ESA Recovery Plan
for the White Salmon River Population
of Middle Columbia River Steelhead

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Prepared by
National Marine Fisheries Service
Northwest Region

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Acronyms and Abbreviations

A/P	abundance/productivity
BACI	Before-After-Control-Impact
BIA	Bureau of Indian Affairs
BPA	Bonneville Power Administration
BRT	Biological Review Team
CAO	Critical Areas Ordinance
CBFWA	Columbia Basin Fish and Wildlife Authority
CEO	County Environmental Ordinance
COE	Corps of Engineers
CRITFC	Columbia River Inter-Tribal Fish Commission
cfs	cubic feet per second
CSMEP	Collaborative Systemwide Monitoring and Evaluation Project
CUP	Conditional Use Permits
CZO	County Zoning Ordinance
DPS	Distinct Population Segment
Ecology	Washington State Department of Ecology
EDT	Ecosystem Diagnosis and Treatment
ESA	Endangered Species Act
ESHB	Engrossed Substitute House Bill
ESU	Evolutionarily Significant Unit
FERC	Federal Energy Regulatory Commission
FMEP	Fisheries Management and Evaluation Plan
FMP	Forest Management Plan
FPO	Floodplain Management Ordinance
FY	fiscal year
HGMP	Hatchery and Genetic Management Plans
ICTRT	Interior Columbia Technical Recovery Team
JOM	juvenile out-migrant
Km	kilometer
LCFRB	Lower Columbia Fish Recovery Board
LSRCP	Lower Snake River Compensation Plan
LUMA	Land Use Management Area
LWS	Little White Salmon
MaSA	major spawning area
MEA	Management Emphasis Area
MiSA	minor spawning area
MPG	major population group
n/a	not applicable
NFH	National Fish Hatchery
NMFS	National Marine Fisheries Service
NPCC	Northwest Power and Conservation Council
NPPC	Northwest Power Planning Council
PCSRF	Pacific Coastal Salmon Recovery Fund

PNAMP	Pacific Northwest Aquatic Monitoring Partnership
PSMFC	Pacific States Marine Fisheries Commission
RCW	Revised Code of Washington
RER	Rebuilding Exploitation Rates
RKM	River kilometer
RM	River mile
RM&E	research, monitoring and evaluation
S/D	spatial structure/diversity
SDP	Substantial Development Permits
SEPA	State Environmental Policy Act
SMP	Shorelines Master Plan
SR	State route
SRFB	Salmon Recovery Funding Board
TRT	Technical Recovery Team
URB	upriver bright
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geographic Service
VARs	Variances
VSP	Viable Salmonid Population
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington Department of Natural Resources
WRIA	Water Resource Inventory Area
W/LC TRT	Willamette/Lower Columbia Technical Recovery Team
WSTRT	White Salmon Technical Review Team
YN	Yakama Nation

Recovery Planning Glossary

abundance: In the context of salmon recovery, unless otherwise qualified, abundance refers to the number of adult fish returning to spawn.

adaptive management: Adaptive management in salmon recovery planning is a method of decision making in the face of uncertainty. A plan for monitoring, evaluation, and feedback is incorporated into an overall implementation plan so that the results of actions can become feedback on design and implementation of future actions.

anadromous fish: Species that are hatched in freshwater, migrate to and mature in salt water, and return to freshwater to spawn.

baseline monitoring: In the context of recovery planning, baseline monitoring is done before implementation, in order to establish historical and/or current conditions against which progress (or lack of progress) can be measured.

broad-sense recovery goals: **G**oals defined in the recovery planning process, generally by local recovery planning groups, that go beyond the requirements for delisting, to address, for example, other legislative mandates or social, economic, and ecological values.

compliance monitoring: Monitoring to determine whether a specific performance standard, environmental standard, regulation, or law is met.

delisting criteria: Criteria incorporated into ESA recovery plans that define both biological viability (biological criteria) and alleviation of the causes for decline (threats criteria based on the five listing factors in ESA section 4[a][1]), and that, when met, would result in a determination that a species is no longer threatened or endangered and can be proposed for removal from the Federal list of threatened and endangered species. These criteria are a NMFS determination and may include both technical and policy considerations.

distinct population segment (DPS): A listable entity under the ESA that meets tests of discreteness and significance according to USFWS and NMFS policy. A population is considered distinct (and hence a "species" for purposes of conservation under the ESA) if it is discrete from and significant to the remainder of its species based on factors such as physical, behavioral, or genetic characteristics, it occupies an unusual or unique ecological setting, or its loss would represent a significant gap in the species' range.

diversity: All the genetic and phenotypic (life history, behavioral, and morphological) variation within a population. Variations could include anadromy vs. lifelong residence in freshwater, fecundity, run timing, spawn timing, juvenile behavior, age at smolting, age

at maturity, egg size, developmental rate, ocean distribution patterns, male and female spawning behavior, physiology, molecular genetic characteristics, etc.
effectiveness monitoring: Monitoring set up to test cause-and-effect hypotheses about recovery actions: Did the management actions achieve their direct effect or goal? For example, did fencing a riparian area to exclude livestock result in recovery of riparian vegetation?

ESA recovery plan: A plan to recover a species listed as threatened or endangered under the U.S. Endangered Species Act (ESA). The ESA requires that recovery plans, to the extent practicable, incorporate (1) objective, measurable criteria that, when met, would result in a determination that the species is no longer threatened or endangered; (2) site-specific management actions that may be necessary to achieve the plan's goals; and (3) estimates of the time required and costs to implement recovery actions.

evolutionarily significant unit (ESU): A group of Pacific salmon or steelhead trout that is (1) substantially reproductively isolated from other conspecific units and (2) represents an important component of the evolutionary legacy of the species.

e**xtinct:** There are no individuals of this former population or species anywhere.

extirpated: No population or individuals in a certain area but conspecifics exist elsewhere.

factors for decline: Five general categories of causes for decline of a species, listed in the Endangered Species Act section 4(a)(1)(b): (A) the present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence.

functionally extirpated: A species or population that has been extirpated from an area; although a few individuals may occasionally be found, they are not thought to constitute a population.

hyporheic zone: Area of saturated sediment and gravel beneath and beside streams and rivers where groundwater and surface water mix.

implementation monitoring: Monitoring to determine whether an activity was performed and/or completed as planned.

independent population: Any collection of one or more local breeding units whose population dynamics or extinction risk over a 100-year time period is not substantially altered by exchanges of individuals with other populations.

indicator: A variable used to forecast the value or change in the value of another variable.

interim regional recovery plan: A recovery plan that is intended to lead to an ESA recovery plan but that is not yet complete. These plans might address only a portion of an ESU or lack other key components of an ESA recovery plan.

intrinsic potential: The estimated relative suitability of a habitat for spawning and rearing of anadromous salmonid species under historical conditions inferred from stream characteristics including channel size, gradient, and valley width.

intrinsic productivity: The expected ratio of natural-origin offspring to parent spawners at levels of abundance below carrying capacity.

kelts: Steelhead that are returning to the ocean after spawning and have the potential to spawn again in subsequent years (unlike most salmon, steelhead do not necessarily die shortly after spawning).

large woody debris (LWD): A general term for wood naturally occurring or artificially placed in streams, including branches, stumps, logs, and logjams. Streams with adequate LWD tend to have greater habitat diversity, a natural meandering shape, and greater resistance to flooding.

legacy effects: Impacts from past activities that continue to affect a stream or watershed in the present day.

limiting factor: Physical, biological, or chemical features (e.g., inadequate spawning habitat, high water temperature, insufficient prey resources) experienced by the fish that result in reductions in viable salmonid population (VSP) parameters (abundance, productivity, spatial structure, and diversity). Key limiting factors are those with the greatest impacts on a population's ability to reach its desired status.

locally developed recovery plan: A plan developed by state, tribal, regional, or local planning entities to address recovery of a species. These plans are being developed by a number of entities throughout the region to address ESA as well as state, tribal, and local mandates and recovery needs.

maintained status: Population status in which the population does not meet viability criteria but does support ecological functions and preserve options for ESU/DPS recovery.

major population group (MPG): A group of salmonid populations that are geographically and genetically cohesive. The MPG is a level of organization between demographically independent populations and the ESU or DPS.

management unit: A geographic area defined for recovery planning purposes on the basis of state, tribal or local jurisdictional boundaries that encompass all or a portion of the range of a listed species, ESU, or DPS.

metrics: A metric is something that quantifies a characteristic of a situation or process; for example, the number of natural-origin salmon returning to spawn to a specific location is a metric for population abundance.

morphology: The form and structure of an organism, with special emphasis on external features.

natural-origin fish: Fish that were spawned and reared in the wild, regardless of parental origin.

parr: The stage in anadromous salmonid development between absorption of the yolk sac and transformation to smolt before migration seaward.

phenotype: Any observable characteristic of an organism, such as its external appearance, development, biochemical or physiological properties, or behavior.

piscivorous: (Adj.) Describes fish that eat other fish.

productivity: The average number of surviving offspring per parent. Productivity is used as an indicator of a population's ability to sustain itself or its ability to rebound from low numbers. The terms "population growth rate" and "population productivity" are interchangeable when referring to measures of population production over an entire life cycle. Can be expressed as the number of recruits (adults) per spawner or the number of smolts per spawner.

recovery domain: An administrative unit for recovery planning defined by NMFS based on ESU boundaries, ecosystem boundaries, and existing local planning processes. Recovery domains may contain one or more listed ESUs.

recovery goals: Goals incorporated into a locally developed recovery plan, which may include recovery, delisting, reclassification, and/or other goals. Broad-sense goals are a subset of recovery goals.

recovery plan supplement: A NMFS supplement to a locally developed recovery plan that describes how the plan addresses ESA requirements for recovery plans. The supplement also proposes ESA delisting criteria for the ESUs addressed by the plan, since a determination of these criteria is a NMFS decision.

recovery scenarios: Scenarios that describe a target status for each population within an ESU, generally consistent with TRT recommendations for ESU viability.

redd: A nest constructed by female salmonids in streambed gravels where eggs are fertilized and deposited.

recovery strategy: Statements that identify the assumptions and logic – the rationale – for the species' recovery program.
riparian area: Area with distinctive soils and vegetation between a stream or other body of water and the adjacent upland.

salmonid: Fish of the family *Salmonidae*, including salmon, trout, chars, grayling, and whitefish. In general usage, the term usually refers to salmon, trout, and chars.

smolt: A juvenile salmonid that is undergoing physiological and behavioral changes to adapt from freshwater to saltwater as it migrates toward the ocean.

spatial structure: Characteristics of a fish population's geographic distribution. Current spatial structure depends upon the presence of fish, not merely the potential for fish to occupy an area.

stakeholders: Agencies, groups, or private citizens with an interest in recovery planning, or who will be affected by recovery planning and actions.

Technical Recovery Team (TRT): Teams convened by NMFS to develop technical products related to recovery planning. TRTs are complemented by planning forums unique to specific states, tribes, or regions, which use TRT and other technical products to identify recovery actions.

threats: Human activities or natural events (e.g., road building, floodplain development, fish harvest, hatchery influences, volcanoes) that cause or contribute to limiting factors. Threats may exist in the present or be likely to occur in the future.

viability criteria: Criteria defined by NMFS-appointed Technical Recovery Teams to describe a viable salmonid population, based on the biological parameters of abundance, productivity, spatial structure, and diversity. These criteria are used as technical input into the recovery planning process and provide a technical foundation for development of biological delisting criteria.

viability curve: A curve describing combinations of abundance and productivity that yield a particular risk or extinction level at a given level of variation over a specified time frame.

viable salmonid population (VSP): an independent population of Pacific salmon or steelhead trout that has a negligible risk of extinction over a 100-year time frame.

VSP parameters: Abundance, productivity, spatial structure, and diversity. These describe characteristics of salmonid populations that are useful in evaluating population viability. See NOAA Technical Memorandum NMFS-NWFSC-42, *Viable salmonid populations and the recovery of evolutionarily significant units*, McElhany et al., June 2000.

Executive Summary

The Endangered Species Act of 1973 (ESA) requires NOAA's National Marine Fisheries Service (NMFS) to develop recovery plans for species listed under the Act. The purpose of recovery plans is to identify actions needed to restore threatened and endangered species to the point that they are again self-sustaining elements of their ecosystems and no longer need the protections of the ESA. Recovery plans are not regulatory documents; they are guidance for anyone involved in species recovery efforts as well as the various state, Federal, tribal, and local entities whose activities and jurisdictions may affect endangered species. A recovery plan provides a roadmap for restoring a listed species or population to biological viability and greater likelihood of long-term survival.

This is a plan for re-establishing the White Salmon River population of Middle Columbia steelhead so that this population can contribute to the conservation and survival of the Middle Columbia River steelhead distinct population segment (DPS).

"Steelhead" is the name commonly applied to the anadromous form of the biological species *Oncorhynchus mykiss*. The species also has a non-anadromous, or resident, form commonly called rainbow trout. NMFS originally listed the species as threatened on March 25, 1999, calling it an "evolutionarily significant unit" (ESU) of salmonids, which included both forms. Recently, NMFS revised its species determinations for West Coast steelhead under the ESA, delineating anadromous, steelhead-only "distinct population segments" (DPS). NMFS listed the Middle Columbia River steelhead DPS as threatened on January 5, 2006 (NMFS 2006, 71 FR 834).

The Middle Columbia steelhead DPS is made up of steelhead populations in Oregon and Washington tributaries of the Columbia River upstream of the Hood and Wind River systems, up to and including the Yakima River. Reasons for listing this DPS included low returns to the Yakima River, poor abundance estimates for Klickitat River and Fifteenmile Creek winter steelhead, and an overall decline of naturally producing "stocks" within the DPS.

The White Salmon watershed drains approximately 386 square miles in south central Washington (Figure ES-1). The river begins along the south slope of Mt. Adams and flows south 45 miles to enter the Columbia River at Underwood, Washington at RM 168.3. White Salmon River steelhead pass one mainstem Columbia River dam, Bonneville Dam, during their migration to and from the Pacific Ocean.

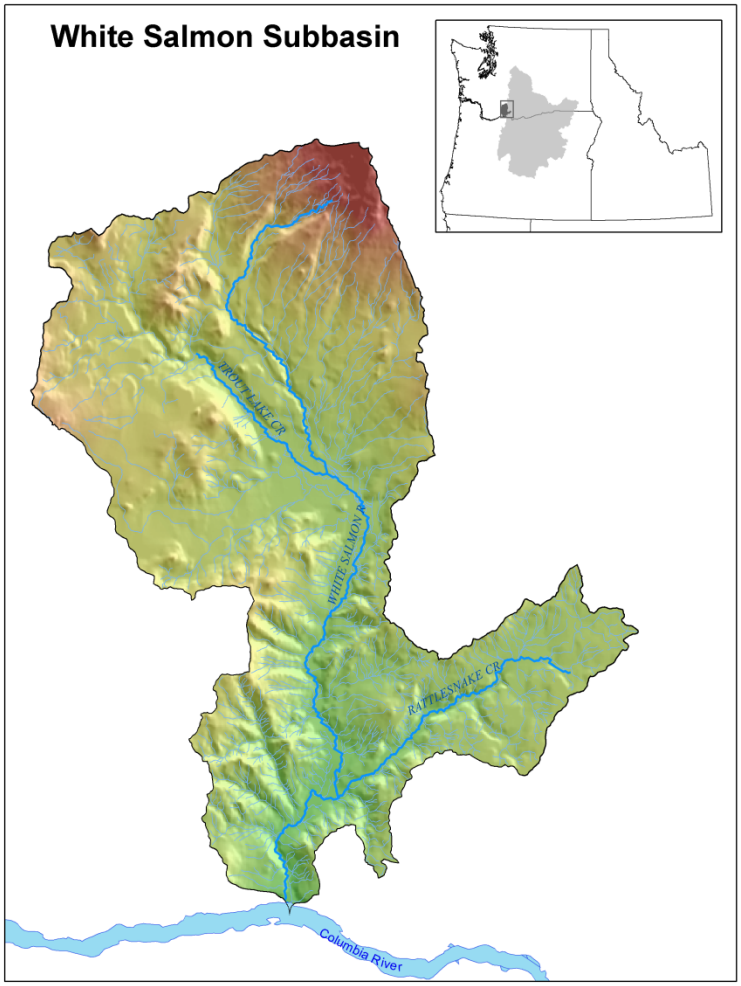

Figure ES-1. White Salmon subbasin in Washington State

Salmon and steelhead production in the White Salmon River subbasin dropped significantly in the early 1900s after construction of Condit Dam at river mile (RM) 3.3 on the White Salmon River. Although the dam was originally constructed with a fish ladder, the ladder was twice destroyed by high flows and was not reconstructed after 1919. The subbasin's native salmon and steelhead populations, including Middle Columbia River steelhead, Lower Columbia River Chinook salmon, Lower Columbia River coho salmon, and Columbia River chum salmon, are now listed for protection under the Endangered Species Act.

The White Salmon steelhead population is considered to be "functionally extirpated" because of its current lack of access to sufficient habitat to support sustained natural production, as well as the presence of a large in-basin hatchery release program below the dam that uses out-of-basin broodstock (ICTRT 2007). Functionally extirpated populations are those of which there are so few remaining numbers that there are not enough fish or habitat in suitable condition to support a fully functional population.

PacifiCorp, the owner of Condit Dam, has received permission from the Federal Energy Regulatory Commission (FERC) to decommission the dam. Dam removal is scheduled to begin in 2009. This Plan includes a proposal to reestablish natural production of steelhead in the White Salmon subbasin, based on natural recolonization of the habitat above the dam after it is removed.

Context of Plan Development

This recovery plan provides direction for potential recovery of the White Salmon River's historical steelhead population. It builds on past and current efforts by the many parties currently working to rebuild the population and improve its habitat. This approach reflects NMFS's belief that it is critically important to base ESA (4f) recovery plans on the many state, regional, tribal, local, and private conservation efforts that are already underway. The White Salmon Recovery Plan is the product of a process initiated by NMFS and incorporates input from the Yakama Nation (YN), Washington Department of Fish and Wildlife (WDFW), Klickitat County, the Washington State Governor's Salmon Recovery Office, other Federal agencies, state agencies, local governments, and the public.

Currently, there are 18 ESA-listed species of Pacific salmon and steelhead in the Pacific Northwest. For the purpose of recovery planning for these species, NMFS Northwest Region designated five geographically based "recovery domains": Interior Columbia; Willamette-Lower Columbia; Puget Sound and Washington Coast; the Oregon Coast; and the Southern Oregon/Northern California Coast (Figure 1-2). The range of the Middle Columbia River steelhead DPS is located in the Middle Columbia sub-domain of the Interior Columbia.

In each domain, NMFS has worked with state, tribal, local and other Federal entities to develop planning forums that build to the extent possible on ongoing, locally led recovery efforts. NMFS defined "management units" based on jurisdictional boundaries as well as areas where local planning efforts were underway. The Mid-Columbia management units are (1) Oregon; (2) Washington Gorge, which, in turn, is subdivided into three planning areas, White Salmon, Klickitat, and Rock Creek; (3) Yakima subbasin; and (4) Southeast Washington.

The White Salmon subbasin is in an area where the Interior Columbia and Willamette-Lower Columbia domains overlap. Three ESA-listed species that spawn in the White Salmon subbasin, i.e., the Lower Columbia River Chinook, coho and chum salmon, also have populations that spawn in tributaries in the Lower Columbia. The White Salmon steelhead recovery plan will be included as an appendix to the recovery plan for the Middle Columbia steelhead DPS. A plan for the White Salmon populations of Lower Columbia spring and fall Chinook, coho, and chum will be completed in the near future as part of the recovery plans for those species. NMFS intends this plan for steelhead to provide a substantial foundation and ecosystem approach that will support all three listed salmon ESUs as well as the steelhead DPS in the subbasin. While many of the limiting factors, strategies, and actions for steelhead will also apply to the three listed salmon species, the Lower Columbia recovery plan will provide specific recovery criteria,

reintroduction strategies, and site-specific actions for those species not included in this steelhead plan.

For each domain, NMFS appointed a team of scientists, nominated for their geographic and species expertise, to provide a solid scientific foundation for recovery plans. The charge of each Technical Recovery Team (TRT) was to define ESU/DPS structures, develop recommendations on biological viability criteria for each ESU or DPS and its component populations, provide scientific support to local and regional recovery planning efforts, and provide scientific evaluations of proposed recovery plans. The Interior Columbia TRT (ICTRT), which provides technical support for the White Salmon plan, includes biologists from NMFS, states, tribal entities, and academic institutions.

All the TRTs used the same biological principles for developing their recommendations for ESU/DPS and population viability criteria – criteria to be used, along with criteria based on mitigation of the factors for decline, to determine whether a species has recovered sufficiently to be downlisted or delisted. These principles are described in a NMFS technical memorandum, *Viable Salmon Populations and the Recovery of Evolutionarily Significant Units* (McElhany et al. 2000). Viable salmonid populations (VSP) are defined in terms of four parameters: abundance, population productivity or growth rate, population spatial structure, and diversity. A viable ESU/DPS is naturally self-sustaining, with a high probability of persistence over a 100-year time period. Each TRT made recommendations using the VSP framework and based on data availability, the unique biological characteristics of the ESUs/DPSs and habitats in the domain, and the members' collective experience and expertise. Although NMFS has encouraged the TRTs to develop regionally specific approaches for evaluating viability and identifying factors limiting recovery, all the TRTs are working from a common scientific foundation.

