**TOTAL**	% of Total
Labor	$ -	$ -	$10,500	$10,500	$10,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 31,500	39%
Fish food													$ 13,903	17%
Vehicle	$ -	$ -	$ 1,200	$ 1,200	$ 1,200	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,600	4%
Misc.													$ 5,000	6%
SUPPORT SERVICES														
Maintenance, Repairs													$ 10,000	12%
Pathology													$ 3,000	4%
SUBTOTAL													**$ 67,003**	
General and Admin.													$ 13,401	
TOTAL													**$ 80,400**	

VALUES USED IN THE COST ESTIMATES

Labor rate	$ 3,500	$/mo.	(rate includes benefits)
Fish food	$ 0.65	$/lb	
Conversion rate	1.5	lb feed/lb fish	
Pounds reared	14259	lbs	

WAHKIACUS ACCLIMATION FACILITY

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	Chinook Rearing													
			Coho Acclimation							Adult Trapping				
Staff	2	2	3	3	2	2	0	0	0	1	1	1		
Water requirement (cfs)	0.5	0.5	30	30	15	15	0	0	0	5	5	5		
Pump horsepower	1.5	1.5	90	90	45	45	0	0	0	15	15	15		
DIRECT OPERATING COSTS													**TOTAL**	% of Total
Labor	$ 7,000	$ 7,000	$ 10,500	$ 10,500	$ 7,000	$ 7,000	$ -	$ -	$ -	$ 3,500	$ 3,500	$ 3,500	$ 59,500	26%
Electricity	$ 108	$ 108	$ 6,480	$ 6,480	$ 3,240	$ 3,240	$ -	$ -	$ -	$ 1,080	$ 1,080	$ 1,080	$ 22,896	10%
Fish food													$ 56,746	25%
Equipment													$ 5,000	2%
Vehicle	$ 800	$ 800	$ 1,200	$ 1,200	$ 800	$ 800	$ -	$ -	$ -	$ 400	$ 400		$ 6,400	
SUPPORT SERVICES														
Maintenance, Repairs													$ 30,000	13%
Pathology													$ 7,000	3%
SUBTOTAL													**$ 187,542**	
General and Admin.													$ 37,508	
TOTAL													**$ 225,000**	

VALUES USED IN THE COST ESTIMATES

Labor rate	$ 3,500	$/mo.	(rate includes benefits)
Electrical rate	$ 0.10	$/kwh	
Hp/cfs ratio	3.0		
Fish food	$ 0.65	$/lb	
Conversion rate	1.5	lb feed/lb fish	
Pounds reared	58201	lbs	

FISH LADDER OPERATION MAINTENANCE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Staff	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25		
OPERATING COSTS													**TOTAL**	% of Total
Labor - Ladder Main.	$ 875	$ 875	$ 875	$ 875	$ 875	$ 875	$ 875	$ 875	$ 875	$ 875	$ 875	$ 875	$ 10,500	53%
Ladder Equipment, Repair													$ 5,000	25%
Vehicle	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100	$ 1,200	
SUBTOTAL													**$ 16,700**	
General and Admin.													$ 3,340	
TOTAL													**$ 20,000**	

VALUES USED IN THE COST ESTIMATES

Labor rate	$ 3,500	$/mo.	(rate includes benefits)

Administrative, Planning, and Contingency (APC) 20%

UPSTREAM ACCLIMATIO

Staff

DIRECT OPERATING COS
Labor
Fish food
Vehicle
Misc.
SUPPORT SERVICES
Maintenance, Repairs
Pathology
SUBTOTAL
General and Admin.
TOTAL

VALUES USED IN THE COST ES
Labor rate
Fish food
Conversion rate
Pounds reared

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MONITORING AND EVALUATION

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Staff	10	10	10	10	10	10	10	10	10	10	10	10		
OPERATING COSTS													**TOTAL**	% of Total
Labor	$40,000	$40,000	$40,000	$40,000	$40,000	$40,000	$40,000	$40,000	$40,000	$40,000	$40,000	$40,000	$ 480,000	66%
Vehicle	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 4,000	$ 48,000	7%
PIT tags													$ 45,000	6%
Misc													$ 30,000	4%
SUBTOTAL													**$ 603,000**	
General and Admin.													$ 120,600	
TOTAL													**$ 724,000**	

VALUES USED IN THE COST ESTIMATES

Labor rate	$ 4,000	$/mo.	(rate includes benefits)

4. Lyle Falls Ladder and Trap Construction

Project Engineering and Permitting (completed)		$ -
Construction*		$ 2,300,000
SUBTOTAL		**$ 2,300,000**
Administrative, Permitting, and Contingencies (APC)	20%	$ 460,000
TOTAL		**$ 2,760,000**
*Estimate by Harbor Consulting Engineers		

5. Klickitat Hatchery Improvements

	Estimate in year 2000 $	2004 $	Cost with APC and Permitting	Year that cost is incurred
New river pipeline - replacement of main water supply line*	$ 730,000	$ 821,621	$ 1,068,000	2006
Hatchery chiller		$ 130,000	$ 156,000	2005
Improve the P25 inlet screen		$ 200,000	$ 260,000	2005
Adult holding pond - new hatchery ladder and larger, 2 cell holding pond*	$ 520,000	$ 585,265	$ 761,000	2006
Improve the P25 settling pond		$ 100,000	$ 130,000	2006
New houses - 2 new employee houses*	$ 135,000	$ 151,944	$ 182,000	2005
Wonder Springs intertie - new pipeline connecting Wonder Springs to the hatchery		$ 200,000	$ 260,000	2006
Springwater intake improvements		$ 165,000	$ 198,000	2005
TOTAL			**$ 3,015,000**	

* Estimates from CH2MHill, 8/14/2000
2000 to 2004 average yearly inflation rate used = 3%
Administrative, Planning, and Contingency (APC) at 20%
Permitting at 10% of project cost

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6. McCreedy Creek Acclimation Site Construction

Description	Units	Unit Cost	Cost
Mobilization	1	$54,160	$54,160
Bridge 20' X 40'	1	$160,000	$160,000
Remove culvert	1	$5,000	$5,000
Clearing & grubbing	17,000 s.y.	$1/s.y.	$17,000
Gravel-surfaced roads	20,000 s.f.	$1/s.f.	$20,000
15" culvert at entrance	30 l.f.	$68/l.f.	$2,040
Earthwork			
Excavation	6,400 c.y.	$7/c.y.	$44,800
Embankment	6,400 c.y.	$7/c.y.	$44,800
Rock rip rap	90 c.y.	$50/c.y.	$4,500
Prep. riverbed for water intake facility	180 s.y.	$10/s.y.	$1,800
Water Supply & Return			
24" CMP w/bedding	465 l.f.	$110/l.f.	$51,150
18" CMP w/bedding	240 l.f.	$74/l.f.	$17,760
10" CMP w/bedding	145 l.f.	$63/l.f.	$9,140
Supply manifolds	2	$1,500	$3,000
Pond control structures	2	$5,000	$10,000
Drainage structures	4	$3,000	$12,000
Pond Lining (Hypalon)	4,700 s.y.	$6/s.y.	$28,200
River Return Headwall	1	$3,000	$3,000
Conc. weirs	3	$2,500	$7,500
Site revegetation	1	$3,000	$3,000
Fencing - 4' high chain link	1,220 l.f.	$24/l.f.	$32,600
Bird netting	46,250 s.f.	$.15/s.f.	$6,940
Water Intake Facility			
Slidegates, installed	2	$1,000	$2,000
Wire screens, 5' X 3'	3	$2,000	$6,000
Aluminium plate screens	100 lbs.	$4/lb.	$400
Denil fish ladder	1	$6,000	$6,000
Stop logs	.84 MBM	$4000/MBM	$3,360
Structural steel	900 lb.	$2/lb.	$1,800
Concrete slab	825 s.f.	$7/lb	$5,780
Foundation wall, 18"	4.5 c.y.	$800/c.y.	$3,600
Concrete wall, 10"	15 c.y.	$800/c.y.	$12,000
Weir	7 c.y.	$800/c.y.	$5,600
Sheet pile cut-off wall	2.7 tons	$4,000/ton	$10,800
Trailers, generator, alarm system	2	$10,000	$20,000
Demobilization	1	$16,250	$16,250
Subtotal			**$631,980**
Design and construction mgmt, 15%			**$94,797**
Contractor's overhead & profit, 15%			$94,797
Contingency, 20%			$126,396
Subtotal			**$947,970**
Administrative, 20%			$189,594
Total Cost			$1,137,564

*Estimate by Harbor Consulting Engineers

7. Wahkiacus Hatchery & Acclimation Facility Construction

	Description	Quan.	Units	Unit Cost	Cost	Totals
KLICKITAT RIVER WATER SUPPLY		24	cfs			
Intake structure	Precast concrete screen base, screens	1	ea	$ 20,000.00	$ 20,000	
Intake installation	Sheet pile, dewatering, structure placement	1	ea	$ 10,000.00	$ 10,000	
Pump chamber	Precast concrete vault, 10'6" x 5' x 6'2" tall ID	1	ls	$ 9,000.00	$ 9,000	
Pumps	12 cfs ea, 20' head, 40 hp	3	ea	$ 15,000.00	$ 45,000	
Pump controls	Sequential start, overloads, controls	3	ea	$ 2,000.00	$ 6,000	
Airblast system	Compressor, tank, piping, timer	1	ls	$ 10,000.00	$ 10,000	
Piping	Fittings, thrust blocks, pipe, valves, installed	1100	ft	$ 80.00	$ 88,000	
Riprap	Discharge stabilization, in place, cover 800 sft, placed	120	tons	$ 90.00	$ 10,800	
						$ 198,800
GROUND WATER SUPPLY		10	cfs			
Well construction	Precast concrete screen base, screens	4	ea	$ 20,000.00	$ 80,000	
Pumps	2 cfs ea, 50' head, 10 hp	4	ea	$ 12,000.00	$ 48,000	
Pump controls	Sequential start, ON/OFF	4	ea	$ 2,000.00	$ 8,000	
Aeration towers	Packed columns	4	ea	$ 3,000.00	$ 12,000	
Piping	Fittings, thrust blocks, pipe, valves, installed	880	ft	$ 80.00	$ 70,400	
						$ 218,400
GENERATORS/ELECTRICAL						
Generator	60 Kw ea, 24 hour fuel tank	2	ea	$ 30,000.00	$ 60,000	
Generator building		1	ea	$ 20,000.00	$ 20,000	
Generator electrical	Automatic transfer switch, wiring	1	ls	$ 10,000.00	$ 10,000	
Service electrical	Main service drop, transformers, main service panel	1	ea	$ 5,000.00	$ 5,000	
Site electrical	Wire pumps, generator	1	ls	$ 10,000.00	$ 10,000	
Alarm system	Alarms, autodialer, wiring	1	ls	$ 5,000.00	$ 5,000	
						$ 110,000
PONDS		8200	cy			
Site preparation	Water control ditching	500	ft	$ 10.00	$ 5,000	
Pond construction	Excavate, form berms	8200	cy	$ 7.00	$ 57,400	
Fill removal	Move 1/5 of the fill	1640	cy	$ 10.00	$ 16,400	
Bottom drain system	Water removal system under ponds	1200	lft	$ 20.00	$ 24,000	
Bottom preparation	4" of sand spread and compacted	820	cy	$ 20.00	$ 16,400	
Liners	Hypalon	73800	sft	$ 0.60	$ 44,280	
Outlet structures	Pre-fabricated steel, with screens	12	ea	$ 1,000.00	$ 12,000	
Predator net system	Supports with net over ponds	81180	sft	$ 1.00	$ 81,180	
Pond labor		320	hrs	$ 50.00	$ 16,000	
						$ 272,660
DISCHARGE (no trap)						
Piping	Fittings, thrust blocks, pipe, valves, installed	950	ft	$ 80.00	$ 76,000	
Adult trap	Pond, ladder	1	ea	$ 10,000.00	$ 10,000	
Riprap	Discharge stabilization, in place, cover 400 sft	60	tons	$ 90.00	$ 5,400	
						$ 91,400
MISC						
Hatchery building	Wood frame building, incubators	2400	sft	$ 40.00	$ 96,000	
Outbuildings	Convert existing bldg. to storage/shop	1	ls	$ 10,000.00	$ 10,000	
Access roads	Gravel surface	100	ft	$ 10.00	$ 1,000	
Misc operating equip.	Feeders, dip nets, O2 meters, etc.	1	ea	$ 5,000.00	$ 5,000	
Site restoration	Fence, re-vegetate	1	ls	$ 10,000.00	$ 10,000	
						$ 122,000
SUBTOTAL						**$ 1,013,260**
Unlisted Item allowance		15%				$ 151,989
Final design, permitting	Final drawings, bid documents, permits	10%				$ 101,326
Construction mgmt.		5%				$ 50,663
Contractor overhead		20%				$ 202,652
SUBTOTAL						**$ 1,519,890**
Administrative, Permitting, and Contingencies		20%				$ 303,978
TOTAL						**$ 1,824,000**

KEY: LS = Lump Sum, EA = Each, LFT = Linear Feet, SFT = square feet, CFT = cubic feet, CY = Cubic Yards, MO = month, HRS = hours

8. Capital Expense Measure Priorities

Following is a prioritized list of measures and their costs. The prioritization reflects the importance placed on different aspects of the Master Plan objectives. The measures are closely interrelated and partial implementation will impact general program goals.

	MEASURE COST	CUMULATIVE TOTAL
KLICKITAT HATCHERY IMPROVEMENTS A. (new pipeline, chiller, P25 intake improvement) Replacement of the 50+ year old pipeline delivering water to the Klickitat hatchery is high priority. It is the only water source for the hatchery incubators and raceways and failure would eliminate 2 year classes of production. The chiller is important to objectives of producing a more "natural" spring chinook smolt and is a low cost measure. The current P25 intake violates NMFS screening criteria.	$ 1,484,000	$ 1,484,000
LYLE FALLS LADDER AND TRAP CONSTRUCTION The capture of local broodstock is required for the supplementation of spring chinook and steelhead.	$ 2,760,000	$ 4,244,000
MCCREEDY ACCLIMATION SITE The acclimation and release of spring chinook and steelhead upstream of Castille Falls will encourage the utilization of this habitat by naturally reproducing populations.	$ 1,138,000	$ 5,382,000
WAHKIACUS ACCLIMATION FACILITY A. (fewer ponds constructed, no groundwater, no adult trap) Plans for the increased production of spring chinook and the addition of winter and summer steelhead to the Klickitat hatchery depend on the having the water and space used by coho and fall chinook made available. Production of half the fall chinook and acclimation of coho at the WAF makes these changes possible while meeting meeting watershed harvest objectives.	$ 1,450,000	$ 6,832,000
KLICKITAT HATCHERY IMPROVEMENTS B. (adult pond, P25 improvement, new houses, Wonder Springs intertie, spring water intake improvement) A larger adult pond allows all the spring chinook required of the program to be held and spawned. The other improvements allow the hatchery to function as a reliable facility in future years.	$ 1,531,000	$ 8,363,000
WAHKIACUS ACCLIMATION FACILITY B. (more ponds, groundwater, adult trap) Additional rearing space improves coho adult survival rates. Groundwater adds to facility security and the adult trap allows the capture of returning adults.	$ 374,000	**$ 8,737,000**

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9. References

- 2003 National Construction Estimator, Craftsman Books.
- Klickitat Hatchery Annual Operating Costs, 1991-1996. WDFW.
- Klickitat Salmon Hatchery Site Improvements, 2000, CH2MHill.
- Klickitat Subbasin Anadromous Fishery Master Plan, 2004, Yakama Nation.
- Lyle Falls Ladder and Trap Cost Estimate, 2004, Harbor Consulting Engineers.
- McCreedy Creek Acclimation Site Statement of Probable Cost, 2004, Harbor Consulting Engineers.
- Wahkiacus Acclimation Facility Cost Estimate, 2004, Sea Springs Co.
- Yakama/Klickitat Project Budget Proposal - Monitoring and Evaluation, 2005, Project 1995-063-35, Contract 14033, Yakama Nation.