Physical Setting

The White Salmon subbasin is part of Washington State's Mid-Columbia River Salmon Recovery Region, which encompasses salmon-bearing streams in Benton, Kittitas, Yakima, and parts of Klickitat county. These counties have a combined human population of 395,000. In addition, the subbasin falls within the state's Water Resource Inventory Area (WRIA) 29. Half of the subbasin lies within the Gifford Pinchot National Forest and supports timber production and recreational uses.

The White Salmon subbasin contains lands ceded to the United States by the Yakama Nation in the Treaty of June 9, 1855. Within this area, the Tribe reserves the right "to hunt and fish at all usual and accustomed places." An in-lieu fishing site is located at the mouth of the White Salmon River, allowing tribal fishers to launch boats in an enclosed area and move out into the Columbia River to their usual and accustomed fishing sites.

Ecosystem Conditions

Condit Dam, at RM 3.3 on the mainstem White Salmon River, blocks all anadromous fish migration to historical habitats in the upper drainage. Operations at Condit Dam alter flows in the lower White Salmon River, causing flows to drop to as low as 15 cubic feet per second (cfs) in the 1.1-mile bypass reach, compared to natural flows of about 700 cfs. The dam has altered the river system through power peaking, which causes diel flow variations, and by impairing watershed processes, such as the transportation of spawning gravels and large wood debris to areas below the project (NPCC 2004).

Above Condit Dam, the White Salmon River displays a relatively constant natural flow pattern because of glacial melt, large water recharge potential, and storage capacity. Tributary stream flows drop to low levels in the summer and peak in the winter.

Habitat conditions in the White Salmon watershed typically reflect past land use practices. Historic logging practices and associated road building, unscreened irrigation diversions, and riparian grazing that impaired natural ecosystem functions have resulted in extreme flow fluctuations, increased sedimentation, reduced riparian vegetation, loss of large woody debris, and increased summer temperature in some areas (NPCC 2004). Until the mid-1980s, timber harvest typically extended to the edge of the stream/river. Extensive grazing occurred since the late 1800s in the Rattlesnake Creek watershed and Trout Lake Valley, reducing native vegetation. Large historical marshy areas in the upper Rattlesnake Creek watershed were actively drained in the early 1900s to improve grazing conditions. Today, timber practices have improved, grazing is better managed, and wetland draining has stopped. Nevertheless, the watershed still shows impacts of past land use actions and, in some areas, present land use practices (Haring 2003). Residential development is occurring with increasing frequency along SR 141 in the lower watershed.

Populations and Major Population Groups

Historically, steelhead, spring Chinook and coho likely ranged up the White Salmon River to the falls at RM 16 and into Buck, Spring, Indian and Rattlesnake creeks (NPCC 2004). A falls at Husum (RM 7.6) may have blocked Chinook migration and created a partial barrier for steelhead and coho (NPCC 2004). All anadromous fish passage to historical habitats in the White Salmon drainage above RM 3.3 ended in 1913 after construction of Condit Dam.

Presently, the historical spring Chinook population is considered extirpated, the historical steelhead population is considered functionally extirpated, and the historical fall Chinook and coho populations are considered at very high risk of extinction (ICTRT 2006; McElhany et al. 2004). However, efforts are underway that may allow the populations to begin rebuilding. Recent decisions regarding the re-licensing of Condit Dam suggest that anadromous fish will regain access to upriver habitats within this decade (NPCC 2004). PacifiCorp is planning to remove Condit Dam in 2009 once permits are acquired.

Biological Viability Criteria

The ICTRT classified the White Salmon River steelhead population as functionally extirpated (ICTRT 2008). The ICTRT considers extirpated populations to be those that are entirely cut off from anadromy, such as the Crooked River population. Functionally extirpated populations are those of which there are so few remaining numbers that there are not enough fish or habitat in suitable condition to support a fully functional population. The ICTRT identified one historical major spawning area (MaSA) within the White Salmon subbasin. A few individuals from the original population may still spawn in the reach below Condit Dam, and some evidence suggests that resident *O. mykiss* may have retained anadromous potential (Allen et al. 2006; Allen 2008).

Limiting Factors

Factors that limit Middle Columbia River steelhead in the White Salmon subbasin are described in Chapter 6. NMFS defines limiting factors as the biological and physical conditions that limit a species' viability – e.g., high water temperature – and defines threats as those human activities or naturally induced actions that cause the limiting factors. For example, removing the vegetation along the banks of a stream (the threat) can cause higher water temperatures (the limiting factor), because the stream is no longer shaded. Analysis of limiting factors and threats across the species' entire life cycle forms the basis for designing recovery strategies and actions.

While the term "threats" carries a negative connotation, it does not mean that activities identified as threats are inherently undesirable. They are typically necessary human activities that may at times have unintended negative consequences on fish populations—and that can also be managed in a manner that minimizes or eliminates the negative impacts.

Blocked Passage

The single greatest factor limiting salmon and steelhead populations in the White Salmon subbasin is the construction and operation of Condit Dam. Salmon and steelhead currently access only a small percentage of their historical spawning and rearing areas.

Tributary Habitat

Other limiting factors in the White Salmon River and its tributaries are altered flow regimes; degraded channel structure, riparian condition and floodplain connectivity; impaired water quality; and increased predation, competition and disease. Details can be found in Chapter 5.

Hatchery Practices and Releases

Releases of Skamania stock winter steelhead (not considered part of the Lower Columbia River or Middle Columbia River steelhead DPSs) may limit the diversity of any naturally produced winter steelhead in the basin. This program has been terminated with the 2008 releases.

Harvest Management

Harvest does not currently limit the abundance or the diversity of White Salmon River populations.

Climate Change

Climate change represents a potentially significant threat to recovery of Mid-Columbia steelhead populations. Changes in climate may adversely affect steelhead across the DPS by exacerbating existing problems with water quantity (lower summer streamflows) and water quality (higher summer water temperatures), and could be detrimental to salmonids and native fish species throughout the DPS. Changing conditions could also affect salmonid health and survival in the ocean through a variety of mechanisms, including increased ocean temperatures, increased stratification of some waters, changes in the upwelling season, shifts in the distribution of salmonids, long term variability in winds and ocean temperatures, increased acidity, and increased atmospheric and oceanic variability (NMFS 2008a, Supplemental Comprehensive Analysis Ch. 5. Available at http://www.nwr.noaa.gov/Salmon-Hydropower/Columbia-Snake-Basin/upload/Final_SCA_Ch1_7.pdf. See also ISAB 2007).

Out-of-Subbasin Factors

Development and operation of the mainstem Columbia River hydropower system significantly altered salmon and steelhead travel conditions in the mainstem Columbia River, resulting in direct mortality of both upstream migrating adults and downstream migrating steelhead kelts, and direct and indirect mortality for downstream migrants (juveniles). The hydro system also changed the hydrograph, depleting historically available nutrients, changing water temperatures, and degrading rearing and food resources for both presmolts and smolts in the Columbia. Changes in the hydrograph leave steelhead more vulnerable to bird predation in the Columbia River estuary and mainstem. Detailed information on the effects of the Federal Columbia River Power System (FCRPS) on salmon and steelhead are provided in the NMFS 2008 FCRPS Biological Opinion and particularly in the Supplemental Comprehensive Analysis (NMFS 2008a).

Fish returning to the White Salmon subbasin must pass Bonneville Dam. Current estimates of steelhead survival through the dam, based on modeling and inferred from studies of hatchery steelhead or Snake River steelhead, are 90 percent survival for out-migrating juveniles and 98.5 percent survival for adult steelhead migrating upstream through the dam. However, mortality may be as high as 22 percent for winter-run steelhead because of marine mammal predation below the dam (NMFS 2008b).

The Columbia River Estuary Module http://www.nwr.noaa.gov/Salmon-Recovery-Planning/ESA-Recovery -Plans/upload/Estuary-Module.pdf discusses factors that limit viability of White Salmon River salmon and steelhead populations in the Columbia River Estuary.

Recovery Goals and Criteria

The primary goal of ESA recovery plans is for the species to reach the point that it no longer needs the protection of the Act – i.e. to be delisted. Delisting criteria are applied to the DPS, not to each population; however, the delisting criteria are based on determinations of the viability of the independent populations that make up the DPS. A viable salmonid population is defined as an independent population that has negligible risk of extinction over a 100-year timeframe (McElhany et al. 2000). Criteria for delisting the Middle Columbia steelhead DPS are described in the Middle Columbia Steelhead ESA Recovery Plan, to which this plan is an appendix.

The White Salmon steelhead population is part of the Cascades Eastern Slope Tributaries major population group (MPG) of the Middle Columbia steelhead DPS. MPGs are geographically and genetically cohesive groups of populations. Having all MPGs within a DPS at low risk provides the greatest probability of persistence for the DPS.

The primary goal of this plan is for the White Salmon steelhead population to be restored to viable status. The ICTRT classified the White Salmon River steelhead population as "basic" in size based on historical habitat potential (ICTRT 2007, Table 1). In order for the White Salmon River population to achieve a 95 percent probability of persistence over 100 years, its productivity would need to be at or greater than 1.56 recruits per spawner at a minimum abundance threshold of 500 spawners.

NMFS and the ICTRT recognize that recovering this functionally extirpated population to a viable level may not be necessary to achieve viability for the Middle Columbia steelhead DPS; however, recovering and maintaining it at some level will provide ecological functions and preserve options for DPS recovery. There are many uncertainties involved in recovery. If the White Salmon population were to be restored even at the level of 25 percent risk, called "maintained" status, it could provide additional support the DPS in the following ways:

- Provide a hedge against the potential risk that the cumulative productivity across populations within an MPG may fall below replacement.
- Provide insurance against catastrophic events. For example, if a catastrophe impacts one or more of the functioning viable populations within the MPG, the other populations will need to be at sufficient levels so that they can replenish those populations lost to or affected by the catastrophe.
- Allow these populations to serve as genetic or demographic "stepping stones" between populations, allowing natural patterns of gene flow and dispersal.
- Provide a buffer against uncertainty in the ICTRT population and MPG criteria. For example, having populations meet maintained standards preserves recovery options in the event that efforts to recover other populations to viable levels fail.

Recovery Strategy and Actions

Chapter 6 describes the recovery strategy for the White Salmon River steelhead population. The recovery strategy contains two key parts: 1) a plan for reintroducing

naturally produced steelhead into historical habitat after the removal of Condit Dam, and 2) improving and increasing freshwater habitat for steelhead production in the subbasin. The plan also recommends ensuring that harvest or hatchery actions do not impede efforts to improve steelhead viability.

Steelhead Reintroduction Plan

In anticipation of the removal of Condit Dam in the fall of 2009, the White Salmon River Working Group, made up of Federal, state, and tribal fisheries managers, as well as representatives of PacifiCorp (Condit Dam operators), developed several options to consider for the reintroduction of steelhead into the White Salmon River. They fleshed out each option with a description of the biological basis for the approach, operational and maintenance needs, and monitoring and evaluation needs. These are the options the Working Group considered (for details, see Appendix I):

1. Natural recolonization – no reintroduction efforts from outside sources.
2. Wild donor from local subbasin as brood source for juvenile release into the White Salmon River. Eggs collected and reared at suitable hatchery, juveniles acclimated and released at White Salmon Ponds.
3. White Salmon resident O. mykiss as brood source, with locally suitable anadromous wild donor stock spawned for juvenile release into upper White Salmon River.
4. White Salmon steelhead captive brood program using captured outmigrating juveniles
5. White Salmon steelhead kelt reconditioning. Recondition local spawners to enhance survival.

Based on the potential to reestablish natural production of steelhead in the basin, the White Salmon Working Group decided that Option 1, natural recolonization, was the best approach. Their reasoning was based on some indications that the (resident) population of *O. mykiss* in the White Salmon River above Condit Dam is still producing smolts, even though anadromy has been eliminated since the construction of Condit Dam and the end of passage in 1919. Recent monitoring in the White Salmon River above Condit Dam has identified *O. mykiss* juveniles displaying smolt behavior and morphology. PIT-tagged juveniles have been detected passing Bonneville Dam, with one being recovered at the tern colony on East Sand Island (B. Allen Personal Communication, 2007). In addition, an individual juvenile *O. mykiss* PIT-tagged above Condit Dam in September 2004 at 98 mm was detected again as an adult ascending Bonneville Dam in July 2006. Genetic analysis of juvenile *O. mykiss* collected in the upper watershed above Husum Falls found differences from hatchery trout released in the basin; additional samples are needed, however, to confirm this finding (Allen et al. 2006).

Additional research by Carmichael (LSRCP 2001) in the Grande Ronde and in Thrower et al. (2004) in Alaska supports the theory that even though the population is functionally extirpated, there is some potential for re-establishing anadromous steelhead in the White Salmon River basin. Using resident *O. mykiss* above Condit Dam could provide a genetic link to historical anadromous *O. mykiss*.

Other Actions

Table ES-1 lists the strategies and actions proposed as an integrated approach to address limiting factors and threats to steelhead in four categories: freshwater habitat, hatcheries, harvest, and hydrosystem.

The Plan also proposes a number of actions focused on data gathering and analysis. These efforts are needed to monitor the current population status and habitat conditions, and to help ensure that efforts to reintroduce salmon and steelhead in the White Salmon are efficient and successful.

Together, the proposed strategies and actions are expected to increase abundance, productivity, spatial structure and diversity of White Salmon River steelhead. The strategies and actions build from past and current efforts to restore passage and improve habitat conditions in the subbasin.

Table ES-1. Recovery Strategies and Actions for White Salmon River Salmon and Steelhead Populations.

Strategies	Key Types of Actions
Freshwater Habitat	
Implement plan for reintroduction of naturally produced steelhead to the White Salmon subbasin.	• Allow natural recolonization. • Install weir in Rattlesnake Creek. • Monitor natural spawner escapement. • Monitor hatchery strays. • Evaluate after 5 years and plan for alternative methods if necessary.
Protect and conserve natural ecological processes that support the viability of populations and their primary life history strategies throughout their life cycle.	• Protect highest quality habitats through acquisition and conservation. • Adopt and manage Cooperative Agreements. • Conserve rare and unique functioning habitats. • Consistently apply Best Management Practices and existing laws to protect and conserve natural ecological processes. • Review, modify, and enforce existing local/county shoreline and critical areas laws/regulations/ordinances pertaining to riparian and floodplain management. • Provide public outreach to educate river uses and others
Gain information needed to identify and prioritize habitat actions that will provide the greatest opportunity to contribute to recovery. Gain information on current population composition and viability to identify reintroduction opportunities.	• Conduct habitat surveys to help prioritize restoration needs. • Measure select habitat attributes above and below Condit Dam to document changes because of removal and time to recovery. • Perform population monitoring. • Assess current Chinook, coho, chum, steelhead, and resident rainbow trout stock composition and viability to determine appropriate stocks and methods for reintroduction. • Continue genetic analyses to determine level of competition between tule and upriver bright fall Chinook salmon. • Monitor salmon and steelhead spawning escapement
Restore passage and connectivity to habitats blocked or impaired by artificial barriers.	• Provide passage at Condit Dam. • Remove or replace barriers blocking or impairing passage including dams, dikes, road culverts and irrigation structures. • Provide screening at 100% of irrigation diversions. • Replace screens that do not meet criteria.
Restore floodplain connectivity and function and channel migration processes.	• Reconnect side channels and off-channel habitats to stream channels. • Restore wet meadows. • Reconnect floodplain to channel. • Relocate or improve floodplain infrastructure and roads. • Conduct public awareness and education about restoration efforts.
Restore channel structure and complexity	• Place stable wood and other large organic debris in streambeds.

Strategies	Key Types of Actions
	• Stabilize streambanks. • Restore natural channel form.
Restore riparian condition and LWD recruitment	• Restore natural riparian vegetative communities. • Develop grazing strategies that promote riparian recovery. • Eradicate invasive plants species from riparian areas.
Restore altered hydrograph to provide appropriate flows during critical periods.	• Implement agricultural water conservation measures. • Improve irrigation conveyance and efficiency. • Restore natural functions and processes through actions identified in strategies above. • Employ BMPs to forest, agriculture and grazing practices and to road management. • Protect and/or rehabilitate springs • Increase pool habitat. • Restore wetlands and other water holding capacity on plateau.
Improve degraded water quality, reduce summer water temperatures.	• Reduce runoff from dairies and failing septic systems. • Restore natural functions and processes through actions identified in strategies above. • Employ BMPs to forest, agriculture and grazing practices and to road management. • Upgrade or remove problem forest roads • Construct water and sediment control basins
Hatchery Practices and Releases	
Evaluate hatchery practices to ensure they do not limit diversity.	• Monitor natural spawner escapement. • Monitor hatchery strays.
Restore natural production in historically utilized habitats, including blocked areas above Condit Dam.	• Implement plans for salmon and steelhead reintroduction into historic habitat when passage is restored.
Harvest	
Manage to maintain current low impact fisheries and reduce harvest-related adverse effects in those fisheries that have significant impacts.	• Maintain current management regulations for low impact fisheries and adjust tributary harvest regulations in areas where harvest significantly impacts steelhead viability.
Hydrosystem	
Improve hydropower operations and facilities to enhance steelhead survival.	• Implement 2008 FCRPS Biological Opinion (NMFS 2008b).
Reduce predation on, and competition between, salmonids	• Reduce predation by pinnipeds • Re-distribute cormorants

Implementation and Cost Estimates

This plan provides specific management strategies and actions needed to address all threats and identifies the partners with the authority, jurisdiction, or resources needed to implement each action (see Table 6-4 of the Plan). These actions represent activities with the greatest potential for protecting and recovering steelhead. Implementation of recovery actions will not be a one-time or short-term initiative. Programs and actions will likely need to be sustained, evaluated, adjusted, and augmented over the recovery period.

Chapter 7 provides cost estimates developed by the Yakama Nation for implementing the proposed habitat actions described in Chapter 6 for the White Salmon drainage. These cost estimates are general range summaries and are based on the costs of specific reach actions identified in tabular form (Table 7-1). Habitat action costs for recovery over a

10-year time period are estimated to be $6.5 million ($2.17 million for years 1-3 and $4.33 million for years 4-10).

Monitoring, Research and Adaptive Management Framework

As part of implementing the White Salmon Recovery Plan, a detailed monitoring and evaluation program will be designed and incorporated into an adaptive management framework based on the principles and concepts laid out in the NMFS guidance document, *Adaptive Management for Salmon Recovery: Evaluation Framework and Monitoring Guidance* (available at http://www.nwr.noaa.gov/Salmon-Recovery-Planning/ESA-Recovery-Plans/Other-Documents.cfm

The White Salmon monitoring and evaluation program will build on existing programs designed for monitoring tributary habitat in the White Salmon. Additionally, the program will provide (1) a clear statement of the metrics and indicators by which progress toward achieving goals can be assessed, (2) a plan for tracking such metrics and indicators, and (3) a decision framework through which new information from monitoring and evaluation can be used to adjust strategies or actions aimed at achieving the Plan's goals.

1. Introduction

The Endangered Species Act of 1973 (ESA) requires NOAA's National Marine Fisheries Service (NMFS) to develop recovery plans for species listed under the Act. The purpose of recovery plans is to identify actions needed to restore threatened and endangered species to the point where they are again self-sustaining elements of their ecosystems and no longer need the protections of the ESA.

This is a plan for re-establishing the White Salmon River population of Middle Columbia steelhead so that this population can contribute to the conservation and survival of the Middle Columbia River steelhead distinct population segment (DPS). The White Salmon River drains approximately 386 square acres in southwestern Washington and joins the Columbia River at Underwood, Washington at RM 163 (Figure 1-1).