Appendix B. Ongoing Facility Improvements

Castile Falls Fishway

Current Status

The Castile Falls are a series of eleven natural falls with a vertical drop of 108 feet over 0.67 miles, in the upper Klickitat River gorge, within the boundaries of the Yakama Reservation. The Yakama Nation (YN) owns the real estate parcels underlying the fishways and access routes. The fishways were constructed in the late 1950s with Mitchell Act funds to provide anadromous access to approximately 45 miles of habitat above the falls. They consist of three different fishways, located between river miles 60.0 and 60.7. Falls 2, 3, and 6 were not considered fish barriers, so no modifications were made. The remaining falls (numbers 1, 4, 5, 7, 8, 9, 10, and 11) all were modified. A 1957 Memorandum of Agreement for Castile Falls Development (1957 MOA), between YN, WDFW, Bureau of Indian Affairs and the U.S. Fish and Wildlife Service, authorized WDFW to construct, operate and maintain the fishways. From 1960 to 1962 Mitchell Act funds were used by Washington Department of Fisheries to construct the three fishways and blast the remaining fish passage obstructions. The original plans called for a tunnel fishway 2,850 feet in length to bypass the entire series of 11 falls. However, as a result of unanticipated sub-surface conditions, the project was amended and a shortened tunnel fishway approximately 750 feet in length was constructed around the two uppermost falls (10 and 11). These two falls were considered the most serious obstructions. Construction of the fishway was begun in 1959 and was completed in 1960. The remaining falls were modified under separate contracts by blasting rock cuts or by the construction of formal fishways (falls 1, 4 & 5, and 7).

The next formal fishway downstream from Falls 10 & 11 is Falls 7. The drop at Falls 7 is 10 feet. A weir pool fishway was constructed in 1962. It consists of 10 pools each with a rise of approximately one foot.

Downstream of the Falls 7 fishway can be found a formal fishway around Falls 4 & 5; it consists of 22 weirs and 21 pools through a 260-foot-long tunnel. The collective drop at these falls is 22 feet. Initial construction of the Falls 4 & 5 fishway began in 1962 and was completed in 1963. The existing 4 & 5 tunnel is approximately 7 feet wide, 6 - 9 feet high, with a 4-foot radius arc soffit; it consists of 20 baffles with a one-foot drop in elevation at each, and one submerged orifice baffle. Each baffle consists of a single weir approximately six feet wide. The center four feet consists of timber stoplogs. The baffled portion of the tunnel is approximately 235 feet long. Baffle spacing varies from 12 to 9.5 feet. The exit to the tunnel has a trash rack approximately 8 feet wide with a clear opening of 11.5 inches. It is provided with one removable opening.

The last downstream fishway at Castile is Falls 1; it is the first barrier that anadromous fish reach in the upper Klickitat River. Falls 1 has a 7-foot drop and was originally modified by blasting a deep channel on one side of the river in 1962. It was found to be inadequate and 7 concrete weirs were installed in a semi-circle around the main falls in 1963.

Changes

In 1999, the YN was awarded Mitchell Act funds via special Congressional appropriations to repair 1996 flood damage and improve passage at the facility. The five-year project has focused on the 10/11 fishway tunnel and the 4/5 fishway tunnel. Construction was initiated in August 2002 on the 10/11 tunnel and was completed in September 2003. Engineering designs have been completed for the 4/5 tunnel; construction is anticipated to begin in August of 2004 and to be completed in 2004. The following is a list of the improvements at each tunnel:

Castile 10/11 fishway tunnel improvements

The following criteria were used as a basis for developing the design alternative. The final design was selected based upon these criteria and recent fishway designs and operational experience. See Figure B-1.

- Entrance velocity 4-8 ft/sec.
- Depth of entrance 2-8 ft.
- Head difference between pools ~1 ft.
- Maximum velocities in slots at weirs ~ 8 ft/sec.

In order to address the low-flow conditions at the entrance, excessive maintenance requirements, and poor passage efficiency, the following improvements to the tunnel are being made:

- Modify trash rack section;
- Install 26 vertical slots baffles;
- Install concrete wall to close off void at tunnel turn;
- Install directional orifice at fishway entrance;
- Install a forebay sluice gate.

Castile 4/5 fishway tunnel improvements

The design of passage improvements will reduce annual maintenance requirements for the system as a whole. The bulk of maintenance is associated with clearing debris from the trash rack and entrance and removing sediments from the tunnel throughout the fish passage season. The following criteria were used as a basis for developing the design alternative. The final design was selected based upon these criteria and recent fishway designs and operational experience. See Figure B-2.

- Entrance velocity 4-8 ft/sec.
- Depth of entrance 2-8 ft.
- Head difference between pools ~1 ft.
- Maximum velocities in slots at weirs ~ 8 ft/sec.

In order to address the low-flow conditions at the entrance, excessive maintenance requirements, and poor passage efficiency, the following improvements to the tunnel are being made:

- Modify trash rack section;
- Install a manual vertical gate system to open/close the forebay;
- Remove certain baffles and submerged weirs;
- Excavate portions of tunnel bottom;
- Install 20 evenly spaced vertical slots baffles;
- Demolish horizontal weirs in their entirety;
- Install concrete sill and entrance orifice;
- Install a forebay sluice gate.

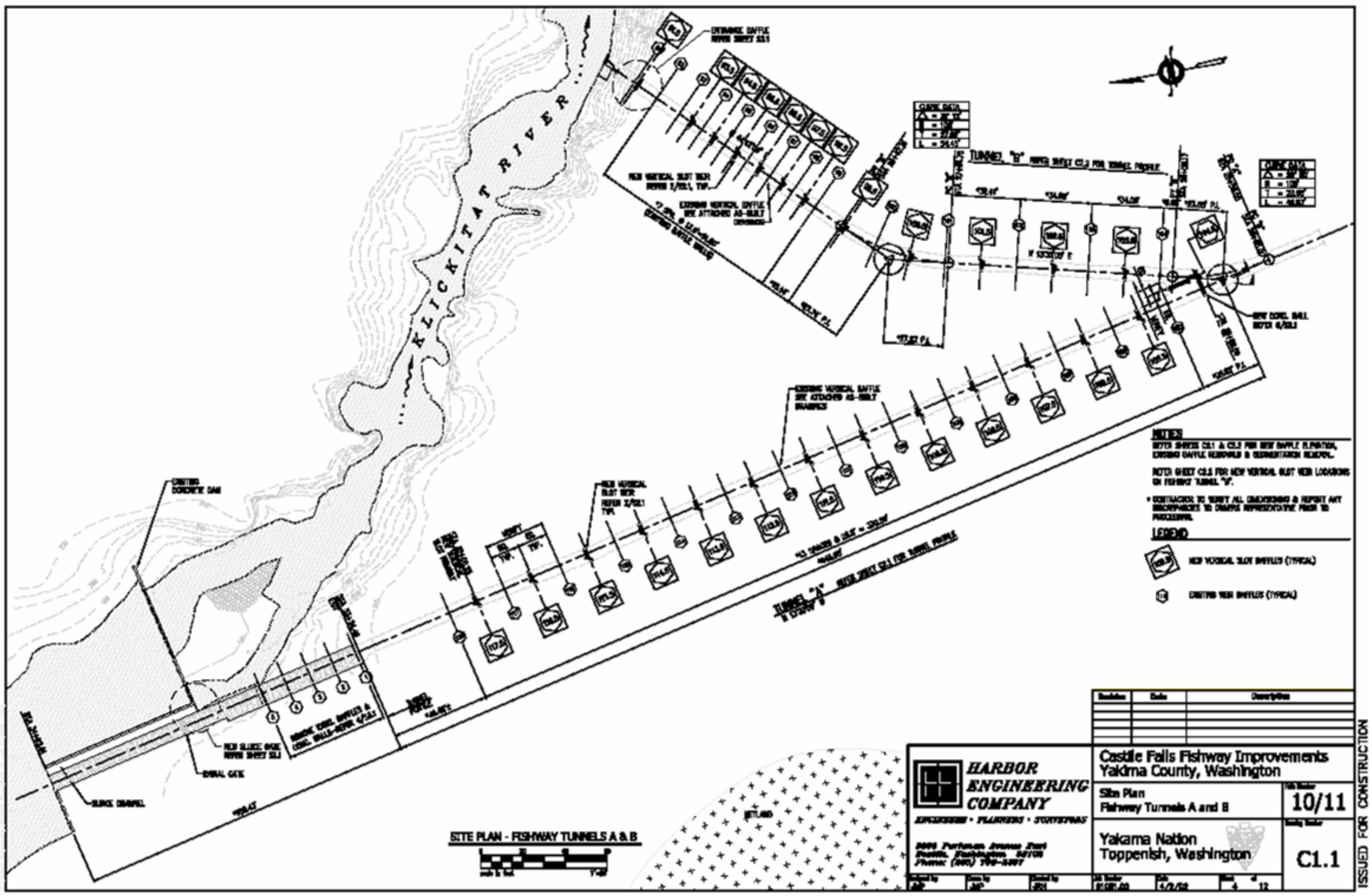


Figure B-1. Castile Falls Fishway Tunnel 10/11 Improvements

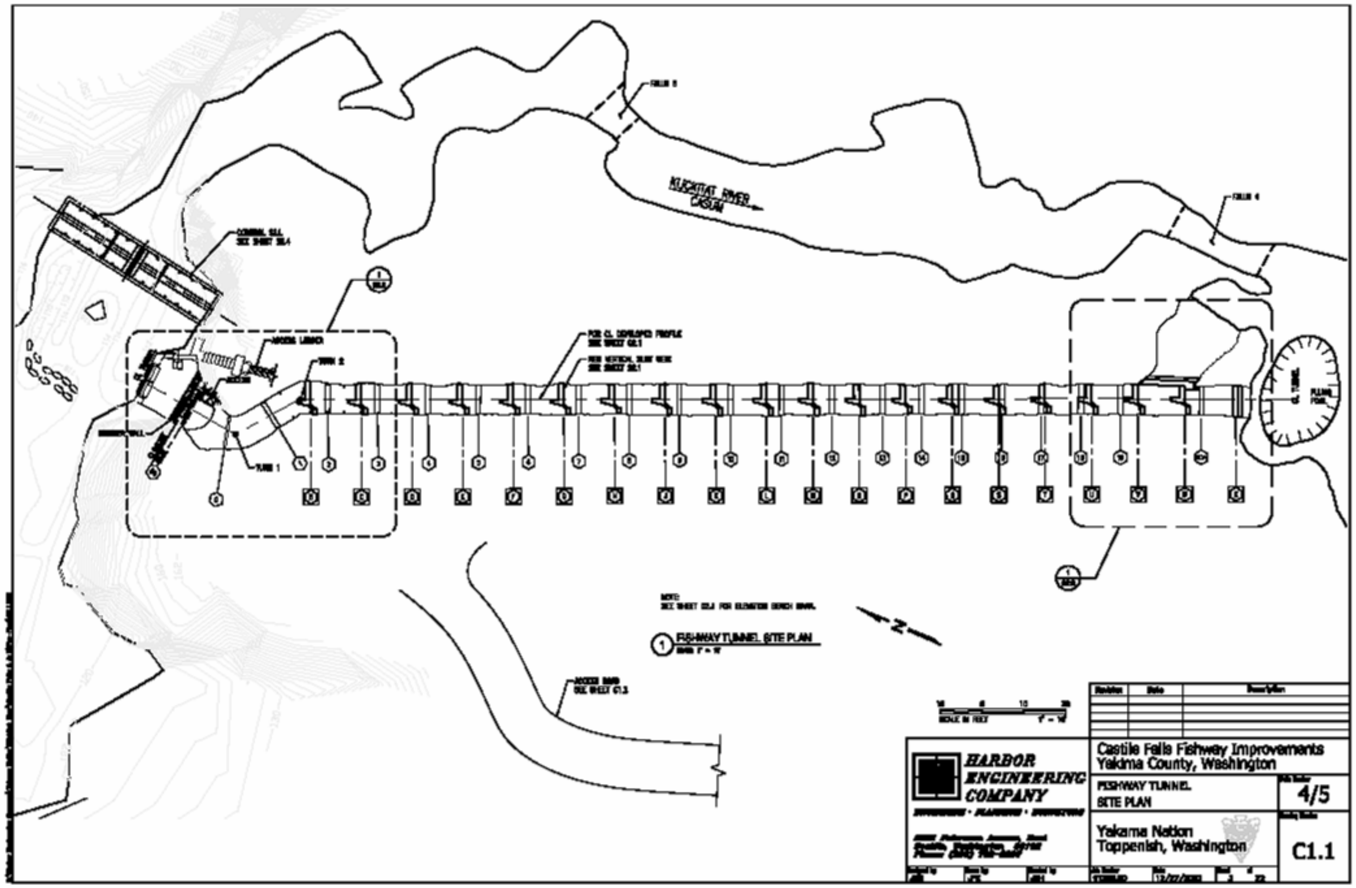


Figure B-2. Castile Falls Fishway Tunnel 4/5 Improvements

Appendix C. Wahkiacus Hatchery and Acclimation Facility

WAHKIACUS HATCHERY AND ACCLIMATION FACILITY

DRAFT ENGINEERING DESIGN REPORT

Yakama Nation

Yakima/Klickitat Fisheries Project

4/15/04

by Greg Ferguson, Sea Springs Co. and Bill Sharp, Yakama Nation

CONTENTS

I. Introduction

The Wahkiacus Hatchery and Acclimation Facility (WHAF) is designed to acclimate up to 1,000,000 coho smolts, to rear and release up to 2,000,000 fall chinook, and to serve as the Klickitat watershed regional fisheries office. Coho releases are planned for the end of April at a size of 15 fish per pound. Fall chinook will be 80 per pound at release in mid-June.

Facility water requirements are summarized in section IX. PRODUCTION PLAN SUMMARY. A peak flow of 24 cfs occurs in late April just prior to release of coho smolts. This flow capacity creates maximum flow densities of 8.4 lbs/gpm for coho and 3.9 lbs/gpm for fall chinook.

Because adult survival improves with lower fish rearing densities, a large part of the site is planned to be converted to pond space. There will be 254,000 cubic feet of rearing volume, with peak volume densities (at the end of April) as follows:

	Fish (lbs)	Volume (cft)	Density (lbs/cft)
Coho	60,294	216,800	0.28
Fall chinook	7,483	37,000	0.20

The main water supply for the site will be surface water from the Klickitat River. A large river water intake on the site is proposed. This location meets several, but not all, of the requirements for a high quality intake. The channel is stable at the location, but a deep scour pool does not exist. Stability is provided by Klickitat river bridge abutments which confine the channel in a fixed position. The water depth at the proposed intake location, however, is moderate. The absence of a deep pool may impact the operation of the intake during severe low flow conditions. Since these conditions are unlikely during the spring acclimation period, low flow limitations would likely only affect potential future late summer rearing programs.

Klickitat water quality in the area is acceptable for spring acclimation, although high turbidity may impact feeding activity and growth. If future rearing programs include rearing at other times of the year, low winter temperatures may cause intake ice formation problems and high summer temperatures may add to stress related disease problems. Use of ground water can reduce these problems and will provide incubation water for fall chinook. Ground water with artesian pressure exists under the site and is planned to be developed.

The facility location is just downstream of the mouth of Swale Creek at river mile 17 at an elevation 512 - 525 feet. It is in the floodplain of Swale Creek and the Klickitat River. Although periodic damage to structures and material deposition in the rearing ponds may occur, flooding may not completely halt the main functions of the facility. If fish are being acclimated at the time of the flooding, those that have reached an advanced smolt stage may exit the pond. These fish will have a reduced acclimation period with resulting lower adult survivals and increased straying.

The main constructed components on the site will be earthen acclimation ponds, a Klickitat River water intake, a hatchery building, a back-up power supply, an effluent settling pond, and a discharge/fish trap. An existing house has been converted to a regional fisheries office and several outbuildings are used for storage.

A concrete intake structure will be constructed on the shoreline of the Klickitat for the main water supply. It will be built below ground level to prevent flood scour damage and will have components that are completely submersible. Axial-flow pumps will deliver water to the ponds. An air-blast system will periodically flush debris that accumulates on the screens back into the river. Three-phase line power will run the pumps and generators provide back-up.

One large pond (225' long, 110' wide, and 4.0' deep), three medium ponds (180' long by 60' wide by 4.0' deep), and 4 small ponds (100' long, 34' wide, and 3.5' deep) will be constructed. The ponds will be formed from dirt on the site and will be lined with plastic. They will have overhead netting to reduce predator losses and to provide cover. Outlet structures will have dam boards to control water levels and screens that prevent fish escape.

Support components include water distribution systems and a generator/electrical building. Alarms will notify personnel of power and water interruptions and an automatic transfer switch will start generators. Gravel access roads will be extended to the ponds and the site will be graded and landscaped, and river banks will be planted with native vegetation after construction activities are completed.

Fish wastes will settle in the large, low-velocity acclimation ponds. Periodically, wastes will be vacuumed off the pond bottoms and diverted to an off-line settling basin, where they will be dried and removed.

Operation of the WHAF will involve a range of fish culture activities. Coho pre-smolts that have been reared at other hatcheries will be trucked to the site in mid-March. They will be reared in the ponds for approximately 6 weeks while full smoltification occurs. Longer and shorter acclimation periods may be tested in the future. At release, the pond outlet screens will be pulled and the smolts will be allowed to migrate volitionally.

Fall chinook will require a full hatchery program. Eyed eggs will be delivered to the site and incubated, fry will be first fed, and fingerlings will be reared to release size. Fish will be moved from smaller to larger rearing units as they grow.

During rearing, fish culturists periodically feed a predetermined amount of fish food. This amount is calculated based on the number and size of fish and on water temperatures. Other typical fish culture activities will include screen maintenance, pond cleaning, growth sampling, and fish health analyses.

Adult coho and fall chinook will return to the Klickitat in the fall, after being subject to various ocean and mainstem river fisheries. The Yakama Nation tribal dip net fishery at Lyle falls and a river sport fishery will harvest adults in the Klickitat. Adults missed by these fisheries will return to the Wahkiacus area. The WHAF discharge will be operated at these times in order to attract and capture these returns in an adult collection pond.

A number of construction and operating permits will be required. A summary of these permits is included in the next section. Flood issues, both the impact of the facility on flood elevations and the potential for damage caused by floods to the site, have been evaluated as part of the permit process. A study was performed that estimated flood elevations and the locations of the floodway and 100-year flood boundaries. This study is summarized in section VIII, and those boundaries are shown on the attached site plan drawing.

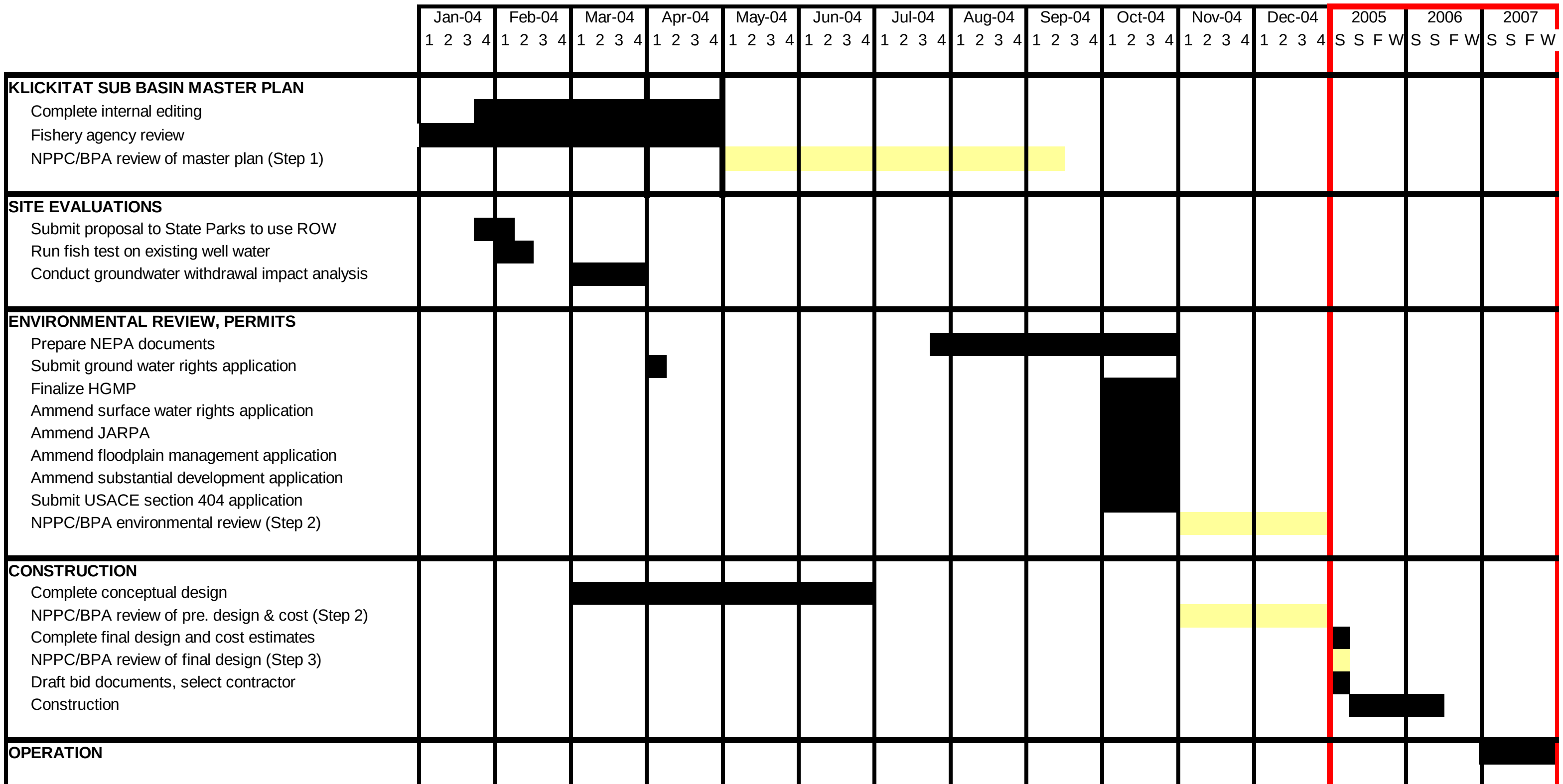
II. Permit Summary

WAHKIACUS PERMIT REQUIREMENT SUMMARY		
PERMIT NAME	**AGENCY**	**CONTACT**
JARPA - Joint Aquatic Resource Permits Application		
HPA	WDFW	Habitat program (360) 902-2534
SHORLINES SUBSTANTIAL DEV.	Klickitat Co.	Planning
FLOODPLAIN MANAGEMENT	Local Govt.	Klickitat Co.
EXCEED. OF WATER QAUL. STANDARDS	WDOE	Regional office
SECTION 404 PERMIT	US ACE	(360) 764-3495
OTHER STATE PERMITS		
ARCHAEOLOGICAL EX.	Office of Arch. & Hist. Pres.	
NPDES, GEN. PERMIT, UPLAND HATCH.	WDOE	Local office
CERTIFICATE OF WATER RIGHT - surface	WDOE	Local office (#S4-34554)
CERTIFICATE OF WATER RIGHT - ground	WDOE	Local office
OTHER LOCAL PERMITS		
CONSTRUCTION	Klickitat Co.	Building 800 583-8078
CONDITIONAL USE	Klickitat Co.	
FLOODPLAIN DEVELOPMENT	Klickitat Co.	
NEPA		
ENVIRONMENTAL CHECKLIST[1]	BPA	
EIS or FONSI	BPA	
BIOLOGICAL OPINION		
BIOLOGICAL ASSESSMENT (HGMP)	NMFS	

[1] www.efw.bpa.gov/portal/Organizations/Government/Federal/Dept_of_Energy/BPA/Environment/NEPA/Watershed/WaterCklst103101.doc