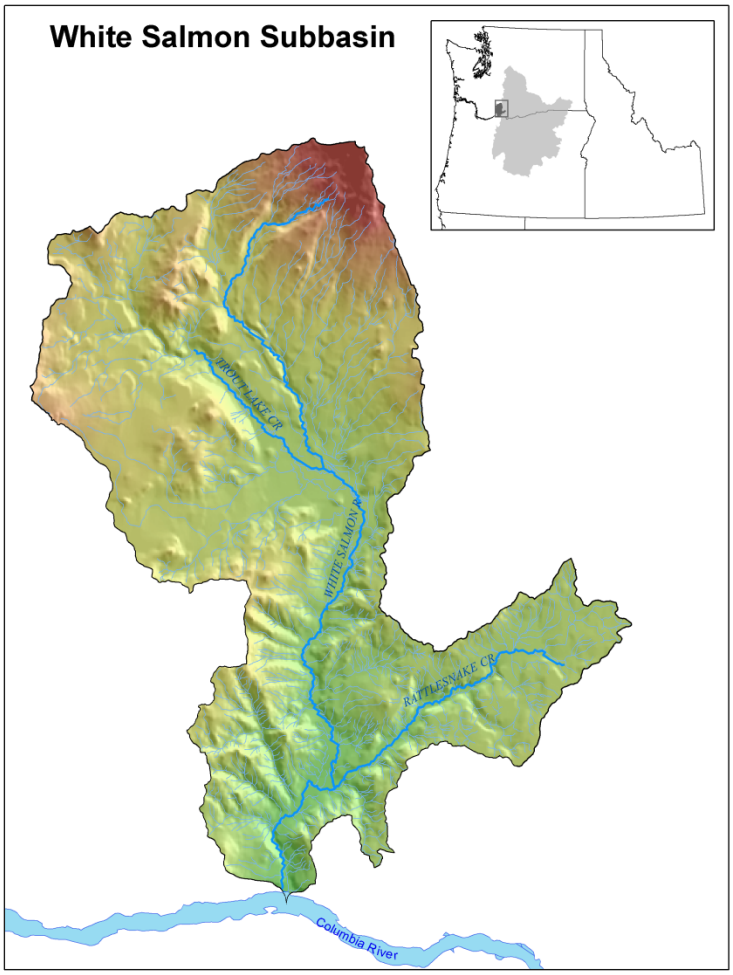

Figure 1-1 White Salmon subbasin (Washington State.

"Steelhead" is the name commonly applied to the anadromous form of the biological species *Oncorhynchus mykiss*. The species also has a non-anadromous, or resident, form that is commonly called rainbow trout. NMFS originally listed the species as threatened on March 25, 1999, calling it an "evolutionarily significant unit" (ESU) of salmonids, which included both forms. Recently, NMFS revised its species determinations for West Coast steelhead under the ESA, delineating anadromous, steelhead-only "distinct population segments" (DPS). NMFS listed the Middle Columbia River steelhead DPS as threatened on January 5, 2006 (NMFS 2006, 71 FR 834).

The Middle Columbia steelhead DPS is made up of steelhead populations in Oregon and Washington tributaries of the Columbia River upstream of the Hood and Wind River systems, up to and including the Yakima River (Figure 1-2). Reasons for listing this DPS included low returns to the Yakima River, poor abundance estimates for Klickitat River and Fifteenmile Creek winter steelhead, and an overall decline of naturally producing "stocks" within the DPS.

Salmon and steelhead production in the White Salmon River subbasin dropped significantly in the early 1900s after construction of Condit Dam at river-mile (RM) 3.3 on the White Salmon River. Although the dam was originally constructed with a fish ladder, the ladder was twice destroyed by high flows and was not reconstructed after 1919. The subbasin's native salmon and steelhead populations, including Middle Columbia River steelhead, Lower Columbia River Chinook salmon, Lower Columbia River coho salmon, and Columbia River chum salmon, are now listed for protection under the Endangered Species Act.

The White Salmon steelhead population is considered to be functionally extirpated because of the current lack of access to sufficient habitat to support sustained natural production, as well as the presence of a large in-basin hatchery release program below the dam, using out-of-basin broodstock (ICTRT 2008).

PacifiCorp, the owner of Condit Dam, has received permission from the Federal Energy Regulatory Commission (FERC) to decommission the dam. Dam removal is scheduled to begin in 2009. This Plan includes a proposal to reestablish natural production of steelhead in the White Salmon subbasin, based on natural recolonization of the habitat above the dam after it is removed.

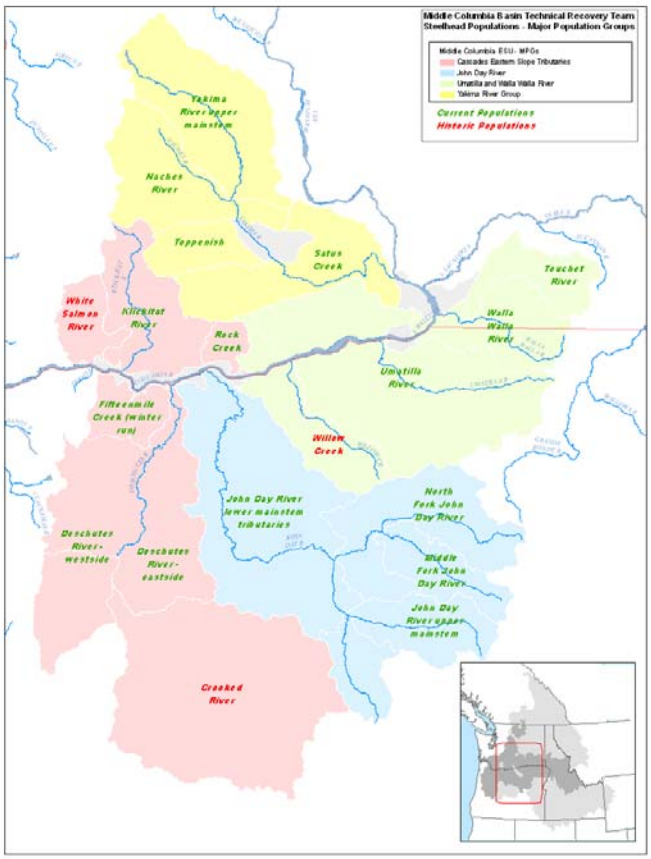

Figure 1-2 Middle Columbia River Steelhead DPS - historical independent steelhead populations (McClure et al. 2003).

NMFS developed this recovery plan with participation and technical contributions from the Yakama Nation (YN), Washington Department of Fish and Wildlife (WDFW), Klickitat County, the Washington State Governor's Salmon Recovery Office, other Federal agencies, state agencies, local governments, and the public. While NMFS is the agency responsible for recovery planning for salmon and steelhead under the ESA, NMFS believes it is critically important to base ESA recovery plans for salmon and steelhead on the many state, regional, tribal, local, and private conservation efforts already underway throughout the region, and has attempted to do so in this plan.

1.1 Purpose of Plan

A recovery plan provides a roadmap for restoring a listed species or population to become a viable component of its ecosystem. Recovery plans are not regulatory; they are guidance for recovery efforts. This Plan describes the current status of the White Salmon steelhead population and its habitat in the White Salmon subbasin and summarizes the results of a technical assessment examining the population's viability. The Plan also identifies the major limiting factors and threats affecting the population and proposes strategies and actions designed to aid in the population's recovery by building on past and current efforts. Finally, the Plan provides an implementation and adaptive management framework for making needed future adjustments on the road to recovery.

1.1.1 ESA Requirements

Section 4(f) of the ESA requires that a recovery plan be developed and implemented for species listed as endangered or threatened under the statute. ESA section 4(a)(1) lists factors for re-classification or delisting that are to be addressed in recovery plans:

A. The present or threatened destruction, modification, or curtailment of [the species'] habitat or range
B. Over-utilization for commercial, recreational, scientific or educational purposes
C. Disease or predation
D. The inadequacy of existing regulatory mechanisms
E. Other natural or human made factors affecting its continued existence

ESA section 4(f)(1)(B) directs that recovery plans, to the extent practicable, incorporate:

1. a description of such site-specific management actions as may be necessary to achieve the plan's goal for the conservation and survival of the species;
2. objective, measurable criteria which, when met, would result in a determination, in accordance with the provisions of this chapter, that the species be removed from the list; and;
3. estimates of the time required and the cost to carry out those measures needed to achieve the plan's goal and to achieve intermediate steps toward that goal.

Once a species is deemed recovered and therefore removed from a listed status, section 4(g) of the ESA requires the monitoring of the species for not less than five years to ensure that it retains its recovered status.

1.1.2 Coordination with Others

The Plan aims to provide consistency between the Plan and related planning and management efforts.

Federal Treaty and Trust Responsibilities

Northwest Indian tribes have legally enforceable treaty rights reserving to them a share of the harvestable salmon and steelhead. Achieving the basic purposes of the ESA such that the species no longer needs the protection of the Act may not by itself fully meet these rights and expectations, although it will lead to major improvements in the current situation. Ensuring a sufficient abundance of salmon to sustain harvest can be an important element in fulfilling trust and treaty rights as well as garnering public support for these plans.

It is NMFS policy that recovery of salmonid populations must achieve two goals: (1) the recovery and delisting of salmonids listed under the provisions of the ESA, and (2) the restoration of the meaningful exercise of tribal fishing rights. "It is the agency's view that there is no conflict between the statutory goals of the ESA and Federal trust responsibility to Indian tribes" (Letter from Terry Garcia, Assistant Secretary for Oceans and

Atmosphere, to Ted Strong, Executive Director, Columbia Inter-Tribal Fish Commission, July 21, 1998). Additionally, NMFS "will continue to join with states and tribes to develop a comprehensive approach to the restoration of fish and wildlife resources in a manner that fulfills all obligations under Federal law, including trust obligations to Indian tribes" (ibid.).

Thus, it is appropriate for recovery plans to take these considerations into account and plan for a recovery strategy that includes harvest. In some cases, the desired abundances for harvest may come about through increases in the naturally spawning population. In others, the recovery strategy may include appropriate use of hatcheries to support a portion of the harvest. So long as the overall plan is likely to achieve the biological recovery of the listed ESU/DPS, it will be acceptable as a recovery plan.

Treaty Indian fishing rights in the Columbia basin are under the continuing jurisdiction of the U.S. District Court for the District of Oregon in the case of *United States v. Oregon*, No. 68-513 (filed in 1968). The parties to *U.S. v. Oregon* are the United States acting through the Department of Interior (USFWS and Bureau of Indian Affairs) and Department of Commerce (National Marine Fisheries Service), the Warm Springs, Umatilla, Nez Perce, Yakama, and Shoshone-Bannock Tribes, and the states of Oregon, Washington, and Idaho. In *U.S. v Oregon*, the Court affirmed that the treaties reserved for the tribes 50 percent of the harvestable surplus of fish destined to pass through their usual and accustomed fishing areas.

The White Salmon subbasin contains lands ceded to the United States by the Yakama Nation in the Treaty of June 9, 1855. Within this area, the Tribe reserves the right "to hunt and fish at all usual and accustomed places." An in-lieu fishing site is located at the mouth of the White Salmon River, allowing tribal fishers to launch boats in an enclosed area and move out into the Columbia River to their usual and accustomed fishing sites.

Several historical seasonal encampments and fishing areas used by local Indian bands were located on the White Salmon and its tributaries. Historically, before European settlement of the area, significant fisheries and winter village sites were located at the mouth of the White Salmon, at Husum Falls (RM 7.6), and at the falls at BZ Corner (RM 12.4). Another important winter village was located at Trout Creek (LLA 1981). The whole Rattlesnake Creek drainage was occupied by Yakama people. Villages were located near the confluence of the White Salmon River and Rattlesnake Creek, and another approximately four miles up the creek. The upper White Salmon watershed also contains historical huckleberry fields traditionally used by the Yakama Nation. Archaeological sites throughout the area testify to the importance of the White Salmon watershed as a seasonal and perennial area of aboriginal use. Present-day tribal groups whose treaty-reserved fisheries were affected by Condit Dam are the Confederated Tribes and Bands of the Yakama Indian Nation, Confederated Tribes of the Warm Springs Reservation of Oregon, Confederated Tribes of the Umatilla Reservation of Oregon, and the Nez Perce Tribe of Idaho (LLA 1981).

Other Federal, State and Local Responsibilities

To ensure consistency in goals, strategies, and actions and to eliminate needless duplication of effort, the process aims to provide consistency between planning for ESA recovery, the NPCC fish and wildlife program, the State of Washington watershed management and salmon recovery programs, and local planning and regulatory efforts.

The Plan builds upon the White Salmon Subbasin Plan (NPCC 2004), which was developed for the NPCC by the Yakama Nation, Washington Department of Fish and Wildlife, and other Federal, state, and local entities. The subbasin plan contains an assessment and inventory of fish and wildlife resources in the subbasin, as well as a management plan identifying locally informed fish and wildlife protection and restoration priorities. The NPCC adopted the White Salmon Subbasin Plan into its Fish and Wildlife Program. Additional scientific data are drawn from other more recent sources, including technical products developed by technical recovery teams appointed by NMFS for the Interior Columbia and Willamette/Lower Columbia recovery domains.

Thus, the Plan is the product of a process initiated by NMFS and involves technical input from the Yakama Nation, Washington Department of Fish and Wildlife, Klickitat County, the Washington State Governor's Salmon Recovery Office, other Federal agencies, state agencies, local governments, and the public. The Plan's recovery direction for White Salmon steelhead includes advice received from these parties.

1.2 Context of Plan Development

Currently, there are 18 ESA-listed ESUs/DPSs of Pacific salmon and steelhead in the Pacific Northwest. For the purpose of recovery planning for these species, NMFS Northwest Region designated five geographically based "recovery domains": Interior Columbia; Willamette-Lower Columbia; Puget Sound and Washington Coast; the Oregon Coast; and the Southern Oregon/Northern California Coast. The range of the Middle Columbia River steelhead DPS is located in the Middle Columbia sub-domain of the Interior Columbia.

The White Salmon subbasin is in an area where the Interior Columbia and Willamette-Lower Columbia domains overlap. Three ESA-listed species that spawn in the White Salmon subbasin, i.e., the Lower Columbia River Chinook, coho and chum salmon, also have populations that spawn in tributaries in the Lower Columbia. The White Salmon steelhead recovery plan will be included as an appendix to the recovery plan for the Middle Columbia steelhead DPS. A plan for the White Salmon populations of Lower Columbia Chinook, coho, and chum will be completed in the near future as part of the Willamette-Lower Columbia recovery plan. NMFS intends this plan for steelhead to provide a substantial foundation and ecosystem approach that will support all three listed salmon ESUs as well as the steelhead DPS in the subbasin. While many of the limiting factors, strategies, and actions for steelhead will also apply to the three listed salmon species, the Willamette-Lower Columbia recovery plan will provide specific recovery criteria, reintroduction strategies, and site-specific actions for those species not included in this steelhead plan.

1.2.1 Technical Recovery Teams

For each domain, NMFS appointed a team of scientists, nominated for their geographic and species expertise, to provide a solid scientific foundation for recovery plans. The charge of each Technical Recovery Team (TRT) is to define ESU/DPS structures, develop recommendations on biological viability criteria for each ESU or DPS and its component populations, provide scientific support to local and regional recovery planning efforts, and provide scientific evaluations of proposed recovery plans. The Interior Columbia TRT (ICTRT) includes biologists from NMFS, states, tribal entities, and academic institutions.

All the TRTs used the same biological principles for developing their recommendations for ESU/DPS and population viability criteria – criteria to be used, along with criteria based on mitigation of the factors for decline, to determine whether a species has recovered sufficiently to be downlisted or delisted. These principles are described in a NMFS technical memorandum, *Viable Salmon Populations and the Recovery of Evolutionarily Significant Units* (McElhany et al. 2000). Viable salmonid populations (VSP) are defined in terms of four parameters: abundance, population productivity or growth rate, population spatial structure, and diversity. A viable ESU/DPS is naturally self-sustaining, with a high probability of persistence over a 100-year time period. Each TRT made recommendations using the VSP framework and based on data availability, the unique biological characteristics of the ESUs/DPSs and habitats in the domain, and the members' collective experience and expertise. Although NMFS has encouraged the TRTs to develop regionally specific approaches for evaluating viability and identifying factors limiting recovery, all the TRTs are working from a common scientific foundation.

In each domain, NMFS has worked with state, tribal, local and other Federal entities to develop planning forums that build to the extent possible on ongoing, locally led recovery efforts. NMFS defined "management units" based on jurisdictional boundaries as well as areas where local planning efforts were underway. The Mid-Columbia management units are (1) Oregon; (2) Washington Gorge, which, in turn, is subdivided into three planning areas, White Salmon, Klickitat, and Rock Creek; (3) Yakima subbasin; and (4) Southeast Washington (Figure 1-3).

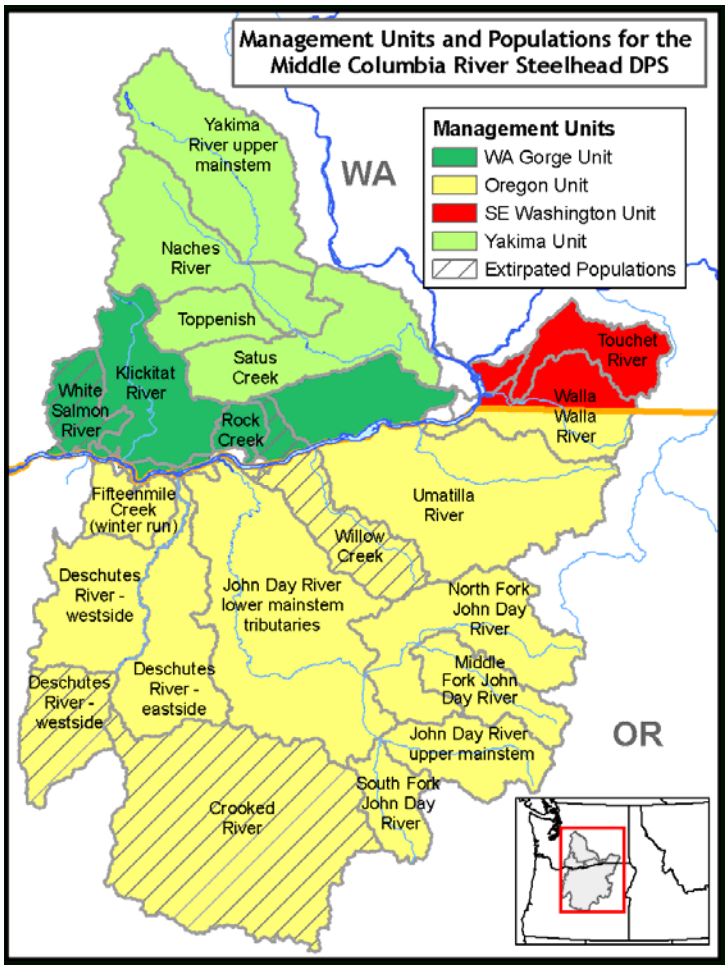

Figure 1-3. NMFS Management Units for the Middle Columbia Steelhead DPS

1.2.2 Planning Forum

NMFS works with state, tribal, local, and other Federal stakeholders to develop a planning forum that is appropriate for each recovery domain; one that builds to the extent possible on ongoing, locally led efforts. In this case, NMFS has worked independently with the Yakama Nation, Klickitat County, Washington Department of Fish and Wildlife, and local entities to develop the recovery plan for White Salmon River steelhead population.

NMFS encourages creation of a local planning forum that could provide guidance for further development and implementation of recovery plans for the Washington Gorge Management Unit and the White Salmon Management Unit in the Willamette-Lower Columbia domain.

1.3 How NMFS Intends to Use the Plan

Although recovery plans are not regulatory and their implementation is voluntary, they are important tools that help to do the following:

- Provide context for regulatory decisions.

- Guide decision making by Federal, state, tribal, and local jurisdictions.
- Provide criteria for status reporting and delisting decisions.
- Organize, prioritize, and sequence recovery actions.
- Organize research, monitoring, and evaluation efforts.

NMFS will encourage Federal agencies and non-Federal jurisdictions to take recovery plans under serious consideration as they make the following sorts of decisions and allocate their resources:

- Actions carried out to meet Federal ESA section 7(a)(1) obligations
- Actions that are subject to ESA sections 4d, 7(a)(2), or 10
- Hatchery and Genetic Management Plans and permit requests
- Harvest plans and permits
- Selection and prioritization of subbasin planning actions
- Development of research, monitoring, and evaluation programs
- Revision of land use and resource management plans
- Other natural resource decisions at the state, tribal, and local levels

NMFS will emphasize recovery plans in ESA section 7 (a)(2) consultations, section 10 permits, and application of the section 4(d) rule by considering:

- Delisting criteria that address both viability and threats
- Description of limiting factors and threats (factors for decline)
- Description of a recovery program (site-specific management actions necessary to achieve recovery of the species)
- Estimates of the time and cost to carry out measures to achieve the plans' goals

In implementing these programs, recovery plans will be used as a reference and a source of context, expectations, and goals. NMFS staff will encourage the Federal "Action Agencies" to describe in their biological assessments how their proposed actions will affect specific populations and limiting factors identified in the recovery plans, and to describe any mitigating measures and voluntary recovery activities in the action area.

2. Biological Background

This chapter describes population and habitat characteristics for the White Salmon steelhead population. The chapter also discusses hatchery production and releases and harvest management in the White Salmon subbasin.

2.1 Populations and Major Population Groups

The ICTRT identified 17 extant and 3 extirpated independent steelhead populations in the Middle Columbia River steelhead DPS (McClure et al. 2003). These populations are show in Figure 2-1. The ICTRT delineated the populations based on genetic information, geography, life-history traits, morphological traits, and population dynamics.