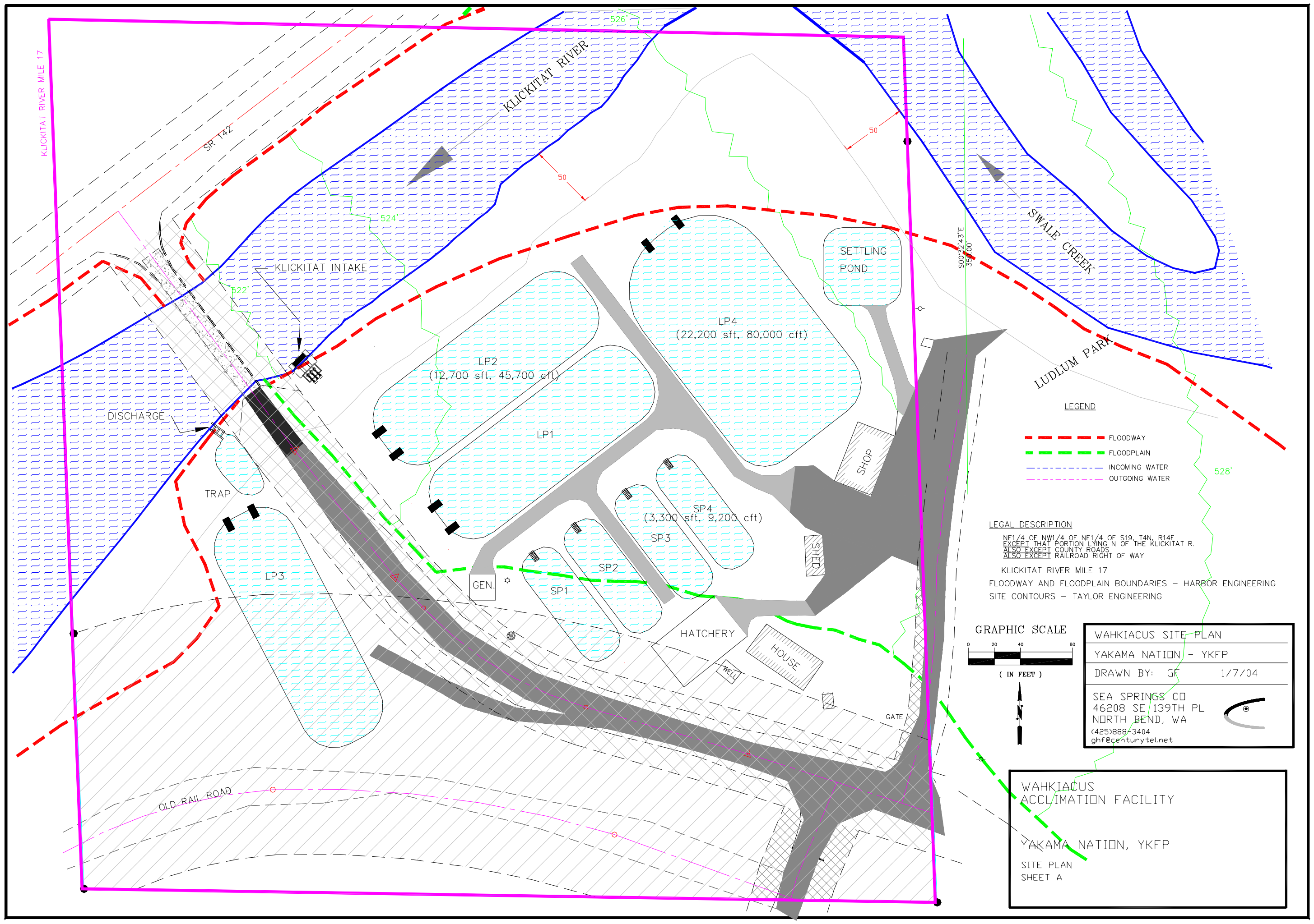
III. Project Development Schedule

APPENDIX. WAHKIACUS ACCLIMATION FACILITY PROJECT SCHEDULE

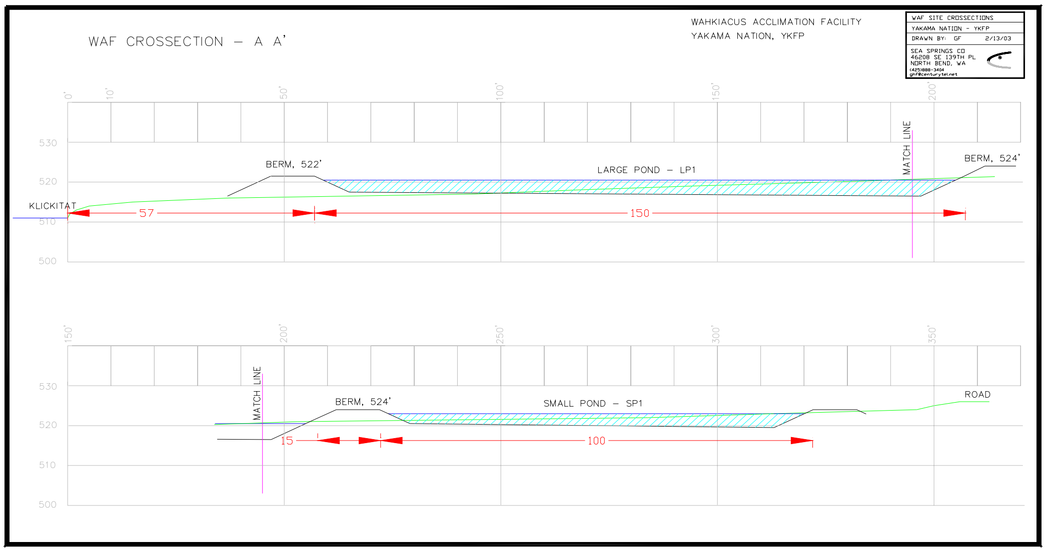


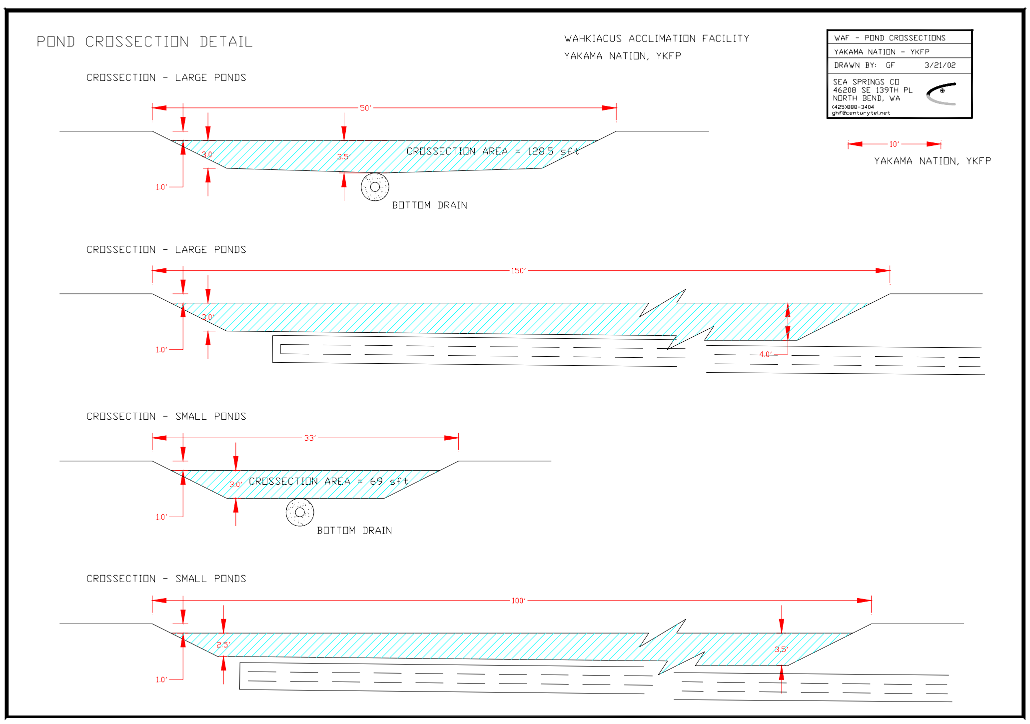
Comment [BS4]: Master Planning schedule adjusted to reflect current timelines. Bill Sharp

IV. Site Plan and Photo

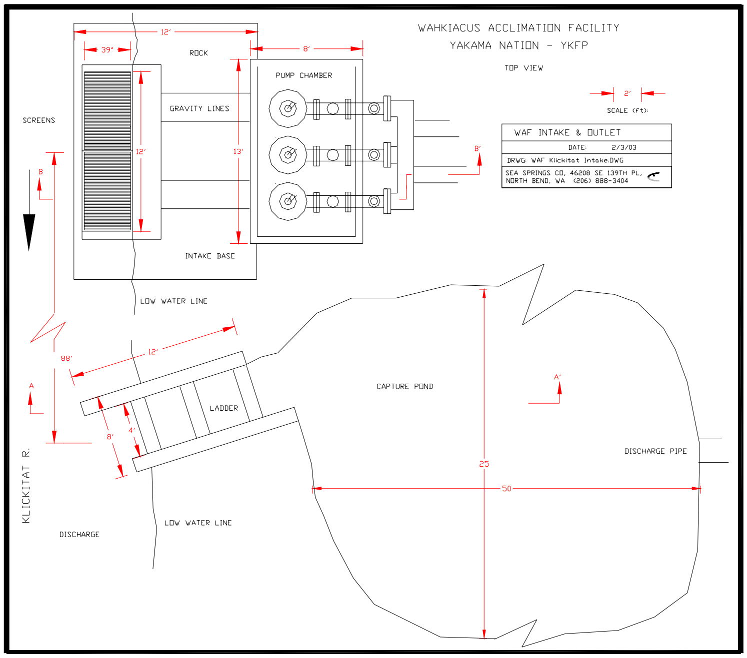


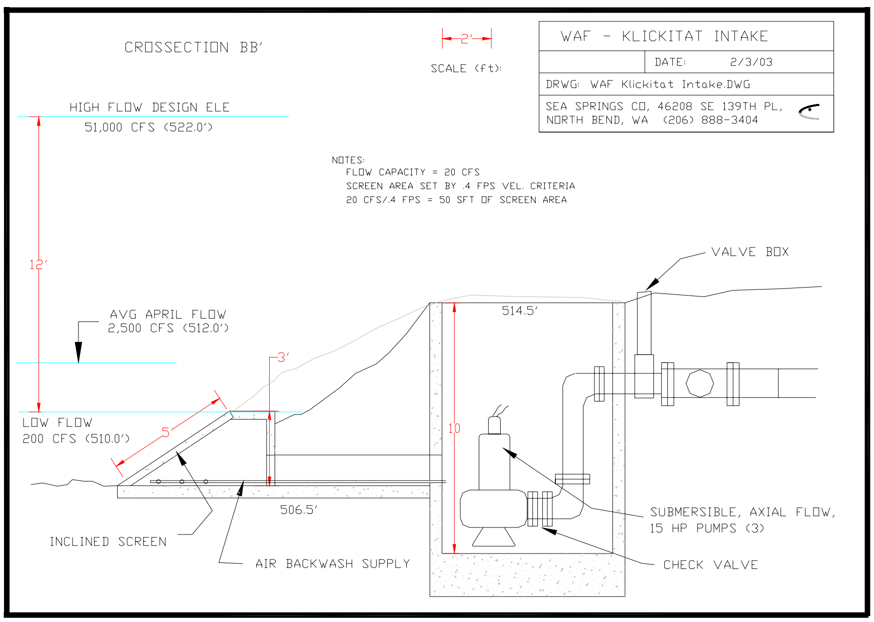
V. Pond Design





VI. Intake and Discharge Design





VII. Effluent Treatment

The minimum hydraulic retention time of the facility is calculated as follows:

Water Volume	254,000	cft
Water Flow	24	cfs
Retention Time	176	minutes

The facility meets the criteria of 2 hours of retention for sites without effluent treatment. However, an off-line settling pond is proposed to ensure that high quality water is being discharged. The pond will be used for treating wastes that are vacuumed off the bottom of the rearing ponds.

Half the ponds are expected to be vacuumed every week and all once just prior to fish release. A 50-gpm trash pump with a vacuum brush head will be used to remove wastes settled in the ponds. The size of the off-line settling pond is calculated as follows:

Cleaning Rate	30	sft/minute
Pond Bottom Area	36,750	sft
Total Cleaning Time	1,225	minutes
Volume of Effluent	61,250	gallons
	8,167	cft

The settling pond is sized to hold this amount of effluent plus the settled wastes from previous cleanings. Allowing 150% of the amount of volume of incoming effluent will provide a safe capacity.

Settling Pond Volume	12,250	cft
Avg Water Depth	4	ft
Pond Surface Area	3,063	sft
Length and Width	55	ft

Solids will be settled for one week and the pond will then be dewatered in preparation for the next cleaning. After the acclimation season is complete, the accumulated wastes will be dried in the pond and removed for disposal off-site.

VIII. Flood Impact Evaluation

A flood study was commissioned to evaluate the impact of the acclimation ponds on flood conditions in the area and to determine risks to the facilities from floods. The Hydrologic Engineering Center's River Analysis System (HEC-RAS) was used to perform one-dimensional steady flow calculations for the Swale Creek and Klickitat River flows. See the WAHKIACUS ACCLIMATION SITE, FLOOD STUDY, HYDROLOGY REPORT, January 23, 2003 by Harbor Engineering Co., for more detail. The 100-year and floodway boundaries were determined by this study.

The Harbor Engineering flood study concluded that the acclimation facilities "will not impact river flood hydraulics." It recommended that no encroachments be made inside the boundaries of the floodway. This recommendation was followed and the ponds have been planned away from the floodway boundaries. Some parts of the Klickitat River intake and the discharge structure are inside the floodway. However, both of these structures (see section VI) are low-profile and will not impact flood elevations or flows.

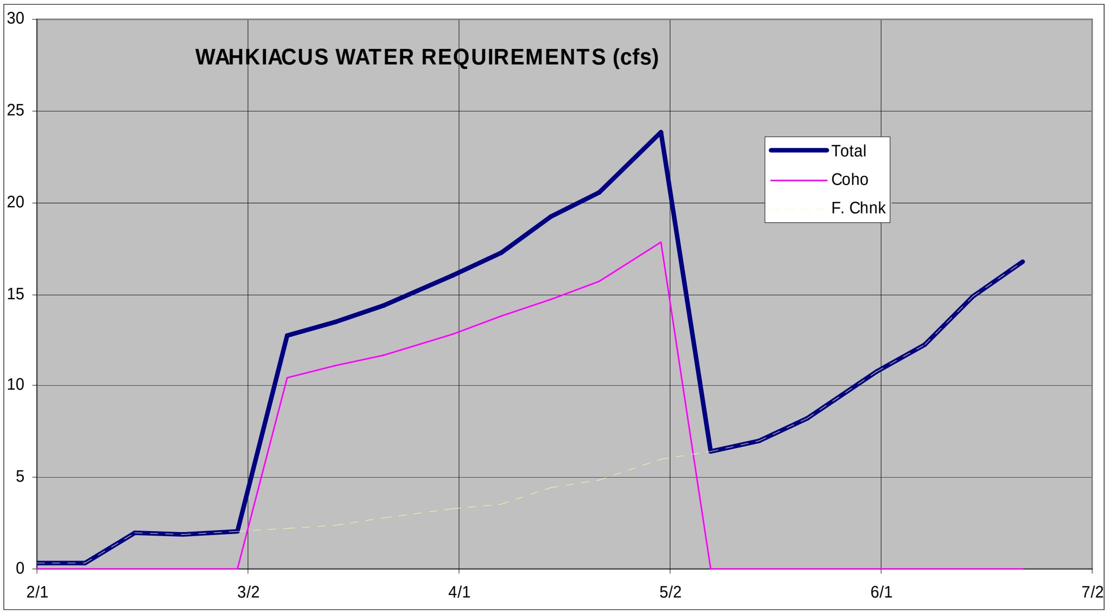
Floods will impact the WHAF, however, because 100-year-flood elevations are higher than pond berms. Damage to the ponds due to floods may require periodic removal of settled flood debris and reconstruction of pond berms. This damage is not expected to be frequent, and repair costs likely will not be high.

IX. Production Plan Summary

Coho Acclimated: 1,000,000 Fall Chinook Reared and Released: 2,000,000

REARING UNIT STOCKING (NUMBERS OF FISH, mortalities not included)											WATER (CFS)		
	Inc	*SP1*	*SP2*	*SP3*	*SP4*	*LP1*	*LP2*	*LP3*	*LP4*	**TOTAL**	CHF	COH	**TOTAL**
Volume		*10,000*	*10,000*	*10,000*	*10,000*	*40,000*	*40,000*	*40,000*	*60,000*	*220,000*			
2/1	2,000,000									2,000,000	0.4	0.0	**0.4**
2/8	2,000,000									2,000,000	0.4	0.0	**0.4**
2/15		500,000	500,000	500,000	500,000					2,000,000	2.0	0.0	**2.0**
2/22		500,000	500,000	500,000	500,000					2,000,000	1.9	0.0	**1.9**
3/1		500,000	500,000	500,000	500,000					2,000,000	2.1	0.0	**2.1**
3/8		500,000	500,000	500,000	500,000	**222,222**	**222,222**	**222,222**	**333,333**	3,000,000	2.2	10.5	**12.7**
3/15		500,000	500,000	500,000	500,000	**222,222**	**222,222**	**222,222**	**333,333**	3,000,000	2.4	11.1	**13.5**
3/22		500,000	500,000	500,000	500,000	**222,222**	**222,222**	**222,222**	**333,333**	3,000,000	2.8	11.6	**14.4**
4/1		500,000	500,000	500,000	500,000	**222,222**	**222,222**	**222,222**	**333,333**	3,000,000	3.3	12.8	**16.1**
4/8		500,000	500,000	500,000	500,000	**222,222**	**222,222**	**222,222**	**333,333**	3,000,000	3.5	13.8	**17.3**
4/15		500,000	500,000	500,000	500,000	**222,222**	**222,222**	**222,222**	**333,333**	3,000,000	4.5	14.7	**19.2**
4/22		500,000	500,000	500,000	500,000	**100,000**	**222,222**	**222,222**	**333,333**	2,877,778	4.8	15.7	**20.5**
5/1		500,000	500,000	500,000	500,000		**100,000**	**222,222**	**333,333**	2,655,556	6.0	17.8	**23.8**

Production Plan Summary (continued)													
REARING UNIT STOCKING (NUMBERS OF FISH, mortalities not included)											WATER (CFS)		
	Inc	*SP1*	*SP2*	*SP3*	*SP4*	*LP1*	*LP2*	*LP3*	*LP4*	**TOTAL**	CHF	COH	**TOTAL**
5/8		405,000	405,000	405,000	405,000	380,000		**100,000**	**333,333**	2,433,333	6.4	0.0	**6.4**
5/15		310,000	310,000	310,000	310,000	380,000	380,000		**150,000**	2,150,000	7.0	0.0	**7.0**
5/22		215,000	215,000	215,000	215,000	380,000	380,000	380,000		2,000,000	8.2	0.0	**8.2**
6/1		95,000	95,000	95,000	95,000	380,000	380,000	380,000	480,000	2,000,000	10.8	0.0	**10.8**
6/8		95,000	95,000	95,000	95,000	380,000	380,000	380,000	480,000	2,000,000	12.2	0.0	**12.2**
6/15		95,000	95,000	95,000	95,000	380,000	380,000	380,000	480,000	2,000,000	14.9	0.0	**14.9**
6/22		95,000	95,000	95,000	95,000	380,000	380,000	380,000	480,000	2,000,000	16.8	0.0	**16.8**


WAHKIACUS WATER REQUIREMENTS (cfs)
Total
Coho
F. Chnk
30
25
20
15
10
5
0
2/1
3/2
4/1
5/2
6/1
7/2

X. NOAA Fisheries Consultation Letter

Bill S.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
525 NE Oregon Street
PORTLAND, OREGON 97232-2737

May 13, 2003

RECEIVED
MAY 19 2003
FISHERIES RESOURCES MANAGEMENT PROGRAM

Memorandom For: Robert Z. Smith, Director
Columbia River Fisheries Development Program

From: Rob Jones, Chief
Propagation, Tributary Fisheries, and Recovery Branch

Subject: ESA Informal Consultation and EFH Consultation Regarding the Construction of the Wahkiacus Acclimation Facility, Klickitat County, Washington.
(tracking number I/NWR/2003/00530)

This memoradum constitutes informal consultation under section 7(a)(2) of the Endangered Species Act (ESA) and its implementing regulations (50 CFR Part 402); in addition, this letter constitutes consultation for Essential Fish Habitat (EFH) under the Magnuson - Stevens Fishery Conservation and Management Act (MSA). This consultation is in response to your April 30, 2003, memorandum regarding the proposal by the Yakama Nation Fisheries Resource Management and Yakima Klickitat Fisheries Project (YN) to construct the Wahkiacus Acclimation Facility on the Klickitat River.