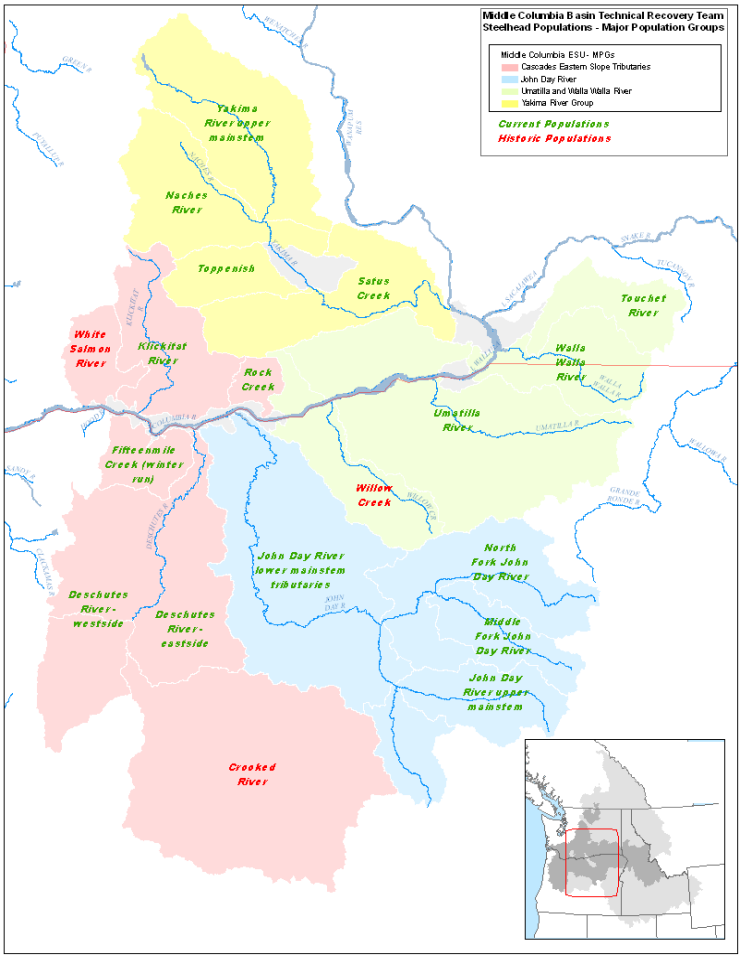

Figure 2-1. Independent Populations in the Middle Columbia River Steelhead DPS

The ICTRT grouped these independent populations into four major population groups (MPGs) within the DPS: the Cascades Eastern Slope Tributaries MPG, Yakima River MPG, John Day River MPG, and Umatilla/Walla Walla MPG. White Salmon is one of

two extirpated populations in the Cascades Eastern Slope Tributaries (Figure 2.2). Populations in the group are united primarily by proximity and occupy diverse habitats, generally those draining the eastern slopes of the Cascades and the Columbia Plateau.

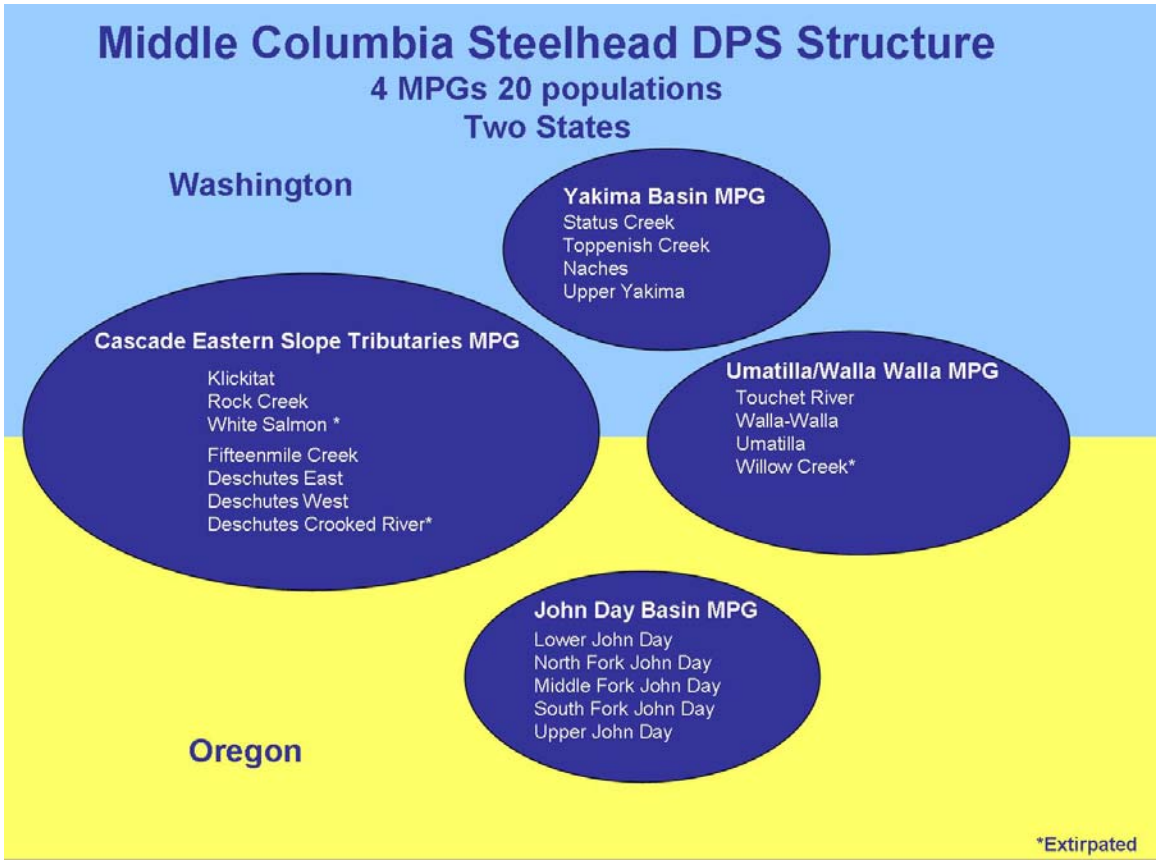

Figure 2-2. Major Population Groups and Populations of Middle Columbia Steelhead.

2.2 Physical Setting

The White Salmon watershed drains approximately 386 square miles in south central Washington. The river begins along the south slope of Mt. Adams and flows south 45 miles to enter the Columbia River at Underwood, Washington at RM 168.3. Elevation in the subbasin ranges from 12,307 feet on Mt. Adams to 72 feet at the river's mouth.

The White Salmon subbasin is part of Washington State's Mid-Columbia River Salmon Recovery Region, which encompasses salmon-bearing streams in Benton, Kittitas, Yakima, and parts of Klickitat county. These counties have a combined human population of 395,000. In addition, the subbasin falls within the state's Water Resource Inventory Area (WRIA) 29. Half of the subbasin lies within the Gifford Pinchot National Forest and supports timber production and recreational uses.

Several reaches of the White Salmon River have received special designations because of their scenic value. The nine-mile reach from the confluence of Gilmer Creek near BZ Corner to Buck Creek is a Federal Wild and Scenic River. A twenty-mile stretch of the

upper White Salmon and Cascade Creek received Senate approval for Wild and Scenic designation and await presidential approval. The reach from Condit Dam (RM 3.3) to the mouth is within the boundaries of the Columbia River Gorge National Scenic Area.

2.3 Ecosystem Conditions

The watershed displays a transitional environment where western areas receive moderate to heavy precipitation compared to more arid eastern areas. Vegetation reflects this transitional location, with mixed forests covering about 95 percent of the watershed and grasslands and shrub-steppe dominating remaining areas (Haring 2003). Trout Lake Valley, the major subbasin valley, is surrounded by hills to the west and rolling plateaus to the east.

The White Salmon River and tributaries carve a watershed that is often rugged and steep, reflecting its past volcanic activity (Figure 2-3). From its headwaters, the White Salmon cuts sharply through mountains with precipitous cliffs and deeply incised canyons, dropping more than 5,000 feet in elevation before it reaches Trout Lake near RM 26, with a gradient change of 200 feet per mile (4 percent) between RM 35 and RM 30. The White Salmon loses another 1,800 feet in elevation from Trout Lake to the Columbia River. Gradient drops an average of 100 feet per mile (2 percent) from RM 17 to RM 12 as the river flows through a steep gorge with several falls. Tributaries between RM 7.6 and 16.3 are inaccessible to fish because of high falls at their mouths (NPCC 2004; WDW 1990).

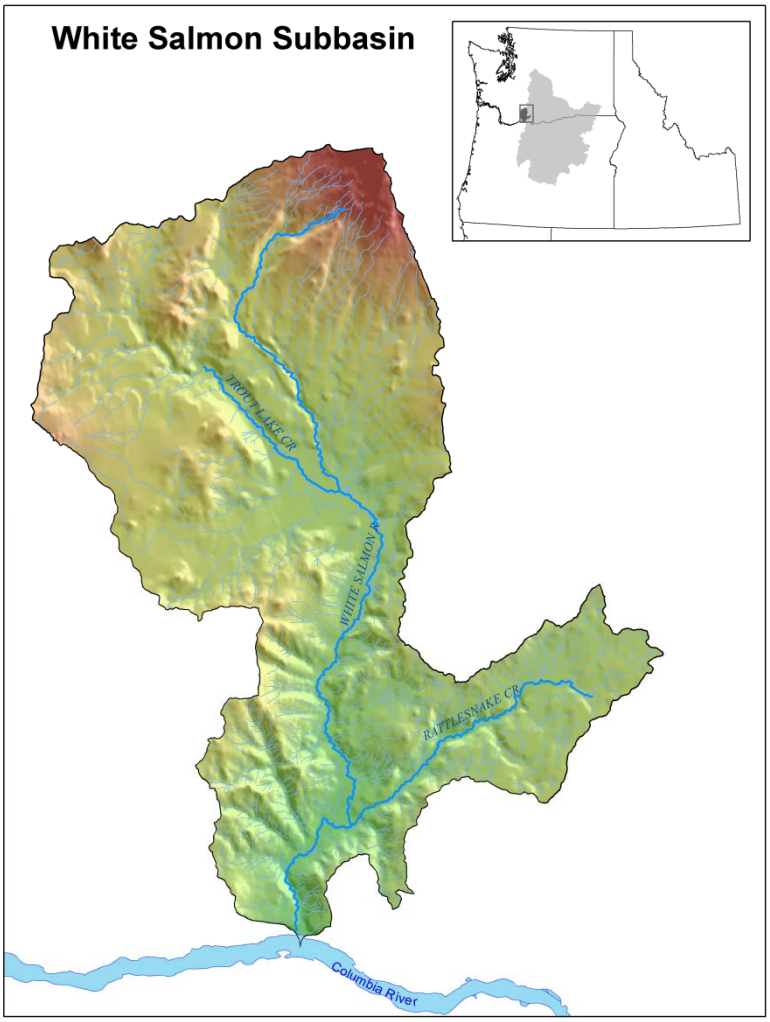

Figure 2-3. White Salmon subbasin, topography and hydrology (NPCC 2004).

2.3.1 Hydrology

The White Salmon River displays a relatively constant natural flow pattern because of glacial melt, large water recharge potential, and storage capacity. Today, this constant flow regime continues throughout much of the mainstem above Condit Dam. Recharged water is released mostly in the middle portion of the mainstem canyon between the Trout Lake Valley and Husum. Peak flows in the mainstem reflect snowmelt runoff, increasing from an average daily flow of 644 cfs during fall months to flows of 1,538 cfs in the spring (Haring 2003).

Operations at Condit Dam alter flows in the White Salmon River below the dam, causing flows to drop to as low as 15 cfs in the 1.1-mile bypass reach compared to natural flows of about 700 cfs. The dam has impacted the river system through power peaking, which causes diel flow variations, and by impairing watershed processes, such as the transportation of spawning gravels and large wood debris to areas below the project (NPCC 2004). PacifiCorp does have an agreement with the USFWS to maintain a flow

of 250 cfs, if possible, to ensure adequate water supply for the USFWS salmon rearing facility (RM 1.6) when there are fish in the rearing ponds. PacifiCorp has maintained these flows for the rearing ponds, although for short periods the flows have been dropped below 250 cfs because of maintenance activities (USFWS 2002).

Tributary reaches of the White Salmon generally display more volatile flows than the mainstem. Tributary stream flows drop to low levels in the summer and peak in the winter. Some tributaries only flow during high flow events and are dry the remainder of the year (NPCC 2004).

2.3.2 Migration Barriers

The upstream limit of all anadromous fish migration in the White Salmon River, except for possibly Pacific lamprey, is the upper falls at Big Brother Falls (RM 16.2) which is approximately 29 feet high. BZ Falls (RM 12.4), about 15 to 17 feet high, is likely to be a barrier for most salmonids, except for steelhead and possibly spring-run Chinook salmon. Husum Falls (RM 7.6) was a historical barrier to fall-run Chinook salmon, sea-run coastal cutthroat trout, and perhaps coho salmon, but the height of the falls was reduced through blasting shortly after the construction of Condit Dam (LLA 1981). Husum Falls is not currently a barrier to the passage of adult resident or anadromous salmonids, but is likely a barrier to the upstream passage of juvenile salmonids and adult chum salmon, as is a falls located at RM 2.6 of the mainstem. Numerous barrier falls 4 feet in height or greater on the river between Husum and Big Brother Falls are partial or complete barriers to the upstream migration of juvenile salmonids (LeMier and Smith 1955). Historic reports of steelhead occurring above Big Brother Falls (LLA 1981) appear to have been because of observers mistaking large resident rainbow trout (*O. mykiss*) for steelhead (Chapman et al. 1990; Bair et al. 2002).

Barriers also restrict salmon and steelhead production in several White Salmon tributaries. With the exception of steelhead, and possibly coho salmon under ideal flow conditions, the falls at RM 1.5 on Rattlesnake Creek and RM 0.8 on Mill Creek are barriers to upstream migration for all salmonids. A 4-foot high diversion dam at RM 1.9 on Buck Creek is a barrier to the upstream migration of salmonids < 9 inches in length (Bair et al. 2002). A waterfall at RM 3.2 on Buck Creek and at the hydro project dam at RM 0.7 on Spring Creek are complete barriers to upstream salmonid migration, as is a double-fall (72-82 feet) at RM 10.6 on Rattlesnake Creek (Allen et al. 2003).

2.3.3 Riparian Function and Condition

In comparison to other subbasins in the Columbia Basin, the White Salmon watershed is lightly to moderately developed. However, historical logging practices and associated road building, unscreened irrigation diversions, and inappropriate riparian grazing that impaired natural ecosystem functions have resulted in extreme flow fluctuations, increased sedimentation, reduced riparian vegetation, loss of large woody debris, and increased summer temperature in some areas (NPCC 2004). Until the mid-1980s, timber harvest typically extended to the edge of the stream/river. Extensive grazing occurred since the late 1800s in the Rattlesnake Creek watershed and Trout Lake Valley, reducing native vegetation. Large historic marsh areas in the upper Rattlesnake Creek watershed

were actively drained in the early 1900s to improve grazing conditions. Today, timber practices have improved, grazing is better managed, and wetland draining has stopped. Nevertheless, many impacts of past land use actions remain in the watershed (Haring 2003). Residential development is occurring with increasing frequency in the lower watershed and along SR 141.

Many habitat areas in the White Salmon River and tributaries remain healthy, with adequate food and oxygen throughout the system, essentially no detrimental chemicals or competition, few unscreened water diversions, and little concern for pathogens. Ecosystem Diagnosis and Treatment (EDT) modeling results show that mainstem habitat is in better shape than tributary habitat, with maximum temperatures, minimum temperatures, and dissolved oxygen remaining at optimum levels (Allen and Connolly 2005). Modeling results indicate, however, that there is potential for increasing the population performance of the diagnostic species in both the mainstem White Salmon and tributaries (Allen and Connolly 2005).

2.4 Life History Characteristics

Oncorhynchus mykiss, of which steelhead and rainbow trout are members, displays a wide variety of life history strategies (Busby et al. 1996). Anadromy is not obligatory in *O. mykiss*, and the heritability of anadromy is much debated (Rounsefell 1958; Mullan et al. 1992). Progeny of anadromous steelhead can spend their entire lives in freshwater (residualize), while progeny of rainbow trout can migrate seaward. The White Salmon subbasin supports both forms of *O. mykiss*. Although rainbow trout are not included in the Middle Columbia River steelhead DPS, genetic analysis shows that White Salmon steelhead and rainbow trout are an inland race of *O. mykiss* (Phelps et al. 1990; Phelps et al. 1994).

Some biologists believe that residual steelhead populations in the form of resident trout may contribute to anadromy in the subbasin. Phelps et al. (1990) found that introgression from hatchery rainbow plants was not evident in wild rainbow trout samples and high levels of genetic diversity still exist in this population. Seiler and Neuhauser (1985) caught more steelhead smolts than were predicted by the modeling. One hypothesis is that the steelhead smolts were produced from resident rainbow trout above Condit Dam, and the genetic diversity and fitness of anadromous *O. mykiss* has been maintained (NPCC 2004). *O. mykiss* from Rattlesnake Creek have been observed showing physiological changes consistent with smoltification, and fish have been detected outmigrating during the typical smolt migration period (B. Allen, personal communication, 2007). As further evidence in support of the retention of anadromous life history traits, a passive integrated transponder (PIT- tagged) *O. mykiss* was detected outmigrating from lower Rattlesnake Creek in March 2005, and was detected again in July 2006 moving up through the adult fish ladder at Bonneville Dam, possibly as a one-salt steelhead (B. Allen, personal communication, 2007).

Steelhead can be divided into two basic run types based on their level of sexual maturity at the time they enter fresh water and the duration of the spawning migration. The stream-maturing type, or summer steelhead, enters fresh water in a sexually immature

condition and requires several months in fresh water to mature and spawn. The ocean-maturing type, or winter steelhead, enters fresh water with well-developed gonads and spawns relatively shortly after river entry (Bambrick et al. 2004). Based on habitat conditions and the composition of nearby populations, it is likely that the White Salmon River population historically supported both summer and winter life history patterns (ICTRT 2008).

Steelhead generally return to the White Salmon River between April and October, although some hold over in the Columbia River throughout the year and enter the river as they approach spawning. Wild steelhead spawn from February to June, with peak spawning in April. Hatchery-reared summer steelhead in the White Salmon subbasin, however, typically spawn earlier, from December to February, with peak activity in January. Steelhead spawning and rearing currently occurs in the lower White Salmon and will occur in both mainstem and tributary habitats after dam removal.

Steelhead eggs incubate in their gravel beds for four to seven weeks, depending on water temperature, before hatching. After emergence, the small fry seek shallow, slow velocity areas within the stream channel, often associated with stream margins. As young steelhead mature they move into water with increasing depth and velocities. Juvenile steelhead typically spend two to three years in freshwater before outmigrating to the ocean. They typically move to interstitial spaces between cobble and boulders for cover during the fall, and remain in this habitat until March. In April, they return to a more active rearing life stage and seek out suitable habitat types. Outmigration occurs in spring and typically peaks in early May (NPCC 2004). Table 2-2 shows key habitat for steelhead during different life stages.

Table 2-2 Key habitat by life stage and time period for steelhead (NPCC 2004).

Life Stage	Relevant Months	Key Habitat Descriptions
Spawning	Mar-Jun	Riffles, tailouts and glides containing a mixture of gravel and cobble sizes with flow of sufficient depth for spawning activity
Incubation	Mar-Jun	Riffles, tailouts, and glides as described for spawning with sufficient flow for egg and alevin development.
Fry Colonization	May-Jul	Shallow, slow velocity areas within the stream channel, often associated with stream margins.
Active Rearing	0-age May-Jul; 1-age, Mar-Oct; 2+-age, Mar-Oct	Gravel and cobble substrates with sufficient depth and velocity, and boulder/large cobble/wood obstruction to reduce flow and concentrate food.
Inactive Rearing	0,1-age Oct-Mar	Stable cobble/boulder substrates with interstitial spaces.
Migrant	1-age, Mar-Jun 2+-age, Mar-Jun	All habitat types having sufficient flow for free movement of juvenile migrants.
Pre-spawning Migrant	Winter, Nov-Apr Summer, All	All habitat types having sufficient flow for free movement of sexually mature adult migrants.
Pre-spawning Holding	Winter, Dec-May Summer, All	Relatively slow, deep water habitat types typically associated with (or immediately adjacent to) the main channel.

Some steelhead are iteroparous (do not die after spawning). A small proportion of repeat spawners, known as kelts, may return to the ocean for a short period and repeat the spawning migration, a life history adaptation that may be fundamental to ensuring population stability. Iteroparity for Mid-Columbia steelhead ranges from reported rates of 2-4 percent above McNary Dam (at RM 292 measured from the mouth of the Columbia) (Busby et al. 1996) up to 17 percent in the unimpounded tributaries below Bonneville Dam (at RM 146.1) (Leider et al. 1986). Iteroparity rates of summer and winter steelhead in the Kalama River, a tributary to the Columbia below Bonneville Dam have been estimated at 15 percent and 21 percent respectively (Withler 1966, Leider et al. 1986), while repeat spawners in the Hood River, an Oregon tributary in the impounded Bonneville Pool above Bonneville Dam, make up 9 percent of the summer and 13 percent of the winter-run of steelhead (Olsen 2004). Iteroparity rates for Klickitat River steelhead were reported at 3.2 percent from combined sampling periods 1979 to 1981 (Howell et al. 1985) and 2005 (Yakama Nation and WDFW adult trapping data 2005). Sampling of adults at Lyle Falls Fishway in 2004 and 2005 has indicated repeat spawning rates of 2.9 percent for summer steelhead and 8.8 percent for winters. Most repeat spawners are females. Iteroparity is a life history trait that should be assessed once steelhead recolonize the White Salmon River, and taken into account when management decisions for White Salmon steelhead are made.

2.5 Hatchery Production and Releases

No hatchery programs in the White Salmon River subbasin are considered part of the Middle Columbia River steelhead DPS. Since 1986, hatchery steelhead from the Skamania Hatchery on the Washougal River have been released into the subbasin to support recreational and tribal fisheries below Condit Dam. This program was terminated with the 2008 releases.

Beginning in 1995, both summer and winter steelhead smolts from broodstock collected at the Skamania Hatchery on the West Fork of the Washougal River were released annually into the White Salmon River below Condit Dam. The summer steelhead broodstock was derived from summer steelhead from the Washougal and Klickitat Rivers. The winter steelhead broodstock was derived from returns to the Washougal River.

The Skamania Hatchery program goal was to provide fisheries for summer and winter steelhead in the White Salmon River as mitigation for hydrosystem development and concomitant habitat loss, and to meet the obligations of the *U.S. v. Oregon* agreement. The program involved an annual release of 24,000 summer and 20,000 winter steelhead smolts, although actual releases varied from year to year. Production consisted of adipose fin-clipped fish to allow for selective fisheries and to facilitate assessment of the ratio of hatchery adults to wild adults. The smolts were trucked from Skamania Hatchery and direct stream-released into the White Salmon River at RM 1.5.

A more suitable broodstock would have to be developed or identified if hatchery fish were used to expedite the recolonization of habitats upstream of Condit Dam. Stray rates for these programs have not been estimated. Monitoring steelhead escapement and production after the scheduled 2009 removal of Condit Dam will determine whether there are impacts from the 2008 releases.

2.6 Harvest

Steelhead fisheries in the White Salmon River are selective for marked hatchery fish, requiring the release of unmarked salmon and steelhead. Historically steelhead harvest, while locally imperative, was likely less important than salmon harvest because of lower abundances and spawning times that coincided with higher flows (NPCC 2004). The Yakama Nation reports that tribal members fished for steelhead historically as high as Husum Falls and Rattlesnake Falls on the White Salmon (J. Meninick, YN Cultural Resources Dept., personal communication, 2006).

3. Recovery Goals and Viability Criteria

The primary goal of ESA recovery plans is for the species to reach the point that it no longer needs the protection of the Act – i.e. to be delisted. Recovery plans may also contain "broad-sense goals," defined in the recovery planning process, that go beyond the requirements for delisting to address, for example, other legislative mandates or social, economic, and ecological values.

Delisting criteria are applied at the DPS level and are based on determinations of the viability of the independent populations that make up the DPS. Criteria for delisting the Middle Columbia steelhead DPS are described in the Middle Columbia Steelhead ESA Recovery Plan, to which this plan is an appendix. This chapter provides recovery goals for the White Salmon steelhead population, describes the criteria to be used to assess progress toward those goals, and describes the role of the White Salmon steelhead population in overall DPS viability.

There are two kinds of criteria that enter into a delisting decision: biological criteria defining viable populations (see Section 3.2) and "threats" criteria related to the five listing factors detailed in the ESA (see Section 3.3). The threats criteria define the conditions under which the listing factors, or threats, can be considered to be addressed or mitigated. Together these make up the "objective, measurable criteria" required under section 4(f)(1)(B). Both kinds of criteria are discussed in this chapter.

3.1 Recovery Goals

The primary goal of this plan is for the White Salmon steelhead population to be restored to viable status. A viable salmonid population is defined as an independent population that has negligible risk of extinction over a 100-year timeframe (McElhany et al. 2000).

If a local, collaborative recovery board is formed, it may choose to define additional, broad-sense goals for the White Salmon subbasin and other areas within the Gorge Management Unit. The board's broad-sense goals for the area would likely build upon direction already adopted by various stakeholders in the area. These goals would then guide the board as it defines and implements future recovery actions for the White Salmon subbasin.

3.2 Biological Viability Criteria

The ICTRT developed biologically based viability criteria for ESA-listed salmon and steelhead in the Interior Columbia domain. The ICTRT based its approach to recovery on guidance from the NMFS Technical Memorandum, *Viable Salmonid Populations and the Recovery of Evolutionarily Significant Units* (McElhany et al. 2000). This memorandum provides general direction for setting viability objectives at the ESU/DPS and component population levels.

Viability criteria at the population level address four VSP parameters (McElhany et al. 2000):

- *Abundance* – the average number of spawners in a population over a generation or more,
- *Productivity* – the performance of a population over time in terms of recruits produced per spawner,
- *Spatial Structure* – a population's geographic distribution and the processes that affect that distribution, and
- *Diversity* – the distribution of genetic, life history and phenotypic variation within and among populations.

The ICTRT grouped specific population level criteria into two categories to assess viability at the independent population level: measures addressing abundance and productivity, and measures addressing spatial structure and diversity. The viability of an independent population is determined by integrating risks across the four parameters.

The ICTRT's objective for population abundance and productivity is that abundance should be high enough that 1) in combination with intrinsic productivity, declines to critically low levels would be unlikely assuming recent historical patterns of environmental variability; 2) compensatory processes provide resilience to the effects of short term perturbations; and 3) subpopulation structure is maintained (e.g., multiple spawning tributaries, spawning patches, life history patterns) (ICTRT 2005).

The ICTRT developed criteria for characterizing the relative size and complexity of Interior Columbia Basin steelhead populations based on their analysis of the intrinsic or historical potential habitat available to the population (ICTRT 2005). This analysis used available Geographic Information System (GIS) data layers showing stream characteristics (e.g. channel width, gradient, valley confinement) and empirically derived relationships between habitat type, stream structure, landscape processes, and spawning. The ICTRT built a model that also incorporated information from local biologists and recovery planners to identify natural barriers to migration and other local variations.

Mid-Columbia steelhead spawn in a wide range of tributary drainage areas, from small creeks, e.g. Fifteenmile Creek or Rock Creek, to very large rivers, such as the Lower John Day. The ICTRT categorized historical population sizes as Basic, Intermediate, Large, and Very Large, and set minimum abundance thresholds for steelhead populations of each type as follows: Basic: 500 spawners; Intermediate, 1,000 spawners; Large, 1,500 spawners; Very Large, 2,250. The abundance thresholds are associated with minimum productivity thresholds, based on modeling studies described in ICTRT March 2007a and November 2007b. Abundance and productivity are linked, within limits; above a certain threshold, higher productivity can compensate for lower abundance and vice versa.

The ICTRT used the concept of the viability curve (W/LC TRT 2007) as a framework for defining population specific abundance and productivity levels to meet the objectives. A viability curve describes combinations of abundance and productivity that yield a

particular risk threshold. The two parameters are linked relative to extinction risks associated with short-term environmental variability. Given a particular productivity level, larger populations are more resilient in the face of year-to-year variability in overall survival rates than are smaller populations. Populations with relatively high intrinsic productivity (expected ratio of spawners to their parent spawners at low levels of abundance) are also more robust at a given level of abundance than populations with lower intrinsic productivity.

The ICTRT generated viability curves for each population to define the combinations of abundance and productivity corresponding to a range of extinction risks— less than 1 percent (very low), less than 5 percent (low), less than 25 percent (moderate), and greater than 25 percent (high) over a 100-year period (Figure 3-1). It targeted population level recovery strategies to achieve less than a 5 percent (low) risk of extinction in a 100-year period. This is consistent with the VSP guidelines and conservation literature (McElhany et al. 2000; NRC 1995).

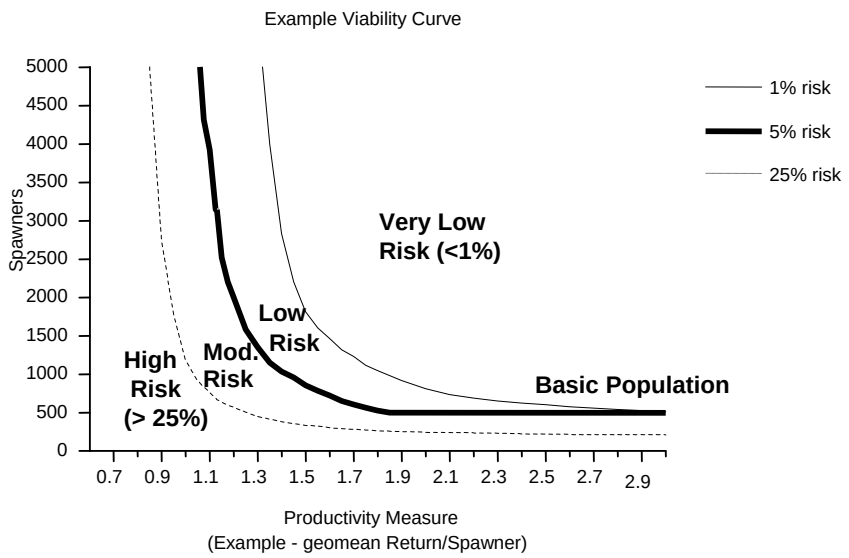

Figure 3-1. Example of an abundance/productivity viability curve.

3.2.1 DPS and MPG Viability Criteria

Since MPGs are geographically and genetically cohesive groups of populations, they are critical components of ESU/DPS spatial structure and diversity. Having all MPGs within an ESU/DPS at low risk provides the greatest probability of persistence for the ESU/DPS. Thus, the ICTRT criterion for a viable ESU/DPS is that all extant MPGs and any extirpated MPGs critical for proper functioning of the ESU/DPS should be at low risk. Further, the following five criteria should be met for an MPG to be regarded as at low risk (viable) (ICTRT 2007):

1. At least one-half of the populations historically within the MPG (with a minimum of two populations) should meet viability standards.

2. At least one population should be classified as “Highly Viable.”

3. Viable populations within an MPG should include some populations classified (based on historical intrinsic potential) as “Very Large," "Large," or “Intermediate,” generally reflecting the proportions historically present within the MPG. In particular, Very Large and Large populations should be at or above their composite historical fraction within each MPG.

4. All major life history strategies (e.g. spring and summer run timing) that were present historically within the MPG should be represented in populations meeting viability requirements.

5. Remaining MPG populations should be maintained with sufficient abundance, productivity, spatial structure, and diversity to provide for ecological functions and to preserve options for ESU/DPS recovery.

3.2.2 Application of Biological Viability Criteria to White Salmon Steelhead Population

The ICTRT classified the White Salmon River population as “basic” in size based on historical habitat potential (ICTRT 2007, Table 1).

Abundance and Productivity
For a basic population, viable status, i.e. a 5 percent or less risk of extinction over a 100-year timeframe, would require a mean abundance threshold of 500 naturally produced spawners. Viable populations demonstrate sufficient productivity to support a net replacement rate of 1:1 or higher at abundance levels established as long-term targets. Productivity rates at relatively low numbers of spawners should, on average, be sufficiently greater than 1.0 to allow the population to rapidly return to abundance target levels.

Spatial Structure and Diversity
In general, the ICTRT defined two goals, or biological or ecological objectives, that spatial structure and diversity criteria should achieve:

- Maintaining natural rates and levels of spatially mediated processes. This goal serves (1) to minimize the likelihood that populations will be lost due to local catastrophe, (2) to maintain natural rates of recolonization within the population and between populations, and (3) to maintain other population functions that depend on the spatial arrangement of the population.

- Maintaining natural patterns of variation. This goal serves to ensure that populations can withstand environmental variation in the short and long terms. (ICTRT 2007, p. 47)

White Salmon Steelhead Relation to MPG

The ICTRT applied the MPG-level viability criteria, defined in Section 3.2, to identify potential viability options for the Eastern Cascades Slope Tributaries MPG, which contains seven steelhead populations: five extant populations (Klickitat River, Deschutes River Westside, Deschutes River Eastside, Rock Creek and Fifteenmile Creek) and two extirpated (White Salmon and Deschutes Crooked River).

Meeting the draft ICTRT MPG criteria would require that at least four of the seven historical populations in this MPG exceed population-level viability objectives, including two from the Large or Very Large size categories. The extirpated White Salmon population is not needed for the MPG to meet these criteria; other populations in the MPG have the size and life history characteristics needed to preserve historical diversity. But the ICTRT cautioned that there are many uncertainties involved in recovery. If the White Salmon population were to be restored even at the level of 25 percent risk, called "maintained" status, it could provide additional support to the DPS in the following ways:

- Provide a hedge against the potential risk that the cumulative productivity across populations within an MPG may fall below replacement.
- Provide insurance against catastrophic events. For example, if a catastrophe impacts one or more of the functioning viable populations within the MPG, the other populations will need to be at sufficient levels so that they can replenish those populations lost to or affected by the catastrophe.
- Allowsthese populations to serve as genetic or demographic "stepping stones" between populations, allowing natural patterns of gene flow and dispersal.
- Providesa buffer against uncertainty in the ICTRT population and MPG criteria. For example, having populations meet maintained standards preserves recovery options in the event that efforts to recover other populations to viable levels fail.

The conclusion for this recovery plan is that the White Salmon steelhead population should be restored to viable status to support the viability of the Cascades Eastern Slope Tributaries MPG and the conservation and survival of the Middle Columbia steelhead DPS.

3.3 Threats Criteria

Listing factors are those features that were evaluated under section 4(a)(1) when the initial determination was made to list the species for protection under the ESA. These may or may not still be limiting recovery when in the future NMFS reevaluates the status of the species to determine whether the protections of the ESA are no longer warranted and the species could be de-listed.

At the time of a delisting decision, NMFS will examine whether the section 4(a)(1) listing factors have been addressed. To assist in this examination, NMFS will use the listing factors (or threats) criteria described in the Middle Columbia steelhead DPS recovery plan, additional data that may have emerged relevant to specific threats to the

White Salmon population, as well as evaluation of biological recovery criteria and other relevant data and policy considerations.

To determine that the affected DPS is recovered to the point that it no longer requires the protections of the ESA, NMFS will review the status of the listing factors according to the specific criteria identified for each of them (see below). The threats need to have been addressed to the point that delisting is not likely to result in their re-emergence. It is possible that current perceived threats will become insignificant in the future as a result of changes in the natural environment or changes in the way threats affect the entire life cycle of salmon. Consequently, NMFS expects that the ranking of threats will change over time and that new threats may be identified. During the 5-year status reviews, NMFS will evaluate and review the listing factor criteria under conditions at the time.

The specific criteria listed below for each of the relevant listing/delisting factors helps to ensure that underlying causes of decline have been addressed and mitigated prior to considering a species for delisting. NMFS expects that if the proposed actions described in the Plan are implemented, they will make substantial progress toward meeting the following listing factor (threats) criteria:

Factor A: The present or threatened destruction, modification, or curtailment of its habitat or range

To determine that the DPS is recovered, threats to habitat should be addressed to a degree sufficient to support a viable Middle Columbia River steelhead DPS as outlined below:

1. Impaired fish passage (e.g., dams and culverts) is addressed, either through removal or modification of obstructions, to improve survival and restore access to historically accessible habitat where necessary to support recovery goals.
2. Flow conditions that support sufficient steelhead rearing, spawning, and migration of a viable DPS are achieved, where possible, through management of Klickitat mainstem and tributary irrigation and hydropower operations, and through the improvement of other water user efficiencies and conservation, including for municipal supply and other consumptive purposes.
3. Forest management practices that protect watershed and stream functions are implemented on Federal, state, tribal, and private lands.
4. Agricultural practices, including grazing, are implemented to protect and restore riparian areas, floodplains, and stream channels, and to protect water quality from sediment, pesticide, herbicide, and fertilizer runoff.
5. Urban and rural development, including land use conversion from agriculture and forestland to residential uses, avoids impairment of water quality or impair natural stream conditions.
6. The effects of toxic contaminants on salmonid fitness and survival in the Klickitat mainstem and tributaries are sufficiently limited so as not to affect recovery.

7. Channel function, including vegetated riparian areas, canopy cover, stream-bank stability, off-channel and side-channel habitats, natural substrate and sediment processes, and channel complexity is restored to provide adequate rearing and spawning habitat.
8. Floodplain function and the availability of floodplain habitats for salmon are restored to a degree sufficient to support a viable DPS. This restoration should include connectivity between river and floodplain and the restoration of altered sediment routing.
9. Water operations management in the mainstem Klickitat and tributaries maximize survival of juvenile rearing, emigrating smolts, and immigrating and spawning adults.

Factor B: Over-utilization for commercial, recreational, scientific or educational purposes

To determine that the DPS is recovered, any utilization for commercial, recreational, scientific, or educational purposes should be managed as outlined below:

1. Fishery management plans for steelhead are in place that (a) accurately account for total fishery mortality (i.e., both landed catch and non-landed mortalities) and constrain mortality rates to levels that are consistent with achieving population viability (i.e., provide for adequate spawning escapement given their productivity); and (b) are implemented in such a way as to avoid deleterious genetic effects on populations or negatively affect the distribution of populations.
2. Federal, state and tribal fishing rules and regulations are effectively enforced.
3. Technical tools accurately assess the effects of the harvest regimes so that harvest objectives are met but not exceeded.
4. Scientific handling of fish from adult and juvenile trapping operations is minimized to reduce indirect mortalities associated with education or scientific programs, while recognizing that monitoring, research, and education are key actions for conservation of the species.
5. To the degree sufficient to support a viable DPS, routine instream construction and maintenance practices are implemented in a manner to reduce or eliminate mortality of listed species.

Factor C: Disease or predation

To determine that the DPS is recovered, any disease or predation that threatens its continued existence should be addressed as outlined below:

1. Hatchery operations do not subject steelhead populations to deleterious diseases and parasites and do not result in increased predation rates of wild steelhead.
2. Predation by avian predators is managed in a way that promotes recovery of salmon and steelhead populations.

3. The northern pikeminnow are managed to reduce predation on steelhead to a degree sufficient to meet recovery goals.

4. Populations of introduced smallmouth bass, walleye, and catfish are managed such that competition or predation does not impede steelhead recovery.

5. **PREDATION BY MARINE MAMMALS ON STEELHEAD RUNS BELOW BONNEVILLE DAM IS MANAGED WITHIN THE FRAMEWORK OF APPLICABLE STATUTES AND TO THE DEGREE NECESSARY TO PROTECT UPSTREAM MIGRATION OF STEELHEAD.**

6. Physiological stress and physical injury that may cause disease or increase susceptibility to pathogens during rearing or migration should be reduced during critical low flow periods (e.g. low water years) or poor passage conditions (e.g. at diversion dams or bypasses).

Factor D: The inadequacy of existing regulatory mechanisms

To determine that the DPS is recovered, any inadequacy of existing regulatory mechanisms that threatens its continued existence should be addressed to the degree necessary to support a viable DPS, as outlined below:

1. Sufficient resources, priorities, regulatory frameworks, and coordination mechanisms are established and/or maintained for effective enforcement of land and water use regulations that protect and restore habitats and for the effective management of fisheries.

2. Habitat conditions and watershed functions are protected through land-use planning that guides human population growth and development.

3. Habitat conditions and watershed function are protected through regulations that govern resource extraction such as timber harvest and gravel mining.

4. Habitat conditions and watershed functions are protected through land protection agreements as appropriate, where existing policy or regulations do not provide adequate protection.

5. Regulatory, control, and education measures to prevent additional exotic plant and animal species invasions are in place.

Factor E: Other natural or human-made factors affecting its continued existence

To determine that the DPS is recovered, other natural and human-made threats to its continued existence should be addressed as outlined below:

1. Steelhead hatchery programs are being operated in a manner that is consistent with individual watershed and region-wide recovery approaches; appropriate criteria should be used for the integration of hatchery steelhead populations and extant natural populations inhabiting watersheds where the hatchery fish return.

2. Hatcheries operate using appropriate ecological, genetic, and demographic risk containment measures for (1) hatchery-origin adults returning to natural spawning

areas, (2) release of hatchery juveniles, (3) handling of natural-origin adults at hatchery facilities, (4) withdrawal of water for hatchery use, (5) discharge of hatchery effluent, and (6) maintenance of fish health during their propagation in the hatchery.

3. Mechanisms are in place to effectively continue monitoring the proportion of hatchery and wild spawners in the subbasin.

4. Mechanisms are in place to reduce the incidence of, and impacts from, introduced, invasive, or exotic plant and animal species.

5. Nutrient enrichment programs should be evaluated to determine where additional nutrient inputs can provide significant benefits.

4. Current Status Assessment

This chapter summarizes currently available information about Middle Columbia steelhead in the White Salmon watershed, including the ICTRT's viability assessment for this population (ICTRT 2008). Related research reports from the ICTRT are available on the Northwest Fisheries Science Center website, http://www.nwfsc.noaa.gov/trt/.