The acclimation pond is to be constructed to replace an acclimation pond damaged in a 1996 flood. The damaged coho salmon acclimation pond at the old Champion Lumber Company consisted of a modification to an existing log pond and associated water supply; its operation and maintenance were funded under the Mitchell Act. Money was provided to the YN to repair the Champion Pond in a supplemental funding bill passed by Congress to address flood damage. Because of problems with the ownership of the Champion Lumber Company land and the potential pollution cleanup problems with the site, the decision was made to seek a different site to acclimate coho salmon in the Klickitat River basin.

The new site, at river mile 17, is designed to acclimate up to 1,000,000 coho smolts and to serve as the Klickitat watershed regional fisheries office for the YN. The project is proposed to be constructed in two phases. The first phase includes the river intake structure, 2 of the large acclimation ponds, a settling pond, and the discharge structure. It will have the capacity for acclimating 374,000 coho smolts. Phase 2 will add the remaining ponds (2 large and 4 small), the generator building, a larger settling pond, and the fish trap (see Ferguson and Sharp 2003). The main construction components on the site will be earthen acclimation ponds, a Klickitat River water intake, a back-up power supply, and a discharge/fishtrap. National Marine Fisheries Service (NMFS), which funds the program through the Columbia River Fisheries Development Program (CRFDP), has determined that the construction may affect, but is not likely to adversely

Wahkiacus Acclimation Facility Informal

affect, Middle Columbia River (MCR) steelhead listed under the ESA. The basis for this determination is considered below.

Endangered Species Act Consultation

One species listed under NMFS' ESA jurisdiction may occur in the action area and was considered in this consultation: MCR steelhead (threatened; *Oncorhynchus mykiss*).

NMFS reviewed the following information during this consultation:

1) The April 30, 2003, memo from R.Z. Smith (NMFS) to Rob Jones (NMFS);
2) The Joint Aquatic Resources Permit Application (JARPA) from YN attached to the April 30, 2003, memo (YN 2003a);
3) information provided in personal communication with R.Z. Smith (NMFS) April 29, 2003;
4) information provided in personal communication with Bill Sharp(YN) several in April-May 2003, ;
5) information provided in personal communication with Dale Bambrick (HCD-NMFS) April 28, 2003;
6) Wahkiacus Acclimation Facility Engineering Design Report, by Greg Ferguson and Bill Sharp (Ferguson and Sharp 2003);
7) Washington Administrative Code 197-11-960 Environmental Checklist, revised March 3, 2003 (WAC 2003);
8) Washington Department of Fish and Wildlife Mid-Columbia Region Fisheries Management and Evaluation Plan (March 30, 2003, draft) (WDFW 2003); and
9) Hatchery and Genetic Management Plan for Klickiat Reprogrammed Coho Salmon Program Draft (April 15, 2003, email to Richard Turner from Bill Sharp (YN 2003b).

The JARPA (YN 2003a), the memorandum (Smith 2003), and the Engineering Design Report (Ferguson and Sharp 2003) provide a complete description of the proposed action. The YN is proposing to construct an acclimation facility that at full capacity will acclimate and release up to 1,000,000 coho smolts (YN 2003b). As described above, the construction of the facility is being funded in part to replace the Champion Acclimation Pond that was damaged in the 1996 flood. The acclimation pond is needed to acclimate coho salmon that are produced to provide harvest opportunities to mitigate for fisheries losses due to the operation and construction of the mainstem Columbia River dams and meet Treaty-trust obligations. Acclimation prior to release, is expected to improve the survival and homing of coho salmon released into the Klickitat River. Production of the coho salmon that will be acclimated at the Wahkiacus Facility is currently funded through the Mitchell Act.

The construction, as described above, will occur in two phases. The main construction components of the first phase will be earthen acclimation ponds, a Klickitat River water intake, a back-up power supply and a discharge/fishtrap. Funding is being sought for the Phase II construction. A concrete intake structure will be constructed on the shoreline of the Klickitat

River for the main water supply (Figure 1). It will be built below ground level to prevent flood damage and will have components that are completely submersible. Three 15 hp, axial-flow pumps will deliver water to the ponds. An air-blast system will periodically flush debris that accumulates on the screens back into the river. Three phase line power will run the pumps. The two large ponds will be 150' long, 50' wide and 3.5' deep, all 8 ponds when completed will be approximately 0.8 acres in total surface area. The discharge/adult trap will be constructed 88' downstream from the intake structure on the opposite side of the bridge (see Figure 1).

The YN propose to construct temporary sheet pile dams at the shoreline areas where the water intake structure and discharge/trap facility are to be placed. The areas will be dewatered, and the excavation will occur by backhoe. A total of 200 cubic yards of material will be excavated from the shoreline area, and the material will be used to build berms around the ponds. The affected area will be about 1000 square feet. To prevent erosion during construction, site water will be confined to the excavated pond areas and will not be allowed to enter the surface waters until suspended solids have settled out. Disturbed areas will be covered with erosion control mats and planted with vegetation after construction.

The proposed action includes measures to minimize and avoid potential environmental impacts from short term increases in turbidity and sedimentation and from accidental release of hazardous materials on listed species that may be present at the project site. In brief, the YN and their contractors will:

- Control sedimentation and flows at the work site by isolating the work area from the mainstem river.
- Hold water from the construction activities in the acclimation ponds until sediment has settled out.
- Keep the work area adjacent to the shoreline as small as possible.
- Restrict backhoe access to the shoreline.
- Limit timing of construction work to the period August 1to September 30.
- Attempt to complete in-water work in about one month.

Flows will not be constricted at the location of the construction, due to the location of the facility on the mainstem Klickitat River and because the construction will be on the shoreline. The intake and discharge facilities are 88' apart (see Figure 1). All work will be completed within the in-water work period for the Klickitat River (June 15 to September 30) as described in the JARPA. The in-water work window is the period of the year when in-water work activities are expected to have the least amount of impact on natural fish species. The in-water work windows are developed by NMFS and Washington State resource agencies. Klickitat River flows during the in-water work window have generally averaged greater than 1959 cfs, 1169 cfs, 836 cfs and 747 cfs for the months of June, July, August, and September, respectively. Flows at these levels will quickly move and disperse any sedimentation produced by the construction activities. Sedimentation produced by the construction activities may be difficult to separate from the high background levels of suspended solids in the Klickitat River that occur during this time period due to glaciers melting upstream of the construction site. Access to the site will be via the upland area of the facility, further reducing the potential for contamination and sedimentation. Resident species and unlisted anadromous chinook salmon and coho salmon that may occur near the project site will easily avoid the work area that is adjacent to the shoreline during the limited duration of the project.

This consultation addresses the construction of the acclimation facility and does not address its operation or hatchery programs that might use the facility. The operation of the artificial propagation activities are being addressed by the YN and NMFS through Hatchery and Genetics Management Plan (HGMPs) currently under development (YN 2003b (draft)). The HGMP describes how, at full production, the Wahkiacus Acclimation Facility proposes to withdraw 20 cubic feet/second (cfs) of Klickitat River water during the spring acclimation period and 5 cfs to operate the adult fish trap during the fall adult salmon return period, and that the intake screen the will be used will meet current NMFS screening criteria. The affects of the hatchery programs will be evaluated during the examination of the HGMPs for the facility, but are not likely to be detrimental to listed steelhead.

The summer and winter steelhead in the Klickitat River are part of the MCR steelhead ESU. Adult winter steelhead are present from November to May in the Klickitat River adjacent to the construction site and are not expected to be affected by the construction activities. Adult summer steelhead are present from June to March in the Klickitat River adjacent to the construction site and are not expected to be affected by the construction activities. Furthermore, juvenile steelhead may also be present in the river at this location (WDFW 2003). Thus, ESA-listed MCR steelhead are expected to be present in the project area during the time of the proposed action. No concerns with the proposed construction activities on steelhead habitat were expressed by the Habitat Conservation Division of NMFS; however, they did have concerns regarding the impacts of hatchery fish on natural fish that will be addressed through the evaluation of the HGMPs (Dale Bambrick, personal communication, Richard Turner, April 28, 2003).

Based on the available information, NMFS concurs with CRFDP's determination that the construction activities associated with the Wahkiacus Acclimation Facility may affect, but are not likely to adversely affect, listed MCR steelhead. In summary, this decision is based on the following:

1) Restricting in-water work to the work window (June 15 - September 30) will minimize the period of time during which natural-origin fish would be affected;
2) flow in the mainstem Klickitat River will not be affected by the work site, which will be isolated from the mainstem river;
3) the intake will have a small foot print of 12' by 15' and the discharge/adult trap will have a foot print of 8' by 12', with a majority of the area above the low water line;
4) even though fish are present at the site, flows in the mainstem Klickitat River at the site are great enough that the shoreline work will not impede upstream and downstream migration, and any sedimentation that may occur will be quickly dispersed;

5) the river is over 100 feet wide at the work site, and thus the location of the site will allow adult and juvenile steelhead to easily avoid the construction activities; and

6) the YN and its contractors will use best management practices and other measures to reduce turbidity and sedimentation caused by the construction activities.

Magnuson-Stevens Fishery Conservation and Management Act – Essential Fish Habitat

Federal agencies are required, under §305(b)(2) of the MSA and its implementing regulations (50 CFR 600 Subpart K), to consult with NMFS regarding actions that are authorized, funded, or undertaken by that agency that may adversely affect EFH. The MSA (§3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." If an action would adversely affect EFH, NMFS is required to provide the Federal action agency with EFH conservation recommendations (MSA §305(b)(4)(A)). This consultation is based, in part, on information provided by the Federal action agency and descriptions of EFH for Pacific salmon contained in Appendix A to Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999) developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce (September 27, 2000).

The proposed action and action area are described above in this concurrence letter. The project area includes habitat which has been designated as EFH for various life stages of chinook (*Oncorhynchus tshawytscha*) and coho (*O. kisutch*).

Because the habitat requirements for the MSA-managed species in the project area are similar to those described for the ESA-listed species, NMFS considers the conservation measures that NMFS included as part of the proposed action to address ESA concerns also adequate to avoid, minimize, or otherwise offset potential adverse effects to designated EFH, and so conservation recommendations pursuant to MSA (§305(b)(4)(A)) are not necessary. Since NMFS is not providing conservation recommendations at this time, no 30-day response from the CRFDP is required (MSA §305(b)(B)).

Conclusion

This concludes informal consultation under the ESA in accordance with 50 CFR 402.14 (b)(1) and EFH consultation under the MSA in accordance with 50 CFR 600.920. NMFS will reinitiate consultation if new information becomes available or circumstances occur that may affect listed species or their critical habitat in a manner or to an extent not previously considered or that affects the basis for NMFS' EFH determination, a new species is listed or critical habitat that may be affected by the action is designated, or the proposed action is modified in a manner that may adversely affect EFH.

cc: F/NWR1 – Richard Turner
F/NWR1 – Robert Bayley
F/NWR1 – Gloria Matthews
F/NWR1 – Misty Schafte (file copy – file code 8.1.6)

References:

Ferguson, G. and B. Sharp. 2003. Wahkiacus Acclimation Facility Engineering Report. Yakama Nation, Yakima Klickitat/Fisheries Project. Toppenish, WA.

PFMC (Pacific Fisheries Management Council). 1999. Appendix A - Identification and description of essential fish habitat, adverse impacts, and recommended conservation measures for salmon. Amendment 14 to the Pacific Coast Salmon Plan. Pacific Fisheries Management Council. Portland, Oregon. 146p.

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WAC (Washington Administrative Code) 197-11-960. 2003. Environmental Checklist. Available from the Yakima Klickitat/Fisheries Project. Toppenish, Washington.

WDFW (Washington Department of Fish and Wildlife). 2003. Fisheries Evaluation and Management Plan for the Mid-Columbia Region. March 7, 2003. Washington Department of Fish and Wildlife, Olympia, Washington.

YN (Yakama Nation). 2003a. Joint Aquatic Resources Permit Application, by Yakama Nation Fisheries Resource Management and Yakima Klickitat Fisheries Project for the construction of the Wahkiacus Acclimation Facility. Attachment to the April 30, 2003 memorandum from R.Z. Smith.

YN (Yakama Nation). 2003b. Hatchery and Genetics Management Plan. Klickitat Reprogrammed Coho Release Plan. April 15, 2003 draft. Yakima Klickitat/Fisheries Project. Toppenish, Washington.

Appendix D. Relationship of Other Projects, Programs, and Legislation to the Klickitat Subbasin Anadromous Fisheries Master Plan

Related Treaties, Laws, Programs, and Plans

The actions described in this master plan are governed by, related to, and/or generally consistent with the following list of treaties, laws, programs, and plans.

Treaty of 1855

In the Treaty of 1855, the Yakama Nation reserved "The exclusive right of taking fish in all the streams where running through or bordering said reservation … and … taking fish at all usual and accustomed places …". No subsequent treaty or agreement between the Yakama Nation and the United States altered or affected this treaty-reserved right.

Mitchell Act (1938)

The Mitchell Act was originally enacted in 1938 to provide for the conservation of the fishery resources of the Columbia River. The Mitchell Act was perceived as an emergency measure to protect the valuable salmon resources of the Columbia River which were threatened by the construction of Bonneville and Grand Coulee dams. Historically, the majority of Mitchell Act-funded production has been coho and tule fall chinook below Bonneville Dam. However, in recent years, Congressional appropriations language has directed that a portion of fish from lower river hatcheries be released upriver to rebuild upriver natural runs.