The ICTRT classified the White Salmon River population as "basic" in size based on historical habitat potential (Table 4–1) (ICTRT 2008). A steelhead population classified as basic has a mean minimum abundance threshold criteria of 500 natural-origin spawners with a sufficient intrinsic productivity (≥ 1.56 recruits per spawner at the minimum abundance threshold) to achieve a 5 percent or less risk ("low risk") of extinction over a 100-year timeframe. In order for the White Salmon River population to achieve a 1 percent or less risk ("very low risk") of extinction over 100 years, productivity would need to be at or greater than 1.64 recruits per spawner at the minimum abundance threshold.

Table 4-1 White Salmon summer/winter steelhead basin statistics (ICTRT 2008).

Drainage Area (km2)	1,368
Stream lengths km* (total)	562
Stream lengths km* (below natural barriers)	85
Branched stream area weighted by intrinsic potential (km2)	0.192
Branched stream area km2 (weighted and temp. limited)	0.192
Total stream area weighted by intrinsic potential (km2)	0.480
Total stream area weighted by intrinsic potential (km2) temp limited	0.480
Size and Complexity category	Basic
Number of MaSAs	1
Number of MiSAs	0

* All stream segments greater than or equal to 3.8m bankfull width were included

**Temperature limited areas were assessed by subtracting area where the mean weekly modeled water temperature was greater than 22°C.

4.1 Abundance and Productivity

The White Salmon steelhead population is considered functionally extirpated. The abundance of native summer and winter steelhead in the White Salmon River before 1919, when the loss of the fish ladder at Condit Dam blocked passage to upriver spawning and rearing grounds, is unknown. Today, some natural steelhead production occurs in the reach below Condit Dam (Bambrick et al. 2004). This natural production has not been extensively monitored, but is believed to be very low. Although there may be some remnant genetic influences from the original White Salmon River steelhead population in fish spawning in the small section of the White Salmon River below Condit Dam, those fish are primarily returns from large releases of out-of-basin hatchery stock.

Historically, this reach supported only 10 percent of steelhead spawning in the White Salmon subbasin, while areas above Condit Dam provided 90 percent of steelhead habitat (NPCC 2004). Of the 3 river miles below Condit Dam, about 1.5 miles are inundated by the Bonneville Dam pool; one mile between the dam and the powerhouse has reduced flows and is in a canyon. Flow in this latter section will be restored after the scheduled dam breach in 2009. EDT models indicate that the reach is capable of supporting a steelhead run size under average ocean conditions of 20 to 50 adults (NPCC 2004).

Table 4-1 shows steelhead performance in the subbasin based on recent EDT modeling results. These results indicate that steelhead productivity in the subbasin dropped from 20.4 under historical conditions to 4.1 with current conditions. EDT results for the White Salmon population reflect steelhead performance in a nearby river system, the Wind River and its major tributary Trout Creek. Planners used information from the Wind River, where good information is available, to supplement limited data for White Salmon steelhead. They consider the EDT-based projections of White Salmon steelhead performance to be reasonable because the rationale developed for using derived information and expanding empirical data for the Wind River was incorporated into the development of the White Salmon River EDT dataset (NPCC 2004).

Table 4-1 Changes in potential steelhead performance in the White Salmon Subbasin from historical to current conditions, based on EDT results (NPCC 2004).

Population	*Scenario*	*Diversity Index*	*Productivity*	*Capacity*	*Abundance*
White Salmon Steelhead	Current without harvest	4%	4.1	26	20
	Historical Potential	95%	20.4	1,196	1,137

4.2 Spatial Structure and Diversity

Biologists generally believe that White Salmon steelhead historically ranged from the mouth to RM 16.3 in the mainstem and into Buck, Spring, Indian and Rattlesnake Creeks (Figure 2-2) (NPCC 2004). Some anecdotal historic records (WDF 1951), suggest that anadromous fish may have once ascended the White Salmon River as far as Trout Lake (RM 28.2). Most biologists, however, consider Big Brother Falls (RM 16.2) to be the upper limit of historical steelhead migration (NPCC 2004). This historical range provided approximately 33 to 40 miles of steelhead spawning and rearing habitat (NPCC 2004; Bambrick et al. 2004; Ecology 2004).

The ICTRT identified one major spawning area (MaSA), Big Brother Falls, within the White Salmon subbasin based on its historical intrinsic potential analysis. The ICTRT defines a MaSA as a system of one or more branches that contains sufficient habitat to support at least 500 spawners. The ICTRT does not consider any population fewer than 500 spawners to be viable, regardless of its intrinsic productivity.

The White Salmon subbasin does not contain any minor spawning areas, or contiguous production areas capable of supporting between 50 and 500 spawners.

The ICTRT identified the MaSA in the White Salmon subbasin using model results that estimated the historical amount of potentially accessible spawning and rearing habitat available to a specific population based on stream width, gradient, and valley width from GIS-based analysis of tributary habitat associated with each population (ICTRT 2005). It did not identify any minor spawning areas, contiguous production areas capable of supporting between 50 and 500 spawners, in the subbasin. Figure 4-1 shows the population boundary and major spawning area identified by the ICTRT for steelhead in the White Salmon subbasin.

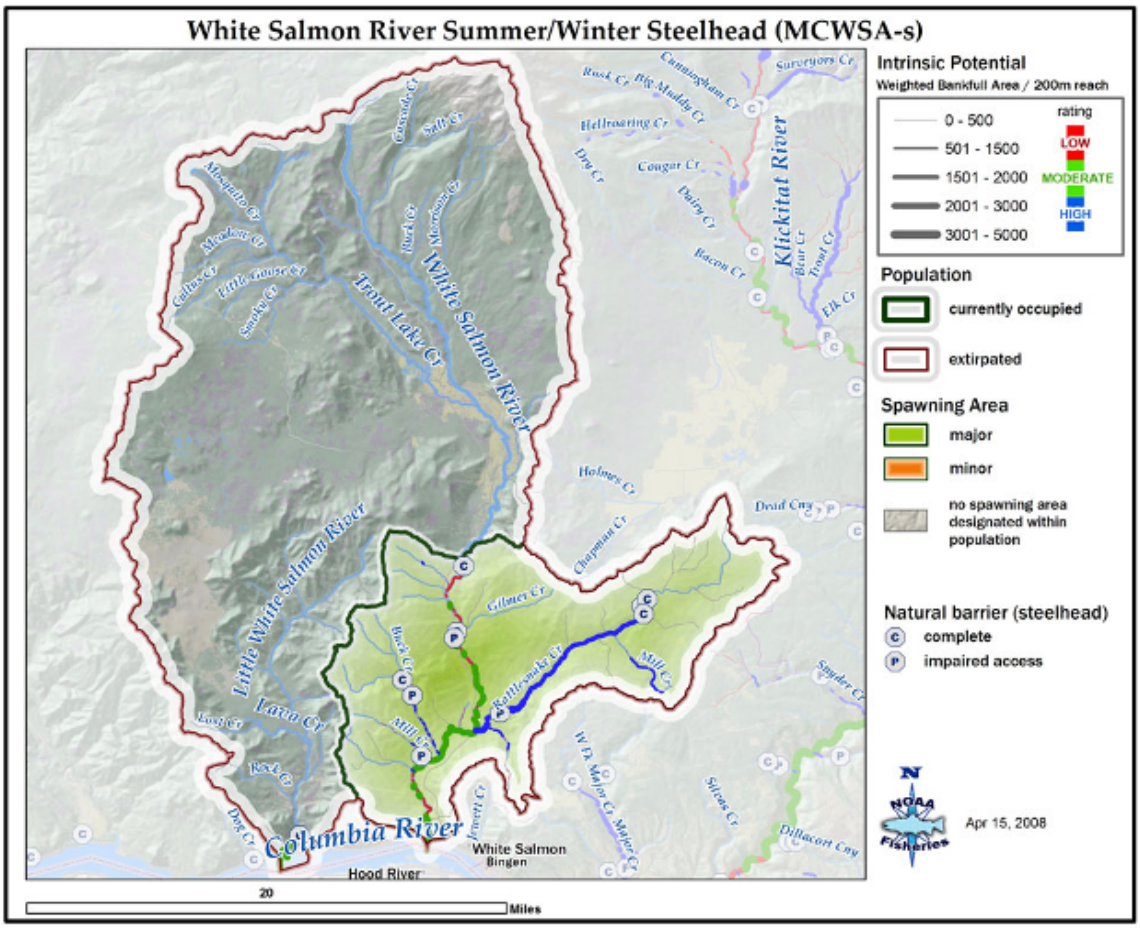

Figure 4-1 White Salmon River summer/winter steelhead population boundary and Major Spawning Area (MaSA) (ICTRT 2008).

5. Limiting Factors and Threats

The reasons for a species' decline are generally described in terms of limiting factors and threats. Analysis of limiting factors and threats across the entire species' life cycle forms the basis for designing recovery strategies and actions. NMFS defines limiting factors as the biological and physical conditions limiting DPS and population status (e.g. elevated water temperature), and defines threats as those human activities or naturally induced actions that cause the limiting factors (e.g. removal of riparian vegetation for agricultural or residential purposes, which causes loss of shade and, consequently, elevated water temperature).

For steelhead and other salmonids, survival to reproduce depends on a complex, interacting system of environmental conditions, with different conditions needed for each life stage. Optimal water temperature, for example, varies (within limits) for adult migration vs. egg incubation or juvenile rearing. Because of this complexity, in many cases the actual limiting factors are poorly understood.

The list of limiting factors for the White Salmon steelhead population, as for the other populations that make up the DPS, is based on a substantial body of research on salmonids, local field data and field observations, and the considered opinions of regional experts. These are implicitly hypothetical statements, made with the expectation that by taking action in the face of some degree of scientific uncertainty, monitoring the results, continuing to conduct research as a high priority, and adapting our management actions in response, the state of our knowledge will improve and so will the survival of these fish, although not necessarily in a directly parallel process.

In that spirit, this chapter describes factors that may be limiting Middle Columbia River steelhead production in the White Salmon subbasin. Section 5.1 identifies freshwater life cycle limiting factors. Section 5.2 describes effects on the populations from hatchery production and releases. Section 5.3 discusses impacts from harvest. Section 5.4 identifies effects from the Columbia River hydrosystem. Sections 5.5 and 5.6 discuss effects of ocean conditions and predation. Section 5.7 summarizes the primary limiting factors for the independent populations.

5.1 Freshwater Habitat

Key freshwater habitat-related factors leading to the decline and/or extirpation of White Salmon River steelhead are discussed below. Habitat-related limiting factors generally express themselves across all populations. Although impact to a species or life stage affected may differ in magnitude because of the utilization of differing habitat niches and timing of incidence in the subbasin, each species is impacted by all the limiting factors and addressing one or more of the limiting factors generally will improve conditions for all species. Exceptions exist, such as removing or improving partial barriers in areas only likely to be reached by steelhead, but factors such as sedimentation, altered flow regimes, and water temperature are likely to affect multiple species.

The discussions reflect the results of recent EDT modeling for the White Salmon subbasin by the USGS under contract to the Yakama Nation and in cooperation with EDT modeling performed by WDFW for the NPCC subbasin planning effort in 2005. Results from the USGS modeling effort are available in 'Assessment of the White Salmon Watershed Using the Ecosystem Diagnosis and Treatment Model' (Allen and Connolly 2005). http://www.mobrand.com/edt.

5.1.1 Blocked Migration and Impaired Passage

The single greatest factor limiting salmon and steelhead populations in the White Salmon subbasin is the construction and operation of Condit Dam. Salmon and steelhead currently access only a small percentage of their historical spawning and rearing areas. Table 5-1 presents the current and historical distribution within the White Salmon subbasin. Chum is the only species that still accesses all of its historical range.

Lack of access by salmon and steelhead to areas above Condit Dam has also halted the marine-derived nutrients cycle. In areas where anadromous fish spawning previously occurred, nutrients and trophic activity that benefit fish, mammals, birds, insects, and vegetation have been lost.

Table 5-1. River miles of salmon and steelhead habitat above and below Condit Dam (NPCC 2004).

Species	*Historical Distribution*	*Current Distribution*	*% of Historical Access*	*Comments*
Chum	1.2 miles	1.2	100%	80% of spawning area flooded by Bonneville Dam
Fall Chinook	3.6 miles	3.4	94%	6% of spawning area above Condit Dam
Sp. Chinook	12.8	0	0%	All spawning area above Condit Dam
Coho	21.1	3.4	16%	Majority of spawning area above Condit Dam
Steelhead	32.9	3.4	10%	Majority of spawning area above Condit Dam

5.1.2 Altered Flow Regimes

Operations at Condit Dam have reduced the rearing potential in the bypass reach below the dam because minimum flows are 15 cfs, compared to natural low flows of approximately 700 cfs. Power peaking associated with dam operation causes further diel flow variation, which has led to dewatering, stranding, and an increase in bioenergetic losses because of movements associated with daily flow changes.

Hydrologic characteristics (peak flows and intra-annual flow) have also been altered through anthropogenic changes in the watershed. A watershed analysis conducted by the U.S. Forest Service in the upper White Salmon River indicated that based on past

management activities, portions of the upper White Salmon River may be subject to increased peak flow events (USFS 1998). Tributary reaches of the White Salmon generally display more volatile flows than the mainstem. Road building, removal of trees from riparian areas, clearing of forests and agricultural lands, loss of wetlands, and other impacts on ecosystem function have increased the intensity of flows in some tributary reaches.

5.1.3 Degraded Channel Structure, Riparian Condition and Floodplain Connectivity

Anthropogenic changes have contributed to a loss of stream corridor structure and function, primarily in the tributaries. Today, some stream reaches suffer from lack of floodplain connectivity, loss of deep pools, reduced conifer densities and size in the riparian zone, lack of large woody debris and increased sediment load (the percentage of fines in spawning gravel, embeddedness and turbidity).

Both timber harvest and fires have impacted forested lands within the subbasin. Seventy-two percent of riparian areas within the upper White Salmon are considered to be late-successional, as compared with 38 percent for the entire basin (USFWS 2002). Dam operations have impaired vital watershed processes below the dam, including bedload transportation and downstream distribution of large woody debris. Recruitment of this material is essential to the creation and maintenance of quality spawning and rearing habitat below the dam. After over 90 years of impoundment, few quality spawning and rearing areas remain in the lower river.

Roads affect salmonid habitat in the White Salmon drainage by reducing natural infiltration and increasing hydroconfinement, leading to altered flow regimes and peak flows, and increased delivery of fine sediment to streams. Road densities in the upper, middle, and lower White Salmon River were calculated to be 3.7 miles per square mile (2.3 kilometers per square km), 3.1 miles per square mile (1.9 kilometers per square kilometer), and 4.0 miles per square mile (2.5 km per square km), respectively. Tributary road density in the upper White Salmon ranged from 0.2 to 4.4 miles per square mile (0.1 to 2.7 km per square km) (USFWS 2002). Road densities in Rattlesnake Creek were found to be 3.54 miles per square mile (2.2 km per square km); Buck Creek has a density of 5.05 miles per square mile (3.1 km per square km) (Allen and Connolly 2005).

5.1.4 Impaired Water Quality

Water quality in the mainstem White Salmon River remains very good. Maximum temperatures and dissolved oxygen levels remain near optimum levels for salmonids. Maximum temperatures in some tributaries, however, have increased because of water withdrawals and lack of mature conifers in the riparian zone. Nutrient enhancement has increased slightly compared to historical levels in both the mainstem and tributaries, as measured by fecal coliform counts, likely because of agriculture and failed septic systems (NPCC 2004). There are currently several segments of the mainstem White Salmon and tributaries listed as impaired waterways (303(d) listings) by the Washington State Department of Ecology, athough some of the data on which these listings are based needs to be updated. Individual reaches on Gilmer Creek, Rattlesnake Creek, the mainstem

White Salmon and Trout Lake Ditch are all listed as Category 5 (water quality impaired) for fecal coliform. Temperature impairments have led to the Category 5 listing of reaches on Indian and Rattlesnake creeks (http://apps.ecy.wa.gov/wats/WATSQBEHome.asp).

5.2 Hatchery Production and Releases

Hatchery summer and winter steelhead from Skamania broodstock have been released into the White Salmon River below Condit Dam to support tribal and recreational fisheries. All hatchery fish are marked to allow for selective fisheries. These releases may limit the diversity of any naturally produced winter steelhead in the basin. However, the primary limitation on summer and winter steelhead in the White Salmon River is limited spawning and rearing habitat. Further, Skamania stock steelhead are not considered reproductively successful when spawning naturally; thus, adverse effects may be limited. The release of these hatchery fish has been terminated as of 2008, and any potential impacts are expected to diminish after 2009.

5.3 Harvest

Harvest does not limit the abundance or diversity of White Salmon River steelhead. The following information may be relevant if naturally produced steelhead begin recolonizing historical habitat after the removal of Condit Dam.

Steelhead fisheries in the White Salmon River, are selective for marked hatchery fish, requiring the release of unmarked fish. Wild summer steelhead impacts were substantially reduced in 1986 after wild steelhead release regulations were enacted. Current impacts from tributary sport fisheries are estimated to be 4 percent for summer steelhead and 4 percent for winter steelhead (NPCC 2004).

Since steelhead in the White Salmon River basin are listed for protection under the ESA, tributary fisheries must be approved by NMFS. WDFW developed a Fisheries Monitoring and Evaluation Plan (FMEP) for steelhead and salmon fisheries in the Mid-Columbia River ESU/DPS in 2001 and is in final consultation with NMFS for a section 4(d) permit for these activities.

Mainstem Columbia River sport and commercial impacts are not estimated directly for White Salmon River steelhead, but are estimated for the Middle Columbia River steelhead DPS (Figure 5-1). Middle Columbia River impacts are less than 2 percent and these impacts occur mainly in the spring Chinook tangle net fishery and the summer steelhead sport fishery (NPCC 2004). WDFW receives authorization for these fisheries through a section 7/10 consultation and biological opinion from NMFS.

Tribal fisheries affect both summer and winter steelhead. These fisheries are authorized through a section 7/10 consultation and biological opinion from NMFS. Tribal fisheries target salmon stocks; steelhead may be incidentally taken when salmon fishing. Summer steelhead are caught primarily in the fall fishery, with fewer fish caught in other fisheries. They are also intercepted in ceremonial and subsistence fisheries. In 2003, the projected impacts to wild Middle Columbia River steelhead from tribal fisheries was 4 percent and

the maximum impact was 9 percent. The annual cumulative impact from all fisheries is likely to range from 11 percent to a maximum of 16 percent of run size (NPCC 2004).

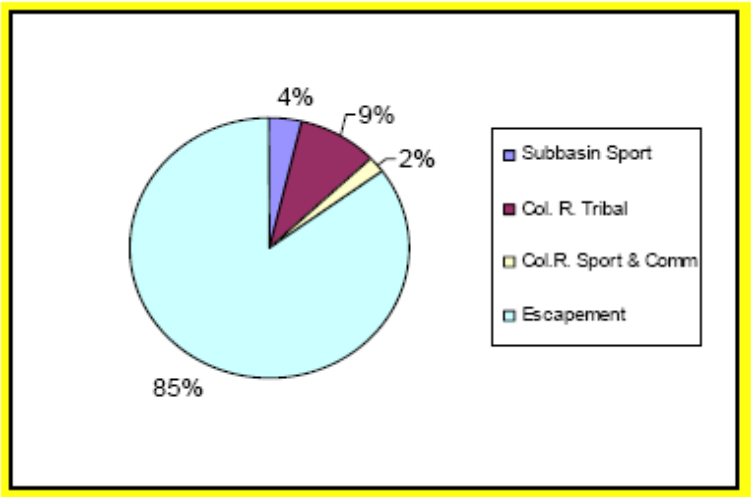

Figure 5-1 Estimated harvest rate by fisheries for White Salmon subbasin wild steelhead (NPCC 2004).

5.4 Hydrosystem

All populations of Mid-Columbia steelhead use the mainstem Columbia River to migrate to and from the ocean, and all are affected by the mainstem Federal dams. Development and operation of the mainstem Columbia River hydropower system significantly alters travel conditions in the mainstem Columbia River, resulting in direct mortality of both upstream migrating adults and downstream migrating steelhead kelts, and direct and indirect mortality for downstream migrants (juveniles). The hydro system also changes the hydrograph, depleting historically available nutrients, changing water temperatures, and degrading rearing and food resources for both presmolts and smolts in the Columbia. Changes in the hydrograph leave steelhead more vulnerable to bird predation in the Columbia River estuary and mainstem.

Before the development of the hydrosystem, Columbia River flows were characterized by high spring runoff from snowmelt and regular winter and spring floods. Dam construction and operations have altered Columbia River flow patterns substantially in the Columbia River and estuary. Historical flow records at The Dalles, Bonneville Dam, and Beaver, Oregon, demonstrate that spring freshet flows have been reduced by about 50 percent, as water is stored for power generation and irrigation. Winter flows have increased about 30 percent (Figure 5-2).

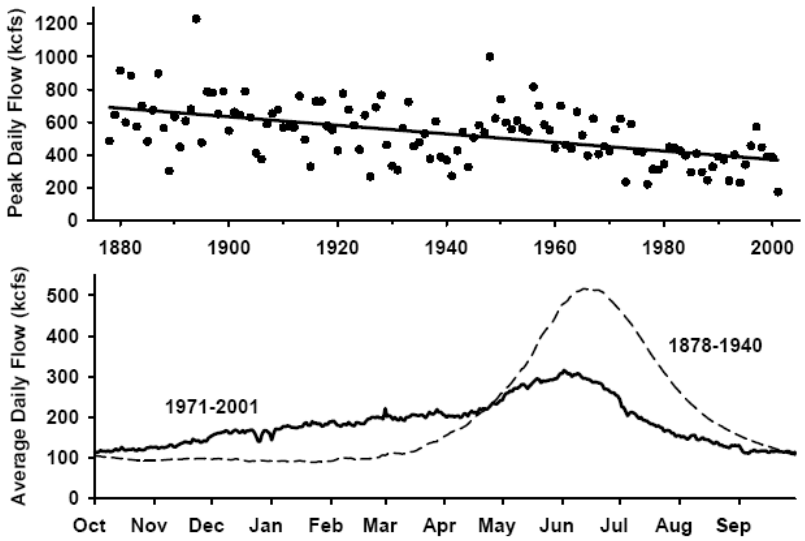

Figure 5-2 Historical changes in average daily flow patterns and flood frequency in the Columbia River at The Dalles (LCFRB 2004).

Flow regulation and reservoir construction have also increased average water temperature in the Columbia River mainstem (Figure 5-3). Summer water temperatures now regularly exceed optimums for salmon (LCFRB 2004). Water temperatures in fish ladders can be higher than ambient river temperatures, which compounds this problem.

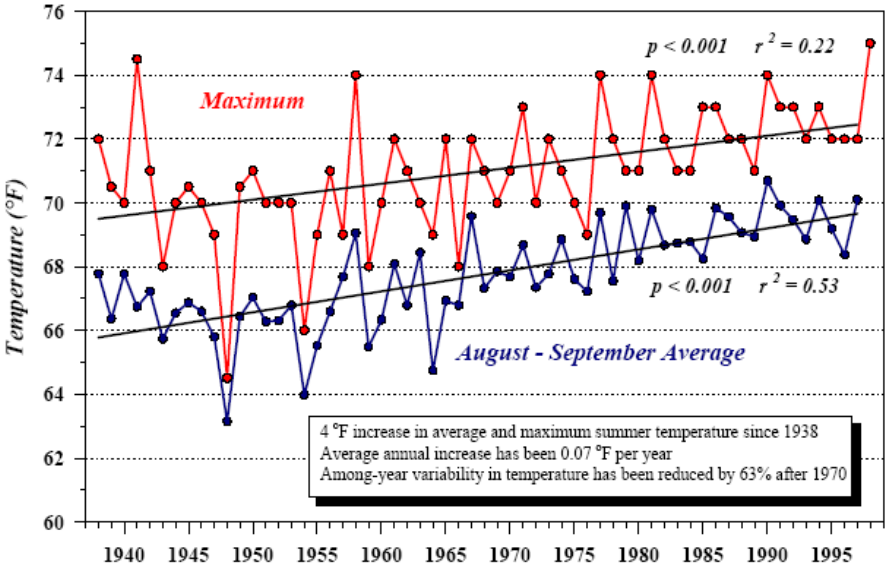

Figure 5-3 Historical changes in summer water temperatures at Bonneville Dam (LCFRB 2004).

The effects of the hydrosystem ─ along with other anthropogenic factors such as channel confinement (primarily diking), channel manipulation (primarily dredging), floodplain development and water withdrawals ─ have significantly influenced salmonid productivity in the Columbia River estuary. Because estuaries provide juvenile salmonids an opportunity to achieve the critical growth necessary to survive in the ocean, proximity of high-energy areas with ample food availability and sufficient refuge habitat

is a key habitat structure necessary for salmonid growth and survival. Loss of connections among these habitats can determine whether juvenile salmonids are able to access the full spectrum of habitats they require.

Reduction of maximum flow levels, dredged material deposition, and diking have all but eliminated overbank flows in the Columbia River, resulting in reduced large woody debris recruitment and riverine sediment transport to the estuary. Water level fluctuations associated with hydropower peak operations may reduce habitat availability and strand juveniles during the downstream migration. Limiting factors for salmon and steelhead from altered flows include:

- Lack of sediments delivered to estuary
- Disruption of natural flow patterns (that affect migration and predation)
- Altered estuarine salinity patterns and estuary turbidity maximum function
- Loss of water-driven access to river edge and off-channel habitat
- Decreased recruitment of macrodetritus (decreased food web productivity)
- Altered juvenile migrations and stranding
- Disrupted turbidity patterns (decreased predator avoidance)

5.4.1 Dam impacts on Outmigrating Smolts

As anadromous juvenile salmonids migrate from freshwater rearing habitats to the ocean, they are vulnerable to a host of factors that affect their survival. Many studies have been conducted in recent years to determine both the direct effects associated with dam passage (e.g., instantaneous mortality, injury, loss of equilibrium, etc.) and indirect effects (e.g., predation, disease, and physiological stress), which contribute to the total mortality of seaward migrating salmonids (Counihan et al. 2005).

White Salmon River salmonids must pass only Bonneville Dam on their way to and from the Pacific Ocean. Annual studies using radio telemetry conducted over recent years have permitted fisheries managers and scientists to ascertain dam-specific survival probabilities for outmigrating smolts. An extensive radio telemetry array of aerial and submerged antennae on Bonneville Dam and along the river downstream of the dam also enabled an estimation of route-specific survival of radio-tagged salmonids through the dam (Counihan et al. 2005).

5.4.2 Dam impacts on Migrating Adults

Steelhead Fallback at Dams

Adult steelhead may fall back (pass back downstream after ascending) over a dam via spillways, turbine intakes, navigation locks, debris sluiceways or juvenile fish collection devices. Bonneville Dam has one of the highest and most variable fallback rates of the Columbia and Snake River systems (Bjornn et al 2000a, 2000b). A combination of factors—dam structure, operation (river inflow, spill and turbine discharge) and the location of the dam relative to natal spawning tributaries and hatcheries –seem to influence fallback behavior at dams (Boggs et al. 2004a). High river flows and associated high spill volumes appear to relate to increased fallback percentages (Boggs et

al. 2004a). When exiting fishways and confronting the impounded waters of the forebay of a dam, steelhead may also be attracted to flow passing through these dam features, or may "overshoot" their natal tributary and fallback over a dam in an effort to return (Ricker 1972). Until recently, fish that passed upstream at Bonneville Dam via the Bradford Island, Oregon fishway fell back at higher rates than those passing on the Washington side, since many fish exiting this fishway followed the Bradford Island shoreline directly into the spillway forebay (Reischel and Bjornn 2003). This situation has improved, however, since Powerhouse 2 has been given priority (i.e. higher discharge through Powerhouse 2, on the Washington side, than Powerhouse 1), so fish seem to be attracted to the fishways on the Washington shore (R. Wertheimer, USACE Fisheries Field Biologist, personal communication, 2006).

Outmigrating Steelhead Kelts

Impacts of the hydrosystem to post-spawn (repeat spawner) steelhead can be both direct (dam passage-related mortality) and indirect (e.g. bioenergetic exhaustion and migration delay because of passage through reservoirs and dams) (Whitt 1954; Withler 1966, ISG 2000; NPPC 1986; Wertheimer and Evans 2005). Indirect effects of impoundment such as high temperatures and low flows may be compounded in kelts because of their post-spawning atrophic state. However, the relationship between these effects and stress, disease resistance and the energetic demands of out-migration are still considered a research need.

While most recent hydroelectric dam mitigation efforts have focused on improving passage (reducing migration delays and mortalities) for out-migrating juveniles, it is as yet unknown to what extent these practices are beneficial or harmful to outmigrating steelhead kelts. River discharge has been positively associated with kelt migration times: migration times are significantly faster in free-flowing reaches of the Columbia River than in impounded reaches. Forebay residence times for kelts appear to be considerably shorter, and passage efficiencies increased during dam spill periods (Wertheimer and Evans 2005).

5.5 Predation, Competition and Disease

Biological impacts (predation, competition, and disease) have increased above background levels but remain low because of limited hatchery releases in the Northwestern Reservoir and below Condit Dam. Below Condit Dam there has been an increase in abundance of predatory native and exotic fishes because of reservoir habitat created by Bonneville Dam.

Primary predators of juvenile salmonids in the Columbia River include northern pikeminnow, smallmouth bass, and walleye. Northern pikeminnow are native cyprinids that are widely distributed throughout the Columbia River basin. They are the subject of an extensive predator control effort. Smallmouth bass and walleye support popular recreational fisheries and walleye are also harvested in commercial fisheries. The Yakama Nation supports evaluation with fishery co-managers and development of

management strategies to address predation of salmonids by non-native piscivorous fish species.

5.6 Ocean Conditions

The effects of ocean conditions on abundance of Pacific salmon and steelhead vary among species and populations within species. Migration patterns in the ocean may differ dramatically and expose different stocks to different conditions in different parts of the ocean. Some species have broad, offshore migration patterns that may extend as far as the Gulf of Alaska (steelhead, chum, some Chinook). Others have migration patterns along the Washington, British Columbia, Oregon and California coasts (Chinook, coho, and cutthroat). Thus, ocean conditions do not have coincident effects on survival across species or populations.

Ocean survival of steelhead has been dramatically affected by widespread changes in ocean conditions. Cooper and Johnson (1992) showed that variation in steelhead run sizes and smolt-to-adult survival was highly correlated between runs up and down the West Coast. Smolt-to-adult survival rates generally varied 10-fold between good and bad years.

5.7 Climate Change

Climate change represents a potentially significant threat to recovery of Mid-Columbia steelhead populations. The Independent Scientific Advisory Board (ISAB) for the Northwest Power and Conservation Council, Columbia River Basin Indian Tribes, and NMFS reviewed the potential effects of climate change on salmonids in the Columbia River basin (ISAB 2007). The ISAB report shows that changes in climate may adversely affect steelhead in freshwater habitats across the DPS by exacerbating existing problems with water quantity (lower summer streamflows) and water quality (higher summer water temperatures). Consistently identified types of impacts on snow pack, stream flow, and water quality in the Columbia Basin are the following (ISAB 2007, p. 15-17):

- Warmer temperatures will result in more precipitation falling as rain rather than snow.
- Snow pack will diminish, and the timing of stream flow will be altered.
- Peak river flows will likely increase.
- Water temperatures will continue to rise.

These changes may affect steelhead more than other salmonids because of their long rearing period in freshwater.

Changing conditions could also affect salmonid health and survival in the ocean through a variety of mechanisms, including increased ocean temperatures, increased stratification of some waters, changes in the upwelling season, shifts in the distribution of salmonids, long term variability in winds and ocean temperatures, increased acidity, and increased atmospheric and oceanic variability (NMFS 2007, 2008a; ISAB 2007).

All other threats and conditions remaining equal, future deterioration of water quality, water quantity, and/or physical habitat can be expected to cause a reduction in the number of naturally produced adult steelhead returning to these populations across the DPS. This possibility further reinforces the importance of achieving survival improvements throughout the entire steelhead life cycle. Recent research also indicates that neighboring populations with differences in habitat may show different responses to climate changes (Crozier and Zabel 2006; Crozier et al. 2008). This research reinforces the importance of maintaining habitat diversity.

5.8 Other Large-Scale Threats

Other large-scale threats that may affect steelhead populations in the White Salmon subbasin include the following:

- Projected continued population growth. Pressures will increase for conversion of forestry and agricultural land uses to residential uses, with potential impacts on habitat and water conditions.
- Increase in exotic invasive species that potentially compete with native flora and fauna and provide food and/or cover to species that potentially compete with, prey on, or carry diseases that could affect native species.
- New disease and/or pathogen introductions (e.g. from marine aquaculture operations on steelhead ocean migration routes, illegal stocking of out-of-subbasin species).
- Natural catastrophic events (e.g. earthquake, volcanic eruption and related effects).

Table 5-2 presents the primary factors limiting steelhead production within the subbasin. It also lists potential impacts on VSP parameters, sites where these impacts may be observed, the underlying threat (anthropogenic cause), life stage affected, significance, and actions that would address the limiting factor.

Table 5-2. Primary present and potential limiting factors in White Salmon MaSA.

Limiting Factor	VSP Parameter Impacted	Sites Affected	Threats	Life Stages Affected	Significance (Scope/Severity)	Actions
Blocked migration	Abundance, productivity, spatial structure and diversity	RM 3.3 of mainstem White Salmon River	Condit Dam	All stages	Passage blocked to 33 miles of historical spawning and rearing habitat.	Remove Condit Dam to restore historic passage.
Impaired passage conditions	Abundance, productivity, spatial structure and diversity	RM 3.8 on Buck Cr; RM 0.7 on Spring Cr.	Unscreened diversions, culverts. Land use practices that lead to lost connectivity from habitat degradation	Spawning, rearing migration	Potential entrainment of fish at diversions	Screen diversions on Buck Creek, elsewhere. Provide passage over manmade irrigation dams and other manmade obstacles.
Altered flow regimes	Primarily abundance and productivity	Mainstem White Salmon 1.1-mile dam bypass reach; Buck & Rattlesnake creeks.	Land use practices that cause increased run-off, lack of floodplain connectivity, loss of wetlands; Dam operations that reduce flows in 1.1-mile bypass reach.	Fry colonization, inactive age-0 and 1, adult holding and spawning, rearing, migration	Currently an estimated 10% increase in peak flow at the Underwood Gauge (RM 2). Ag. diversion withdraws 70% of flow from Buck Creek, unused flow returns to White Salmon via gully (Klickitat Lead Entity 2005).	Remove Condit Dam to restore flow regime. Restore wetlands, floodplain connectivity and other water holding capacity.
Genetic changes and/or competition with hatchery steelhead	Abundance and productivity	All spawning areas	Skamania hatchery releases; strays from other areas	Spawning and rearing	Unknown	Monitor.
Degraded channel structure and complexity (primarily loss of LWD)	Primarily abundance and productivity	Mainstem White Salmon 1.1-mile dam bypass reach; Mainstem White Salmon: Buck to Husum; Buck Creek	Land use practices that reduce habitat diversity, riparian/floodplain function, and channel complexity	Fry colonization, juvenile rearing, overwintering, pre-spawners, spawners	Wood is needed to form pools, improve sediment sorting, and provide greater habitat complexity.	Place LWD as appropriate and feasible. Address removal of wood by boaters. Add structure to form pools.
Degraded riparian condition	Primarily	Lower White	Road densities,	Egg incubation,	Loss of wetland and	Restore floodplain

Limiting Factor	VSP Parameter Impacted	Sites Affected	Threats	Life Stages Affected	Significance (Scope/Severity)	Actions
and reduced floodplain connectivity	abundance and productivity	Salmon mainstem; Rattlesnake Cr.	logging and land conversion to agriculture and residential uses	fry colonization, inactive age-0 and 1	floodplain connectivity reduces capacity for flood flows and increases bed scour and runoff. Loss of riparian functions.	connectivity. Restore native riparian vegetative communities.
Elevated stream temperatures	Abundance, productivity, spatial structure	RM 3.3 to 5.0 on mainstem (Northwestern Reservoir); Buck Cr.; Rattlesnake Cr; Indian Cr.	Land use practices that lead to loss of riparian function, altered flow regimes, water diversions	Juvenile rearing, active age-0, spawning, migration	Conifers needed in riparian areas to provide shade and reduce temperatures.	Riparian conversion project needed to establish conifers, improve base flow
Altered sediment routing (high fine sediment levels)	Primarily abundance and productivity	Lower White Salmon mainstem; Rattlesnake Creek	Road densities, land use practices that increase bank instability, Condit Dam removal	Spawning, egg incubation, fry colonization, inactive age-0 & 1, rearing, migration	Removal of Condit Dam may cause short-term high sediment volume. Loss of floodplain connectivity, increased erosion, bed scour.	Restore LWD and floodplain connectivity. Review road management activities for opportunity to improve sediment capture.
Harassment, predation and competition	Abundance, productivity, diversity	Northwestern Reservoir; Bonneville Pool	Inundation by Bonneville Pool; Land use practices that lead to loss of riparian function; hatchery releases	Adult migrants, pre-spawners, holding, juveniles	Increase in exotic species and recreational activity in lower river. Incidental take during fisheries targeting hatchery steelhead is low.	Remove Condit Dam. Improve programs that target exotic piscivorous fish in the mainstem Columbia.

6. Recovery Strategy and Actions

The preceding chapters summarize recovery goals, biological criteria and threats criteria, current status assessment, and the major limiting factors and threats identified for the White Salmon River steelhead population. How will we reach recovery? The White Salmon recovery strategy contains two key parts: 1) a plan for reintroducing naturally produced steelhead into historical habitat after the removal of Condit Dam, and 2) improving and increasing freshwater habitat for steelhead production in the subbasin. The plan also recommends ensuring that harvest or hatchery actions do not impede efforts to improve steelhead viability.

Since blocked passage at Condit Dam is the primary limiting factor for steelhead and the dam is scheduled to be removed in 2009, it is necessary to consider how anadromous fish will be reintroduced to their historical habitat, whether by natural recolonization, artificial propagation, or some combination of the two. A reintroduction plan is described in Section 6.1.

Additional actions regarding freshwater habitat, hatcheries, and the hydrosystem are also proposed. Table 6-1 shows the types of strategies and the actions proposed to address the limiting factors and threats impeding the survival of White Salmon steelhead. These strategies and actions are defined with the intent of bringing the White Salmon steelhead population to viable status.

Table 6-1. Recovery Strategies and Actions in the White Salmon subbasin.

Priority Strategies	Populations Affected and Addressed	Key Types of Actions	VSP Parameters Addressed	Limiting Factors Addressed
		Freshwater Habitat		
Implement plan for reintroduction of naturally produced steelhead to the White Salmon subbasin.	White Salmon population of the Middle Columbia Steelhead DPS	• Install weir in Rattlesnake Creek. • Allow natural recolonization. • Monitor natural spawner escapement. • Monitor hatchery strays. • Evaluate after 5 years and plan for alternative methods if necessary.	All parameters	Lack of access to habitat
Protect and conserve natural ecological processes that support the viability of populations and their primary life history strategies throughout their life cycle. Priority Locations: Rattlesnake Creek, Indian Creek, Buck Creek, White Salmon River (Buck Creek to Husum), Spring Creek	White Salmon population of the Middle Columbia Steelhead DPS	• Protect highest quality habitats through acquisition and conservation. • Adopt and manage Cooperative Agreements. • Conserve rare and unique functioning habitats. • Consistently apply Best Management Practices and existing laws to protect and conserve natural ecological processes. • Review, modify, and enforce existing land use planning documents and ordinances pertaining to riparian and floodplain management. • Provide public outreach to educate river uses and others	All Parameters	Degradation of tributary habitat-forming processes and functions (loss of channel structure, floodplain connectivity, riparian vegetation and LWD recruitment)
Gain information needed to identify and prioritize habitat actions that will provide the greatest opportunity to contribute to recovery. Priority Locations: Watershed areas above and below Condit Dam Gain information on current population composition and viability to identify reintroduction opportunities.	White Salmon population of the Middle Columbia Steelhead DPS	• Conduct habitat surveys to help prioritize restoration needs. • Measure select habitat attributes above and below Condit Dam to document changes because of removal and time to recovery. • Perform population monitoring. • Assess current Chinook, coho, chum, steelhead, and resident rainbow trout stock composition and viability to determine appropriate stocks and methods for reintroduction. • Monitor salmon and steelhead spawning escapement.	All Parameters	Many factors, including key stock status indicators now not available. Would be able to determine trends in populations.
Restore passage and connectivity to habitats blocked or impaired by artificial barriers. Priority Locations: Site of Condit Dam, White Salmon River below Dam, Buck Creek	White Salmon population of the Middle Columbia Steelhead DPS	• Provide passage at Condit Dam. • Remove or replace barriers blocking or impairing passage including dams, dikes, road culverts and irrigation structures. • Provide screening at 100% of irrigation diversions. • Replace screens that do not meet criteria.	Abundance, Productivity, Spatial Structure	Loss of historical habitat because of blocked or impaired fish passage (dams, culverts, unscreened diversions)
Restore floodplain connectivity and function and channel migration processes. Priority Locations: Rattlesnake Creek, Indian Creek, Buck Creek, White Salmon River (Buck Creek to Husum, Condit Dam to Buck Cr., mouth of Condit Dam), Spring Creek	White Salmon population of the Middle Columbia Steelhead DPS	• Reconnect side channels and off-channel habitats to stream channels. • Restore wet meadows. • Reconnect floodplain to channel. • Relocate or improve floodplain infrastructure and roads. • Conduct public awareness and education about restoration efforts.	Abundance, Productivity, Spatial Structure	Degraded floodplain connectivity and function (loss of off-channel habitat, side channels, channel morphology, key habitat quantity, and connected hyporheic zone)
Restore channel structure and complexity Priority Locations: Rattlesnake Creek, Indian Creek, Buck Creek, White Salmon River (Buck Creek to Husum, Condit Dam to Buck Cr., mouth of Condit Dam), Spring Creek	White Salmon population of the Middle Columbia Steelhead DPS	• Place stable wood and other large organic debris in streambeds. • Stabilize streambanks. • Restore natural channel form.	Abundance, Productivity	Degraded channel structure and complexity (loss of spawning and rearing habitat, LWD, pools)