National Environmental Policy Act (1969)

NEPA requires analysis of the environmental effects of major federal actions or decisions. The decision by a federal agency to fund a major program such as the Klickitat Subbasin Anadromous Fishery program could be considered a major action requiring the preparation of an Environmental Impact Statement, or, if some doubt exists as to the significance of the environmental impacts, an Environmental Assessment.

Endangered Species Act (1973)

The stated purpose of the ESA is to "provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved." The Klickitat basin includes the following ESA-listed species: steelhead (part of the Mid-Columbia ESU listed as Threatened in March of 1999) and bull trout (*Salvelinus confluentus* listed as a Threatened species in June of 1998). This master plan discusses the risks and benefits of proposed conservation and enhancement plans as they relate to these two ESA-listed species.

United States versus Oregon

This landmark treaty fishing rights litigation addresses Columbia Basin salmonid harvest and production activities. Management agreements and plans among the parties to the litigation, which include the Columbia River treaty tribes, the states of Oregon, Washington, and Idaho, and the United States, establish production and harvest levels for a variety of species and have been subject to lengthy negotiations. The last Columbia River Fishery Management Plan (CRFMP) expired in 1998. Renegotiation of this plan is in progress and is scheduled for completion by mid-2004. Jurisdiction over the case resides with the U.S. District Court of Oregon.

Pacific Northwest Power Planning and Conservation Act (1980)

This Act extended the responsibilities of the Bonneville Power Administration (BPA), which was already established to market electrical power from federal dams on the Columbia River system, to include development of energy conservation resources and enhancement of Northwest fish and wildlife that have been affected by construction and operation of the Federal Columbia River Power System (FCRPS). The Act also created the Northwest Power Planning Council (NPPC), made up of representatives from the four Northwest states, with responsibilities to develop a Columbia River Basin Fish and Wildlife Program to implement the fish and wildlife goals of the Act. (The NPPC changed its name to the Northwest Power and Conservation Council (NPCC) in 2003.) BPA has the responsibility to decide whether and to what extent it provides the actual funding for the program (BPA 2001). The activities proposed in this Master Plan would be subject to decisions by NPCC and BPA under this Act.

Pacific Salmon Treaty (1985)

This treaty between the U.S. and Canada governs the joint management of Pacific salmon including harvest, rehabilitation, and enhancement.

Magnuson-Stevens Fisheries Conservation and Management Act

This Act ensures that state fishing regulations off the coasts of Oregon, Washington, and California conform to the federal Fisheries Management Council regulations, which are constrained by the Pacific Salmon Treaty, ESA, and orders of federal courts, such as *U.S. v. Oregon*, *U.S. v. Washington,* and treaty Indian fishing rights. It also establishes Essential Fish Habitat for salmonids.

Subbasin Plans (1990 and 2000)

The NPPC's Columbia River Basin Fish and Wildlife Program called for long-term planning for salmon and steelhead production. In 1987, the Council directed the region's fish and wildlife agencies and Indian tribes to develop a system-wide plan consisting of 31 integrated subbasin plans for major river drainages in the Columbia Basin. The main goal of this planning process was to develop options or strategies for doubling salmon and steelhead production in the Columbia River. The strategies in the subbasin plans were to follow seven policies listed in the Council's Columbia River Basin Fish and Wildlife Program, as well as several guidelines or policies developed by the basin's fisheries agencies and tribes.

The Klickitat Subbasin Plan was one of the 31 subbasin plans that comprise the system planning effort (Yakama Nation 1990). All 31 subbasin plans were developed under the auspices of the Columbia Basin Fish and Wildlife Authority (CBFWA), with formal public input and involvement from technical groups representative of the various management entities in each subbasin. The basin's agencies and tribes used these subbasin plans to develop the Integrated System Plan, submitted to the Power Planning Council in late 1990. The System Plan guided the adoption of future salmon and steelhead enhancement projects under the NPPC's Columbia Basin Fish and Wildlife Program.

In addition to providing the basis for salmon and steelhead production strategies in the System Plan, the subbasin plans attempted to document current and potential production. The plans also summarized the agencies' and tribes' management goals and objectives, documented current management efforts, identified problems and opportunities associated with increasing salmon and steelhead numbers and presented preferred and alternative management strategies.

A draft Klickitat Subbasin Summary was prepared for the NPPC in August of 2000 as part of the current Columbia basin-wide effort to develop updated, formal subbasin plans under the

Provincial Review process (Sharp 2000). A summary of its goals and objectives is provided in Appendix E.

Wy-Kan-Ush-Mi Wa-Kish-Wit: *Spirit of the Salmon* Tribal Restoration Plan (1995 and 2000 update)

This plan was developed by the four Columbia River Treaty Tribes to restore fish runs using gravel-to-gravel management (emphasizing restoration of naturally reproducing populations). In early 2000 the YN updated the TRP as part of recommended actions to the NPPC Fish and Wildlife Program for the Phase I Amendment Process. Recommendations for fish and wildlife resources in the Klickitat basin were submitted as one of nine subbasin plans within the YN "ceded area" (CRITFC 2000).

Scientific Review Team Review of Artificial Production (Brannon et al. 1999)

This independent scientific review of the Columbia Basin artificial production program analyzed its effectiveness in meeting mitigation responsibilities and enhancing salmonid production, and evaluated supplementation of natural runs. It describes guidelines that provide the biological basis for NPPC policy on artificial production.

Artificial Production Review (NPPC 1999)

This NPPC report to Congress on the use of artificial production in the Columbia Basin includes recommendations for policy reform and strategies for implementing new policies.

NMFS Hatchery and Genetics Management Plan

The National Marine Fisheries Service (NMFS) developed a template for describing in detail anadromous salmonid hatchery programs in Washington, Oregon, and Idaho. The template, called a Hatchery and Genetics Management Plan, is used to assess artificial production impacts on listed anadromous fish and to provide a source of comprehensive information for regional production and management planning (http://www.nwr.noaa.gov/1hgmp/hgmptmpl.htm). At the time of the writing of this Master Plan, Hatchery and Genetics Management Plans (HGMPs) were being finalized though a collaborative effort with basin managers and NOAA Fisheries. Current versions are available on line at www.apre.info.

Related Projects in the Klickitat Subbasin

Program/Plan and Number	Manager	Description and Relationship to Master Plan
BPA 1995-068-00 Preliminary Design for Passage and Habitat Improvement	YN	This project was initiated in August 1995 as an integrated watershed analysis to identify specific passage and habitat improvement needs. Baseline information was also collected to guide development of production and research objectives. This project, which produced engineering designs for Lyle Falls Facility and Castile Falls Fishway Improvements, was completed in March of 2003. It is anticipated that the production actions described in this Master Plan will eventually work in concert with these habitat and passage improvements for improving fish production.
BPA 1995-063-35 Yakima/Klickitat Project M&E	YN	The near-term goal of the Klickitat Project is to collect baseline data on existing habitat conditions, fish populations, and existing passage conditions throughout the Klickitat basin. This database will provide necessary information for Ecosystem Diagnosis and Treatment (EDT) analysis. Mainstem and tributary passage improvements will be identified and prioritized. Long-term goals of the project are to implement habitat restoration, supplementation projects, and passage improvements in the basin, as identified through the EDT process for each diagnostic species. Associated with these projects will be ongoing monitoring and evaluation (M&E) of the implemented projects and the continued refinement of the EDT model. The EDT model itself is an important component of the M&E process and will be used to guide future Klickitat Hatchery operations through the transition from WDFW to YN/YKFP operation.
BPA 1997-056-00 Klickitat Watershed Enhancement Project	YN	This project focuses on the Klickitat River and its tributaries that provide or affect salmonid habitat. The project emphasizes restoration and protection of watersheds supporting anadromous fish production, particularly steelhead (*Oncorhyncus mykiss*) which are listed as Threatened within the Mid-Columbia ESU. Restoration activities will be aimed at restoring stream processes by removing or mitigating watershed disturbances and improving habitat conditions and water quality. In addition to steelhead, habitat improvements will benefit chinook (*O. tshawytscha*) and coho (*O. kisutch*) salmon, resident rainbow trout, and enhance habitat for many terrestrial and amphibian wildlife species. Protection activities will complement restoration efforts within the subbasin by securing refugia and preventing degradation. The project addresses goals and objectives presented in the Klickitat Subbasin Summary and the 1994 NPPC Fish and Wildlife Program.

BPA Klickitat Management	YN	The Klickitat basin component of the YKFP, as referenced in the Columbia River Basin Fish and Wildlife Program (CRBFWP), is responding to the need for scientific knowledge of viable means to rebuild and maintain naturally spawning anadromous fish stocks. The Project's spring chinook, steelhead, coho and fall chinook programs fall within the three-step approval process established by the NPCC for production programs. All programs are currently at step one in that process. Project research is expected to lead to specific supplementation strategies for spring chinook and steelhead, including recommendations for new production and acclimation facilities, and refinement of release numbers for coho and fall chinook. In the Klickitat basin, the YKFP proposes to use supplementation to increase populations of spring chinook and steelhead. The coho and fall chinook production programs will continue to import hatchery eggs (fall chinook) and hatchery pre-smolts (coho) for rearing and release from acclimation ponds in the basin.
BPA 1999-024-00 Bull Trout Assessments in the Columbia River Gorge	WDFW	The goals of this cooperative project between the Yakama Nation (YN) and Washington Department of Fish and Wildlife (WDFW) are to initiate studies to determine the relative abundance of bull trout in Bonneville Reservoir, determine whether they originate in Hood River, Klickitat River, or somewhere else, and investigate their life history. Bull trout are an ESA-listed species, which could be affected by actions described in this master plan.
NOAA Fisheries Mitchell Act Flood Repair Fund	YN	This project uses Mitchell Act funds made available for major maintenance activities to repair 1996 flood damage to Mitchell Act facilities (Castile Falls and Champion Pond Acclimation Site). Project funds will be used to reconstruct two tunnel fishways at Castile Falls, and to construct a new acclimation pond in the lower Klickitat subbasin. The work will enhance YKFP in-basin supplementation and habitat restoration efforts currently underway.
Washington State Salmon Recovery Funding Board (SRFB) projects	YN WDFW others	The Salmon Recovery Funding Board was established by the Washington Legislature through the Salmon Recovery Planning Act (Engrossed Substitute House Bill 2496). The role of the Governor's Salmon Recovery Office is to coordinate and produce a statewide salmon strategy; assist in the development of regional salmon recovery plans; secure current and future funding for local, regional, and state recovery efforts; and provide the Biennial State of Salmon report to the Legislature. Several SRFB projects have been completed and are ongoing in the Klickitat basin. See Chapter 9 of the master plan.
Pacific Coastal Salmon Recovery (PCSRF) projects	YN	The Pacific Coastal Salmon Recovery Fund (PCSRF) was established by Congress in FY 2000 to provide grants to the state and tribes to assist state, local and tribal salmon conservation and recovery efforts. To date the PCSRF funds have been used to purchase the Wahkiacus acclimation property, conduct geotechnical safety inspection of Castile Falls, design and fabricate safety walkway to Castile 4/5 tunnel, and purchase rearing troughs for steelhead at Klickitat Hatchery.

Appendix E. Klickitat Subbasin Summary: Goals, Objectives and Strategies

Klickitat Subbasin Summary: Goals, Objectives and Strategies

The following goals, objectives, and strategies for the Klickitat basin are summarized from the Klickitat Subbasin Summary (Sharp 2000). The goals, objectives, and strategies in the master plan build on those in the Subbasin Summary.

Overall Subbasin Goal: Protect, Restore and Enhance Fish and Wildlife Species and habitats.

A. Goal: Increase information base necessary to manage fish, wildlife and habitats.

Objectives

1. Compile and analyze existing data on species distribution and habitat requirements, and identify critical habitat areas.
2. Complete inventory of fish and wildlife habitat baseline (basin-wide).
3. Assess population status, habitat relationships and geographic distribution of species about which little is known.
4. Develop management alternatives based on initial assessments.
5. Implement management alternatives and monitor fish and wildlife populations and responses to management actions.
6. Adjust management actions according to monitoring and evaluations results.

B. Goal: Ensure the exercise of tribal fishing rights and non-tribal fishing opportunities.

Objectives

1. Establish upward trends in naturally sustaining fish populations.
2. Restore abundance and distribution of fish and other aquatic species across their native ranges.
3. Maintain and enhance the existing terminal fishery for coho and fall chinook.
4. Conserve genetic diversity and allow natural patterns of genetic change to persist.
5. Coordinate fisheries management plans with all other applicable basin-wide management plans.
6. Establish a comprehensive harvest monitoring plan.
7. Increase natural production by improving passage to the upper basin and tributaries.

Strategies

1. Institute a supplementation-based production program for spring chinook and steelhead that includes retrofitting the existing Klickitat Hatchery.
2. Provide harvest opportunities for tribal and non-tribal fishers.

C. Goal: Restore watershed function, water quality and habitats.

Objectives

1. Identify proper functioning conditions for fish and wildlife habitats.
2. Prioritize habitats for protection and restoration for salmonids and other aquatic species.
3. Prioritize habitats for protection and restoration for wildlife species.
4. Prioritize areas for protection and restoration of cultural resources.
5. Permanently protect and maintain priority natural and cultural resources.
6. Improve water quality and quantity in prioritized reaches to comply with regulatory standards.
7. Monitor restoration and protection activities and evaluate effectiveness to guide adaptive management.

Strategies

1. Conduct basin-wide assessment, prioritization, restoration, and protection of fish and wildlife habitat conditions that includes identification and mitigation of in-channel, riparian, and upland source areas for limiting habitat conditions. Restore a proper functioning condition for all biotic and abiotic ecological parameters in the Klickitat subbasin.[9]
2. Reduce and prevent future anthropogenic impacts from riparian and wetland development, roads, abandoned railroads, agriculture, and forestry.

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[9] Properly functioning condition implies the sustained presence of habitat forming and maintaining processes in a watershed (e.g., normative patterns of riparian succession, bedload transport, channel migration and runoff) such that the long-term survival of the species is ensured over the entire range of natural variation.

Appendix F. Upper Klickitat Acclimation Facility Options

INTRODUCTION

The Klickitat Master Plan calls for acclimating 200,000 summer steelhead and 200,000 spring chinook in the upper basin. Different acclimation methods and sites were evaluated prior to choosing a preferred program design.

Table F-1 summarizes the basic site requirements for this acclimation program. Locations that met biological criteria and that have the flows and space shown in the table were identified.

Table F-1. Acclimation site rearing specifications

	Number of Fish	Fish Size (#/lb)	Total Weight (lbs)	Water Needed (gpm)	Water Needed (cfs)	Space Needed (cft)	Area 4' Depth (sft)	Area 4' Depth (acres)	Pond Width (ft)	Pond Length (ft)	Vol Density (lbs/cft)	Flow Density (lbs/gpm)
SPRING CHINOOK												
	200,000	15	13,333	2,222	4.9	66,667	16,667	0.38	75	224	0.20	6.00
STEELHEAD												
	200,000	8	25,000	3,125	6.9	62,500	15,625	0.36	72	217	0.40	8.00
TOTAL SITE REQUIREMENTS												
	400,000		38,333	5,347	11.9	129,167	32,292	0.74				

Note: The values calculated are minimums for remote sites; more space and more water flow provide a safety factor in case water supplies are interrupted.

ACCLIMATION SYSTEM OPTIONS

1. EXISTING PONDS

Ponds that are fed by streams are priority acclimation sites. Water supply security is high (no pumps or intakes), environmental disturbance is minimal, natural rearing conditions are mimicked, and few permits are required. A temporary net is placed across the discharge to hold fish captive during acclimation, and is removed after release. See Figure F-1 for an example of such a site. A disadvantage is that local fish movements are blocked during the acclimation season.

2. CONSTRUCTED PONDS IN STEAM CHANNEL

Ponds constructed in existing stream channels would have high water supply security. These have the same advantages as the existing pond option, #1 above. Environmental disturbance and permits would be more significant issues (Figure F-2), although in the long term, the ponds could be considered a positive habitat feature. Ponds in the stream channel would be subject to periodic early release of fish during floods and periodic damage in the form of silt and rock accumulation.

3. CONSTRUCTED PONDS ADJACENT TO STREAM CHANNEL

Ponds excavated near stream channels would be supplied by water from a constructed, gravity-flow intake. See Figure F-3.

4. PORTABLE, CONSTRUCTED REARING UNITS

Ponds can be constructed using portable steel walls. The new Prosser raceways use this construction style. These walls could be assembled on a flat piece of ground to form large ponds. Water would need to be lifted about 4 feet above ground level.

5. TRUCK MOUNTED, PORTABLE REARING UNITS

A 40 foot-long, flatbed truck trailer with sides built to hold water would have a volume of 960 cubic feet with 4-foot water depth. This would hold 1,700 steelhead smolts at a 0.3 lbs/cubic foot density; multiple units would be used at each site. Water would need to be lifted about 8 feet above ground level. An advantage of this configuration is that units would be easily movable from site to site.

6. CONSTRUCTED CONCRETE RACEWAYS

Sites with concrete raceways and pumped water supplies could be built that are similar to those used by the YKFP for spring chinook supplementation (Figure F-4). A primary advantage of this type of facility is the large number of rearing units, allowing the replication of research groups.

7. NET ENCLOSURES

In stream areas where flows are moderate in large sections, a net enclosure could be used. It would have all 4 sides and the bottom covered with net material and predator netting over the top. Floats and shore cables would hold the net up and lead weights would retain its shape. See Figure F-5. This system would allow free upstream and downstream fish passage, should be very low cost, and would be environmentally benign. Disadvantages include potential damage from high flows and floating debris, along with not allowing for effluent treatment.

8. STREAM PLANTS WITH SHORT-TERM ACCLIMATION

Direct truck plants of fry, smolts, or adults in slack water areas of the mainstem Klickitat are an option. Fish movement out of the areas can be somewhat delayed with barrier nets, and fish would be fed while they remain confined. High flows and nets that do not function well would allow fish to exit the sites fairly rapidly. Acclimation periods would be short—for many fish only a day or two. The comparison of this technique with full-term acclimation and direct stream plants has not been done.

Figure F-1. Existing Natural Acclimation Pond – Butcher Creek, Wenatchee Basin

Figure F-2. Constructed Pond in Stream Channel - Mahar Acclimation Pond near Nason Creek, Wenatchee Basin

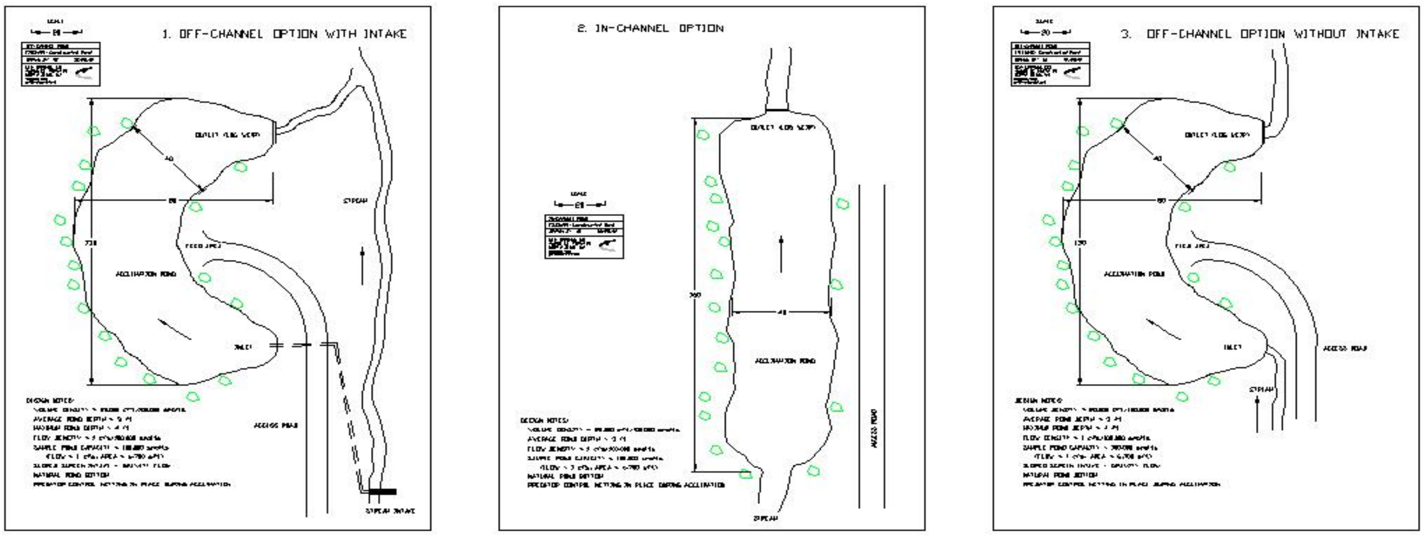


Figure F-3. Constructed Acclimation Pond Options

Figure F-4. Constructed Concrete Raceways - Easton Spring Chinook Acclimation Pond, YKFP

Figure F-5. Net Enclosure - Sharp's Pond, Klickitat River, YKFP

Table F-2 summarizes the critical features of the different types of acclimation methods that were evaluated.

Table F-2. Summary of features of acclimation site options

	PUMPS AND GENERATORS	*PORTABILITY*	*WATER INTAKE*	*WATER RIGHTS*	*EXCAV. PERMITS*	*HPA*	*RESEARCH UNITS*	*COST*
EXISTING POND								
	NO	NO	NO	NO	NO	NO	NO	LOW
CONSTRUCTED PONDS IN STEAM CHANNEL								
	NO	NO	NO	NO	YES	YES	NO	LOW
NET ENCLOSURES								
	NO	YES	NO	NO	NO	NO	NO	LOW
CONSTRUCTED PONDS ADJACENT TO STREAM CHANNEL								
	NO	NO	YES	YES	YES	YES	NO	MOD.
PORTABLE, CONSTRUCTED REARING UNITS								
	YES	YES	YES	YES	YES	YES	YES	MOD.
TRUCK MOUNTED, PORTABLE REARING UNITS								
	YES	YES	YES	YES	YES	YES	YES	HIGH
CONSTRUCTED CONCRETE RACEWAYS								
	YES	NO	YES	YES	YES	YES	YES	HIGH
STREAM PLANTS WITH SHORT TERM ACCLIMATION								
	NO	YES	NO	NO	NO	NO	NO	LOW

DISCUSSION

Steelhead and chinook are acclimated and released at approximately the same time (Figure F-6). Acclimating both species in the same rearing unit may cause interaction problems between the 8/lb steelhead and 15/lb chinook (impacting feeding behavior, for example), and disease issues need to be evaluated. A preferred method is to construct separate rearing units for each species.

Figure F-6. Release Timing for Spring Chinook (CHS) and Steelhead (SHS)

FEBRUARY				MARCH				APRIL				MAY				JUNE			
1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
						CHS													
						SHS													

Notes:

CHS are now released from the hatchery at the end of March to make room for fall chinook (later releases would be preferred if the option were available).

Skamania summer steelhead are now planted in the Klickitat "on or after April 15".

Pumped water sites will require a primary generator, a back-up, and an automatic transfer switch. They should be manned full time, either on-site, or within a 30-minute travel time. Gravity-flow supplies are generally preferred, although they withdraw stream water for longer distances and are not possible at low-head sites.

Gravity-flow water intakes will be subject to failure, mainly during high flow events. If not properly anchored, they can move in the stream. A more likely failure mode is having the intake screens plug due to moving bed loads and woody debris. This would be common during high flow events in the spring with snow loaded watersheds like the Klickitat.

Natural rearing conditions such as low fish densities, cover, fluctuating water temperatures, and some predation may improve adult survivals. Either constructing or using existing natural features is possible.

Data from the Cle Elum spring chinook supplementation experiment has shown spring chinook adults disperse widely around the acclimation sites. As a result, one site is adequate for spring chinook acclimation and it could be located almost anywhere upstream of Castille Falls. There is less certainty about the number and location of summer steelhead sites, although because steelhead also enter streams well ahead of spawning, it is believed that they may also have time to search out appropriate habitat.

PREFERRED ALTERNATIVE

The option that best meets the criteria for acclimation in the upper Klickitat is the use of existing ponds. However, such sites with road access in appropriate areas have not been found. After evaluating the other acclimation options, pond construction was chosen as the preferred alternative. The selected site will have a gravity flow water supply, separate ponds for chinook and steelhead, and will feature low density rearing.

Several locations considered are shown in Figure F-7.

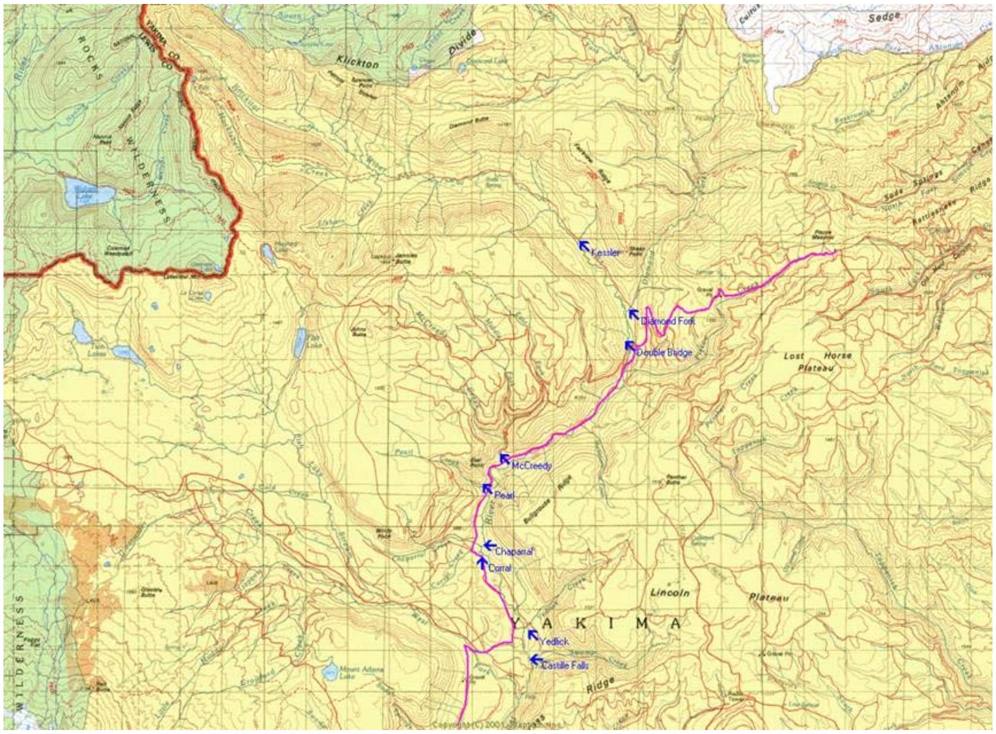
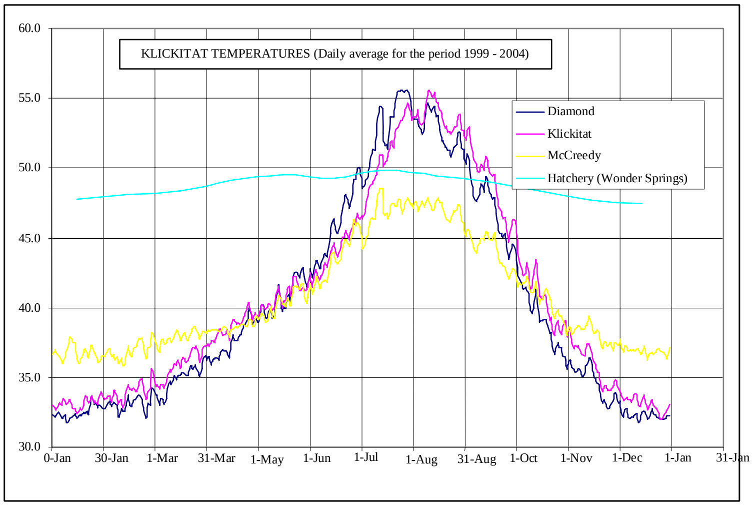


Figure F-7. Acclimation Site Alternatives

These locations were studied for their location, biological suitability, environmental impacts, water flow and temperature (see Figure F-8), access, and constructability. McCreedy, with an excellent water supply and good road access, was chosen as the site that will best meet program goals. The water temperature profile indicates a large spring water influence in the creek, reducing winter icing problems and providing a relatively stable flow quantity.

Figure F-8 Site Water Temperatures



A conceptual design of the McCreedy Creek Acclimation Sites is shown in Figure F-9.

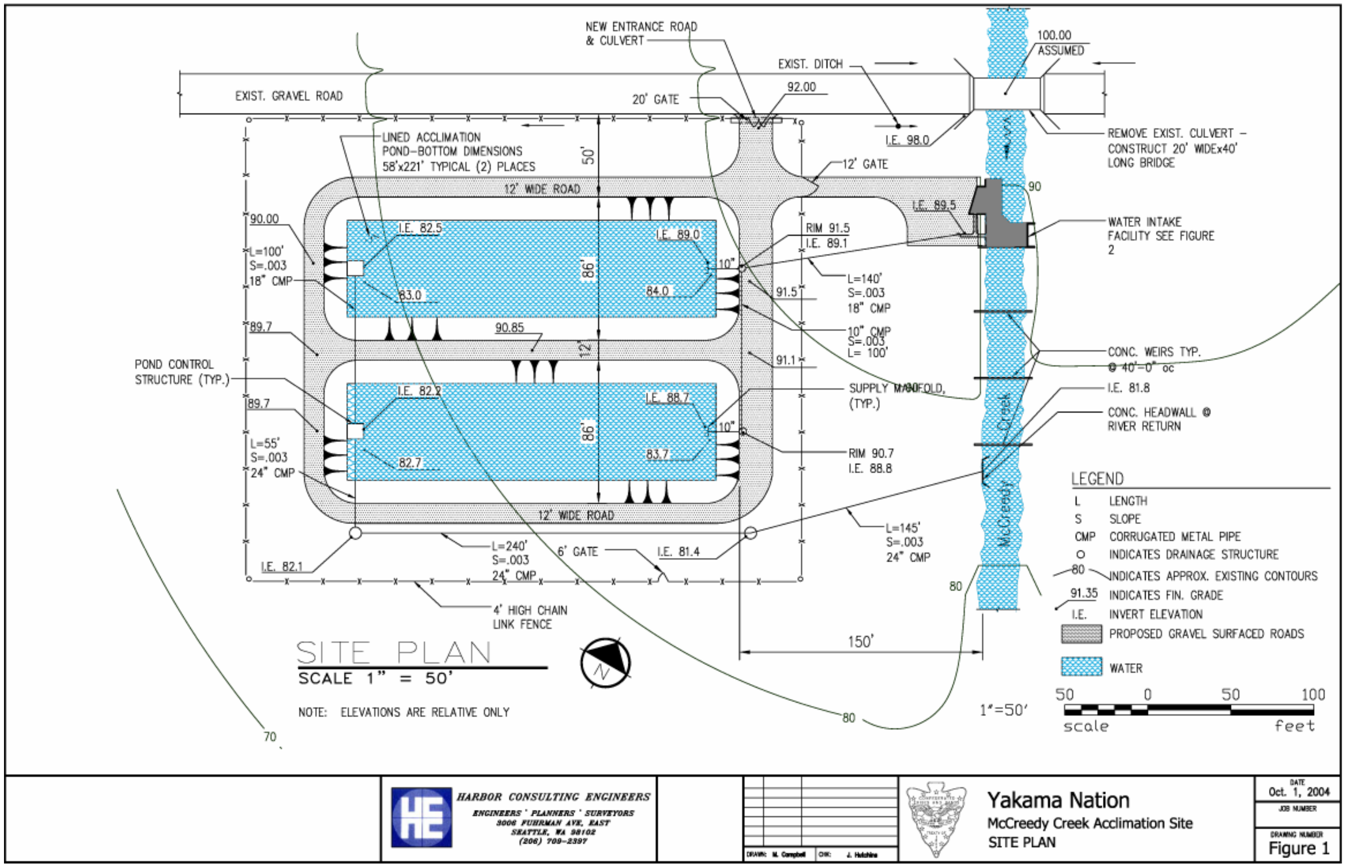


Figure F-9. McCreedy Site Plan

Appendix G. Summary of Data Collection and Reporting Strategies

Table G-1. Data to be collected and reported for monitoring and evaluation purposes.

Data/Statistic to collect and report	Hatchery Spring Chinook	Supplementation Line Spring Chinook	Summer Steelhead	Fall Chinook	Coho
Hatchery Produced					
Number of natural brood fish collected by sex and age	Not applicable. Will use hatchery origin fish for this line.	Yes, these data will be recorded.	Yes, these data will be recorded.	Not applicable. Fish will be transferred as eyed eggs from Priest Rapids Hatchery and will likely be 100% hatchery origin. See HGMP.	Not applicable. Fish will be transferred as pre-smolts from Washougal Hatchery and will likely be 100% hatchery origin.
Number of hatchery brood fish collected by sex and age	Yes, these data will be recorded.	Not applicable. Will use natural origin fish for this line.	Not applicable. Will use natural origin fish.	Not applicable – see text.	Not applicable – see text.
Number of natural brood fish spawned by sex and age	Not applicable. Will use hatchery origin fish for this line.	Yes, these data will be recorded.	Yes, these data will be recorded.	Not applicable – see text.	Not applicable – see text.

Data/Statistic to collect and report	Hatchery Spring Chinook	Supplementation Line Spring Chinook	Summer Steelhead	Fall Chinook	Coho
Number of hatchery brood fish spawned by sex and age	Yes, these data will be recorded.	Not applicable. Will use natural origin fish for this line.	Not applicable. Will use natural origin fish.	Not applicable – see text.	Not applicable – see text.
Pre-spawning survival	Yes, these data will be recorded.	Yes, these data will be recorded.	Yes, these data will be recorded.	Not applicable – see text.	Not applicable – see text.
Egg-to-release survival	Yes, these data will be recorded.	Yes, these data will be recorded.	Yes, these data will be recorded.	Yes, these data will be recorded.	Not applicable – see text.

Data/Statistic to collect and report	Hatchery Spring Chinook	Supplementation Line Spring Chinook	Summer Steelhead	Fall Chinook	Coho
Smolt-to-adult return survival (SAR)	Smolt survival in-river will be estimated using screw traps. The adult trap at Lyle Falls will allow estimation of NOR and HOR adult returns.	Smolt survival in-river will be estimated using screw traps. The adult traps at Lyle and Castile Falls will allow estimation of NOR and HOR adult returns.	Smolt survival in-river will be estimated using screw traps. The adult trap at Lyle Falls will allow estimation of NOR and HOR adult returns.	Smolt survival in-river will be estimated using screw traps. The adult trap at Lyle Falls will allow estimation of NOR and HOR adult returns provided that funds are made available to 100% mark 4.0 million release.	Smolt survival estimates from release to Bonneville Dam will be derived from PIT tag data. Smolt survival in-river will be estimated using screw traps. Adult survival to Bonneville Dam can be estimated from PIT tag data. The adult trap at Lyle Falls will allow estimation of NOR and HOR adult returns.

Data/Statistic to collect and report	Hatchery Spring Chinook	Supplementation Line Spring Chinook	Summer Steelhead	Fall Chinook	Coho
Adult recruit per spawner ratio	Can be estimated from spawner survey data, hatchery records, harvest data, and Lyle trap counts.	Can be estimated from spawner survey data, hatchery records, harvest data, and Lyle trap counts and Castile Falls video monitoring.	Can be estimated from spawner survey data, hatchery records, harvest data, and Lyle trap counts and Castile Falls video monitoring.	Can be estimated from spawner survey data, hatchery records, harvest data, and Lyle trap counts.	Not applicable since fish released as smolts.

Naturally Produced					
Number of natural origin adults in the spawning escapement by sex and age	Data will be obtained from escapement estimates and supplementation line brood stock collections.		Data will be obtained from escapement estimates and natural origin brood stock collections.	Lyle trap, harvest, and spawning ground survey samples.	Lyle trap, harvest, and spawning ground survey samples.
Pre-spawning survival	Can be calculated from Lyle trap estimate, harvest above Lyle, hatchery returns, and spawning ground escapement estimate.	Can be calculated from Lyle trap and Castile Falls estimates, harvest above Lyle, and spawning ground escapement estimate.	Can be calculated from Lyle trap and Castile Falls estimates, harvest above Lyle, and spawning ground escapement estimate.	Can be calculated from Lyle trap estimate, harvest above Lyle, and spawning ground escapement estimate.	Can be calculated from Lyle trap estimate, harvest above Lyle, and spawning ground escapement estimate.
Smolt population estimate	Screw traps	Screw traps	Screw traps	Screw traps	Screw traps
Natural egg-to-smolt survival	Egg counts can be derived from redd count estimate using an estimate of fecundity from hatchery records. Smolt estimates from screw traps.	Egg counts can be derived from redd count estimate using an estimate of fecundity from hatchery records. Smolt estimates from screw traps.	Egg counts can be derived from redd count estimate using an estimate of fecundity from hatchery records. Smolt estimates from screw traps.	Egg counts can be derived from redd count estimate using an estimate of fecundity from Washougal records. Smolt estimates from screw traps.	Egg counts can be derived from redd count estimate using an estimate of fecundity from Washougal records. Smolt estimates from screw traps.

Smolt to adult return survival (SAR)	Smolt estimates from screw traps and adult estimates from Lyle trap.	Smolt estimates from screw traps and adult estimates from Lyle trap.	Smolt estimates from screw traps and adult estimates from Lyle trap.	Smolt estimates from screw traps and adult estimates from Lyle trap.	Smolt estimates from screw traps and adult estimates from Lyle trap.
Adult recruit per spawner ratio	Brood (cohort) tables will be constructed and updated annually using above data.	Brood (cohort) tables will be constructed and updated annually using above data.	Brood (cohort) tables will be constructed and updated annually using above data.	Brood (cohort) tables will be constructed and updated annually using above data.	Brood (cohort) tables will be constructed and updated annually using above data.
Marking strategies	HxH crosses (~600K) release will be 100% diagnostically marked.	100% of release will have a blank CWT inserted into the snout.	Skamania stock releases will be discontinued. 200,000 release will be 100% diagnostically marked.	**If funds available these may be 100% adipose fin-clipped.**	**If funds available these may 100% adipose fin-clipped.** Approximately 10,000 fish will be PIT tagged for acclimation evaluation.

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Year	Run[1]	Harvest[2] Sport	Harvest[2] Tribal	Escape[3]	Redds[4]
1986-87	9,834	1,480	6,008	2,346	
1987-88	3,751	1,514	1,342	895	
1988-89	4,208	1,718	1,486	1,004	
1989-90	1,702	833	631	238	95
1990-91	2,957	1,055	1,722	180	72
1991-92	3,595	831	1,906	858	
1992-93	3,251	1,260	1,215	776	
1993-94	3,402	1,236	1,354	812	
1994-95	1,915	891	567	457	
1995-96	1,714	873	418	423	169
1996-97	1,081	621	284	176	71
1997-98	2,140	1,080	490	570	228
1998-99	1,437	662	179	596	239
1999-00	1,728	603	217	908	363
2000-01	2,845	1,489	559	797	319
2001-02	5,186	3,713	712	761	304
2002-03[5]			1,014	725	290
Avg:[6]	2,727	1,225	872	630	207

Year	Run[1]	Harvest[2] Sport	Harvest[2] Tribal	Escape[3]	Redds
1986-87	8,598	1,480	6,008	1,110	
1987-88	3,279	1,514	1,342	423	
1988-89	3,679	1,718	1,486	475	
1989-90	1,68	833	631	217	

	1				
1990-91	2,905	1,055	1,722	128	51
1991-92	2,847	831	1,906	110	44
1992-93	2,842	1,260	1,215	367	
1993-94	2,974	1,236	1,354	384	
1994-95	1,674	891	567	216	
1995-96	1,482	873	418	191	
1996-97	1,075	621	284	170	68
1997-98	1,630	1,080	490	60	24
1998-99	1,114	662	179	273	109
1999-00	1,06	603	217	243	97

	2				
2000-01	2,545	1,489[4]	559	498	199
2001-02	4,833	3,713[4]	712	408	163
2002-03			1,014	653	261
Avg:[5]	2,375	1,225	872	277	94

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Table 6. Transition plan summary for production of target species at the Klickitat Hatchery

Klickitat Hatchery Production	**Current to 2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Coho	1,000,000	0	0	0	0	0
Spring chinook	600,000	1,450,000	1,450,000	1,450,000	1,450,000	1,450,000
Steelhead	200,000[1]	200,000	200,000	200,000	200,000	200,000
Fall chinook	4,000,000	4,000,000	2,000,000	2,000,000	2,000,000	2,000,000

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Table 9. Klickitat Hatchery spring chinook smolt release plan

Klickitat Watershed Releases	**Current to 2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Klickitat hatchery production	800,000	1.45 mill.	1.45 mill.	1.45 mill.	1.45 mill.	1.45 mill.
On-station releases	600,000	600,000	600,000	600,000	600,000	600,000
Upper basin acclimation	200,000	850,000	850,000	850,000	850,000	850,000

site releases	fry[1]					
Size[2]	10-15 fpp	10-15 fpp	To be determined			
Pounds	64,000	116,000	116,000	116,000	116,000	96,700

[1] The existing program (proposed through 2005) calls for 200,000 fry to be released directly into the river above Castile Falls in May.

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	Estimate in year 2000 $	2004 $
New river pipeline - replacement of main water supply line*	$730,000	$821,621
Hatchery chiller		$130,000
Improve the P25 inlet screen		$200,000
Adult holding pond - new hatchery ladder and larger, 2 cell holding pond*	$ 520,000	$585,265
Improve the P25 settling pond		$100,000
New Houses - 2 new employee houses*	$135,000	$151,944
Wonder Springs Intertie - new pipeline connecting Wonder Springs to the hatchery		$200,000
Spring water intake improvements		$165,000
TOTAL		

* Estimates from CH2MHill, 8/14/2000
2000 to 2004 average yearly inflation rate used = 3%
Administrative, Planning, and Contingency (APC) at 20%
Permitting at 10% of project cost

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	MEASURE COST	CUMULATIVE TOTAL
KLICKITAT HATCHERY IMPROVEMENTS A. (new pipeline, chiller, P25 intake improvement) Replacement of the 50+ year old pipeline delivering water to the Klickitat hatchery is high priority. It is the only water source for the hatchery incubators and raceways and failure would eliminate 2 year classes of production. The chiller is important to objectives of producing a more "natural" spring chinook smolt and is a low cost measure. The current P25 intake violates NMFS screening criteria.	$1,484,000	$1,484,000
LYLE FALLS LADDER AND TRAP CONSTRUCTION The capture of local broodstock is required for the supplementation of spring chinook and steelhead.	$2,760,000	$4,244,000
UPSTREAM ACCLIMATION SITES A. (2 of 3 constructed) The acclimation and release of spring chinook and steelhead upstream of Castile Falls will encourage the use of this habitat by naturally reproducing populations.	$ 496,700	$4,740,700

WAHKIACUS HATCHERY & ACCLIMATION FACILITY A. (fewer ponds constructed, no groundwater, no adult trap) Plans for the increased production of spring chinook and the addition of winter and summer steelhead to the Klickitat hatchery depend on having the water and space used by coho and fall chinook made available. Production of half the fall chinook and acclimation of coho at the WHAF makes these changes possible while meeting watershed harvest objectives.	$1,450,000	$6,190,700
KLICKITAT HATCHERY IMPROVEMENTS B. (adult pond, P25 improvement, new houses, Wonder Springs intertie, spring water intake improvement) A larger adult pond allows all the spring chinook required of the program to be held and spawned. The other improvements allow the hatchery to function as a reliable facility in future years.	$1,531,000	$7,721,700
UPSTREAM ACCLIMATION SITES B. (1 of 3 constructed) Construction of the third acclimation site more fully distributes fish into the upstream habitat.	$ 248,300	$7,970,000
WAHKIACUS HATCHERY & ACCLIMATION FACILITY B. (more ponds, groundwater, adult trap) Additional rearing space improves coho adult survival rates. Groundwater adds to facility security and the adult trap allows the capture of returning adults.	$374,000	**$8,344,000**