Priority Strategies	Populations Affected and Addressed	Key Types of Actions	VSP Parameters Addressed	Limiting Factors Addressed
Restore riparian condition and LWD recruitment Priority Locations: Rattlesnake Creek, Indian Creek, Buck Creek, White Salmon River (Buck Creek to Husum Falls), Spring Creek	White Salmon population of the Middle Columbia Steelhead DPS	• Restore natural riparian vegetative communities. • Develop grazing strategies that promote riparian recovery. • Eradicate invasive plants species from riparian areas.	Abundance, Productivity	Degraded riparian condition (native riparian vegetative communities, LWD recruitment)
Restore altered hydrograph to provide appropriate flows during critical periods. Priority Locations: Rattlesnake Creek, Indian Creek, Buck Creek	White Salmon population of the Middle Columbia Steelhead DPS	• Implement agricultural water conservation measures. • Improve irrigation conveyance and efficiency. • Restore natural functions and processes through actions identified in strategies above. • Employ BMPs to forest, agriculture and grazing practices and to road management. • Protect and/or rehabilitate springs • Increase pool habitat. • Restore wetlands and other water holding capacity on plateau.	Abundance, Productivity	Altered hydrology (low summer flow, scouring peak flows because of degraded watershed conditions and/or streamflow alterations and withdrawals for irrigation and other uses)
Improve degraded water quality, reduce summer water temperatures. Priority Locations: Upper White Salmon mainstem, Rattlesnake Creek, Indian Creek, Buck Creek	White Salmon population of the Middle Columbia Steelhead DPS	• Reduce runoff from dairies and failing septic systems. • Restore natural functions and processes through actions identified in strategies above. • Employ BMPs to forest, agriculture and grazing practices and to road management. • Upgrade or remove problem forest roads • Construct water and sediment control basins	Abundance, Productivity	Degraded water quality (abnormal temperatures or fine sediment, nutrients from runoff, pesticides and other chemicals and/or because of water withdrawals that reduce natural streamflows.
Hatchery				
Restore natural production in historically utilized habitats, including blocked areas above Condit Dam.	White Salmon population of the Middle Columbia Steelhead DPS	• Implement plans for salmon and steelhead reintroduction into historical habitat when passage is restored.	All parameters	Risks related to steelhead and salmon reintroductions to historical habitat using hatchery fish.
Evaluate hatchery practices to ensure they do not limit diversity.	White Salmon population of the Middle Columbia Steelhead DPS	• Monitor hatchery strays. • Monitor natural spawner escapement.		
Harvest				
Maintain current low impact fisheries and reduce harvest-related adverse effects in those fisheries that have significant impacts.	White Salmon population of the Middle Columbia Steelhead DPS	• Maintain current management regulations for low impact fisheries and adjust tributary harvest regulations in areas where harvest significantly impacts steelhead viability.	Abundance, Productivity	Commercial, recreational and tribal fisheries in ocean, mainstem Columbia River and tributaries.
Hydrosystem				
Improve hydropower operations and facilities to enhance steelhead survival,	White Salmon population of the Middle Columbia Steelhead DPS	• Implement 2008 FCRPS Biological Opinion (NFMS 2008).	All Parameters	Hydrosystem development and operations in mainstem Columbia River alter steelhead migration conditions and delay passage.
Reduce predation on, and competition between, salmonids	White Salmon population of the Middle Columbia Steelhead DPS	• Reduce predation by pinnipeds • Re-distribute cormorants	Abundance, Productivity	Hydrosystem development and operations in mainstem Columbia River increase predation on, and competition between, salmonids.

6.1 Steelhead Reintroduction Plan

In anticipation of the removal of Condit Dam in the fall of 2009, the White Salmon River Working Group, made up of Federal, state, and tribal fisheries managers, as well as representatives of PacifiCorp (Condit Dam operators), developed several options to consider for the reintroduction of steelhead into the White Salmon River. They fleshed out each option with a description of the biological basis for the approach, operational and maintenance needs, and monitoring and evaluation needs. These are the options the Working Group considered (for details, see Appendix I):

1. Natural recolonization – no reintroduction efforts from outside sources.
2. Wild donor from local subbasin as brood source for juvenile release into the White Salmon River. Eggs collected and reared at suitable hatchery, juveniles acclimated and released at White Salmon Ponds.
3. White Salmon resident *O. mykiss* as brood source, with locally suitable anadromous wild donor stock spawned for juvenile release into upper White Salmon River.
4. White Salmon steelhead captive brood program using captured outmigrating juveniles
5. White Salmon steelhead kelt reconditioning. Recondition local spawners to enhance survival.

Based on the potential to reestablish natural production of steelhead in the basin, the White Salmon Working Group decided that Option 1, natural recolonization, was the best approach. Their reasoning was based on some indications that the (resident) population of *O. mykiss* in the White Salmon River above Condit Dam is still producing smolts, even though anadromy has been eliminated since the construction of Condit Dam and the end of passage in 1919. Recent monitoring in the White Salmon River above Condit Dam has identified *O. mykiss* juveniles displaying smolt behavior and morphology. PIT-tagged juveniles have been detected passing Bonneville Dam, with one being recovered at the tern colony on East Sandy Island (B. Allen, Personal Communication, 2007). In addition, a juvenile *O. mykiss* PIT-tagged above Condit Dam in September 2004 at 98 mm was detected ascending Bonneville Dam in July 2006. Genetic analysis of juvenile *O. mykiss* collected in the upper watershed above Husum Falls found differences from hatchery trout released in the basin; additional samples are needed, however, to confirm this finding (Allen et al. 2006).

Additional research by Carmichael (LSRCP 2001) in the Grande Ronde and in Thrower et al. (2004) in Alaska has identified a potential strategy for steelhead in the White Salmon. Research conducted by Thrower et al. (2004) indicated that*:*

> [*a*]*fter 70 years of freshwater residency, a formerly anadromous, wild, freely breeding population of O. mykiss has retained large amounts of genetic variability associated with growth, precocious maturation and smolting despite complete selection against the phenotypic expression of at least one of the fitness related characters (smolting migration) critical for the reestablishment of an anadromous population….Genetic potential for smolting can lie dormant or be maintained through a dynamic interaction between smolting and early maturation for decades despite complete selection against the phenotype. The results have significant implications for the preservation of threatened anadromous stocks in fresh water and the inclusion of resident fish of*

formerly anadromous populations, currently trapped behind longstanding barriers to migration, as one component of the same population.

This information supports the theory that even though the population is functionally extirpated, there is some the potential for reestablishing anadromous steelhead in the White Salmon River basin. Using resident *O. mykiss* above Condit Dam will provide a genetic link to historical anadromous *O. mykiss*.

Natural Recolonization Strategy:

1. Natural recolonization – no reintroduction efforts from outside sources
   a. Biological Basis
      i. Potentially a small number of returning native adults but may not be sufficient number to restart population.
      ii. Recent USGS studies identify PIT-tagged resident *O. mykiss* migrating from the White Salmon above Condit Dam. One PIT tag collected at East Sand Island, and one detected passing back upriver through the Bonneville Dam fishway (steelhead life history may still be present in upper watershed).
   b. Operational & Maintenance Needs
      i. Maintenance of weir(s) in tributary stream(s).
   c. Monitoring & Evaluation Needs
      i. Monitor all natural spawner escapement.
      ii. Monitor hatchery stray steelhead on the spawning grounds.
      iii. Juvenile fish surveys for abundance and growth (via PIT tagging).
      iv. Rotary Screw Trap (both in lower river and above current reservoir site) to collect out migrants for DNA analysis, and juvenile production.
      v. Adult and juvenile weir trap and/or instream PIT tag detector for monitoring in Rattlesnake Creek.
      vi. Redd capping to conduct DNA analysis.

The key to the success of this option is to implement all of the proposed monitoring and evaluation activities, including screw trap operations and the installation of a weir on Rattlesnake Creek to monitor adult escapement, adult movement, and presence/absence of stray hatchery origin steelhead. In the future, if the need arises, the weir could be used to exclude hatchery origin adults creating a refuge for naturally produced steelhead. Another reason that the White Salmon Working Group supported option 1 was that the removal of Condit Dam provides a rare opportunity to study the natural recolonization of newly available habitat without using hatchery intervention. Option 1 will be evaluated and an assessment made after 5 years to determine if the approach should continue or if the other proposed options should be considered.

The White Salmon Working Group is also developing recovery strategies for tule fall Chinook, spring Chinook, coho, and chum salmon. These will be available as part of the Lower Columbia River Recovery Plan. The Working Group has agreed on a salvage plan for tule fall Chinook salmon to maintain natural production once Condit Dam is removed in 2009. In 2008 the salvage plan will be tested to see if enough adult tule fall Chinook can be captured below Condit Dam and safely transported to spawning habitat above the dam. Transported tule fall Chinook

will be monitored to determine post-release survival, movement, and spawning habitat preferences.

Much remains unknown about the current status of the historical salmon and steelhead populations in the White Salmon, and the capability of habitat conditions to support increased production. The following actions are proposed to establish a baseline of current population status and habitat conditions, and to help ensure that efforts to reintroduce salmon in the White Salmon are efficient and successful. These actions were identified by the Yakama Nation, USGS, WDFW, USFWS, and Underwood Conservation District.

Data gathering and analysis needs to be conducted before Condit Dam is removed and salmonids are reintroduced to areas above the dam. This information will inform project selection and implementation, and improve the rate and success of reintroduction.

A multi-agency cooperative process for planning for reintroduction is outlined below. Table 6-2 summarizes the biological objectives, actions and existing strategies for data gathering and analysis that are needed before removal of Condit Dam. Specific actions are presented in Table 6-3. The Yakama Nation, USGS, WDFW, USFWS, and Underwood Conservation District agree to these general biological objectives and provided the detailed actions for which they would accept responsibility.

Some of these monitoring and evaluation activities have been implemented starting in 2006 and continue through to the present in preparation for the expected removal of Condit Dam in October of 2009 (e.g., Allen et al. 2006; Smith et al. 2007). Funding is being sought to complete the pre-dam removal monitoring activities and to continue the monitoring post-dam removal.

Table 6-2. Biological objectives, management strategies, and actions to acquire baseline habitat information in White Salmon watershed before and after removal of Condit Dam (Yakama Nation 2006).

Biological Objective	Full Description	Actions and Existing Strategies
Implement reintroduction plan.	Steelhead will be allowed to naturally recolonize habitat above Condit Dam. Intensive monitoring activities will be implemented, including a weir on Rattlesnake Creek, juvenile monitoring in the lower river to evaluate steelhead spawning and juvenile production.	Continue monitoring activities already occurring in the basin and expand to include weir in Rattlesnake Creek.
Complete assessment of habitat conditions prior to reintroduction.	Complete habitat surveys to help prioritize restoration needs, and measure select habitat attributes above and below Condit Dam to document changes because of removal as well as time to recovery.	An assessment of existing conditions is needed to prioritize recovery efforts.
Characterize Habitat Conditions - Fecal coliform	In the 1990s, sampling by UCD detected high fecal coliform levels. Resulting nutrient enrichment may decrease juvenile or adult fish survival, although there is low certainty of the relationship between fecal coliform and salmon survival. A rehabilitation strategy is recommended. Sampling may help determine if actions in the past ten years have improved the situation.	Reduce runoff from dairies and failing septic systems.
Complete gathering information on existing salmonid stocks.	Determine the status, life histories, and genetic composition of fish populations in the White Salmon River and its tributaries above and below Condit Dam that will be accessible to anadromous salmonids.	Finalize adult and juvenile monitoring program for existing stocks in the White Salmon River. Assess interaction of bright and tule Chinook populations and rainbow and steelhead.
Hatchery Status Monitoring	Monitor the proportion and origin of hatchery salmon and steelhead on the spawning grounds	Continue to count adipose marked and unmarked carcasses and CWT adults.
Maintain genetic diversity of listed salmonids	Continue to monitor current Chinook, coho, chum, steelhead, and resident rainbow trout stock composition and viability to determine effects of reintroduction actions.	To maintain the genetic diversity of salmonid species in the White Salmon River, complete analysis of information that describes the stocks and genetic diversity that currently exists.
Place wood in streams to restore habitat	Use existing surveys of LWD in Rattlesnake Creek (USGS), to determine locations for LWD enhancement in high priority areas with willing landowners. Conduct surveys and develop plans and costs for work to occur once anadromous passage has been re-established.	The White Salmon Subbasin Plan identifies restoring LWD as a secondary action, recommended once passage has been provided above Condit Dam.
Plant riparian areas to increase canopy cover	Plant riparian areas to increase canopy cover which reduces stream temperatures. The objective is to reforest understocked riparian areas, and also to survey existing plantings using monitoring criteria in the White Salmon Subbasin Plan.	The subbasin plan identifies restoring riparian zones through planting seedlings as a strategy for improving habitat above Condit Dam.
Population Status Monitoring	Monitor salmon and steelhead spawning escapement to estimate viable salmonid population parameters.	Mark-recapture; Area-Under-the-Curve

Biological Objective	Full Description	Actions and Existing Strategies
Assess effect of anadromous fish on resident fish.	Assess the resident fish population prior to the reintroduction of anadromous salmonids.	Assess resident trout contribution to smolts below Condit Dam. Comprehensive monitoring program (trout population). Assess change in resident population after steelhead re-colonization/reintroduction.

Table 6-3 presents specific actions, responsible parties, duration, and cost for anadromous fish reintroduction planning. These actions would establish a baseline of current population status and habitat conditions for salmon reintroduction.

Table 6-3. Needed actions, cost and time schedule for reintroduction planning in the White Salmon subbasin (Yakama Nation 2006).

Actions, Costs, and Time for Foreseeable Reintroduction Monitoring				
Action	**Responsible Party**	**Description**	**Duration (in years)**	**Estimated Budget (in dollars)**
Implement Steelhead and Salmon Reintroduction Plans	White Salmon Technical Working Group	Work cooperatively with WDFW, USFWS, USGS and other agencies and stakeholders to draft an Anadromous Reintroduction Plan for the White Salmon River (YN)	1	12,000
Assess the viability of spawning gravels above and below Condit Dam	Yakama Nation	Review habitat surveys already conducted (such as those performed for the Report A: Characterization of flow, temperature, and habitat conditions and fish populations in the Rattlesnake Creek watershed. Pages 1-159 in P. J. Connolly, editor. 2003). Collaborate with USGS and UCD habitat activities under current proposal to identify potential areas. Perform stream surveys and identify areas with appropriate-sized gravels.	2	$34,000
Conduct stream habitat monitoring below Condit Dam	Yakama Nation	Conduct habitat surveys on 2-3 stream reaches per year using TFW methodology. These habitat surveys will quantify key stream habitat components and indicators of aquatic health including: 1) large woody debris, 2) frequency and depth of pools, 3) substrate composition, 4) stream gradient, 5) floodplain connectivity, and 6) riparian vegetation characteristics (e.g., species composition, age structure, shading). They will be utilized as reference reaches for comparison to post Condit Dam removal conditions.	3	42,000
Sample spawning gravel/sediment	Yakama Nation	Collect and analyze McNeil core samples from approximately 8 sites	2	13,000
Monitor Water Temperatures	Underwood Conservation District	Conduct continuous water temperature monitoring at 14 sites in the subbasin, including the mainstem White Salmon, Rattlesnake Creek, Indian Creek, and Buck Creek	3	18,000
Assess riparian reforestation needs	Underwood Conservation District	Identify, plan and plant riparian areas to increase canopy cover, which reduces water temperatures and reduces sediment input from unstable banks. Survey existing plantings for performance after 1, 3, 5 and 10 years.	3	11,000
Plan for Large Woody Debris Installation	Underwood Conservation District	UCD will work with partners and willing landowners to establish potential sites, and accomplish engineering surveys and other planning work, to establish at least 2 sites ready for installation of in-stream wood in Rattlesnake Creek	3	11,000
Monitor Water Quality	Underwood Conservation District	Conduct one year (6 rounds) of Water Quality monitoring at 14 existing stations in the Watershed, replicating work done in the 1990s.	1	11,000
Monitor Rattlesnake Creek stream level	Underwood Conservation District, USGS	Monitor Rattlesnake Creek stream levels by maintaining and operating the existing Rattlesnake Creek Stream Gauge.	3	36,000

Actions, Costs, and Time for Foreseeable Reintroduction Monitoring				
Action	**Responsible Party**	**Description**	**Duration (in years)**	**Estimated Budget (in dollars)**
Install a large multiplexing PIT-tag detector in Buck Creek near Northwestern Reservoir in 2007.	USGS	The detector unit that will be placed in Buck Creek, which is just above the backwaters of Condit Dam, will be a large multiplexing unit with the capacity for six antennas. The unit will be used, as has been done in Rattlesnake Creek, to estimate the importance of Buck Creek as part of the life history of *O. mykiss* in the White Salmon River. With the addition of this unit and the small unit in Spring Creek, all tributaries that are known to have been accessible to anadromous fish before Condit Dam will be monitored. The unit will also be used as the lowermost boundary for mark-recapture population estimates.	0.5	35,000
Derive estimates of salmonid population abundance in select portions of Buck and Spring creeks as well as a reference reach in Rattlesnake Creek.	USGS	Obtain an estimate of population density and biomass of resident salmonids in selected portions of Buck Creek, Spring Creek, and Rattlesnake Creek, which will include portions on state and Federal lands and on as much of the privately owned lands as possible.	2.5	27,000
Determine fish species composition, distribution within Buck Creek, Spring Creek and the White Salmon River from NW lake to BZ Falls).	USGS	To document the distribution and abundance of individual fish species within the portion of the watershed thought to be accessible to anadromous fish prior to restoration activities and the potential removal, or laddering of Condit Dam	2.5	25,000
Install two small, stationary, in-stream PIT-tag detectors in the lowermost portion of Spring Creek in FY07.	USGS	Stationary PIT-tag readers offer the potential for full-year, everyday monitoring of fish movement in and out of a stream system	0.5	9,000
PIT tag 2,000 juvenile salmonids (primarily O. mykiss) each year above and below Condit Dam to track individual movement and seasonal growth rates.	USGS	PIT-tag salmonids in the mainstem White Salmon River from BZ Falls to Condit Dam, in the tributaries (Buck, Rattlesnake and Spring creeks), and accessible areas below Condit Dam	2.5	22,000
Obtain and archive tissue samples in a non-lethal manner for genetic analysis.	USGS	A tissue sample (fin clip) from a subsample of salmonids captured during electrofishing, carcass surveys and smolt trapping will be removed and preserved (95% ethanol) for future genetic analyses (an in-kind contribution has been found, but not finalized, to pay for this supplementary genetics work).	2.5	10,000
Determine existing kinds, distribution, and severity of fish diseases in the watershed above and below Condit Dam.	USFWS, USGS	Obtain fish specimens for disease sampling using a longitudinal and tributary sampling strategy. This will facilitate the development of a fish-health baseline for areas that would be accessible and inaccessible (above barriers) to anadromous salmonids in the future.	2.5	9,000
Use in-stream PIT-tag readers to assess a novel method for population estimates by comparing multiple pass removal estimates with mark-	USGS	In association with multi-pass removal population efforts, test a refined method for population estimates.	2	11,000

Actions, Costs, and Time for Foreseeable Reintroduction Monitoring				
Action	**Responsible Party**	**Description**	**Duration (in years)**	**Estimated Budget (in dollars)**
recapture estimates with the reach bounded by in-stream readers to account for immigration and emigration.				
Download and maintain existing PIT-tag detectors.	USGS	As currently designed, all PIT tag detectors will be required to be downloaded once each week.	2	27,000
Submit applicable PIT-tag related information to PTAGIS database.	USGS	All PIT-tag data will be entered in the PTAGIS database, which is maintained by Pacific States Marine Fisheries Commission.	2	14,000
Assess fish life history attributes within Buck Creek, Spring Creek, Rattlesnake Creek and the White Salmon River (from NW Lake to BZ Falls).	USGS	In order to track movements, growth, and other life history attributes of resident salmonids, most fish larger than 70 mm that are captured during stream surveys will be PIT-tagged.	2	13,000
Monitor flows in tributary systems (Buck and Spring creeks)	USGS	Stream discharge measurements will be taken every two to three weeks during the low flow period.	2.5	24,000
Conduct habitat surveys with emphasis on restoration needs in Buck and Spring creeks and the mainstem White Salmon River above Condit Dam.	USGS	As done in Rattlesnake Creek (Allen et al. 2003), physical stream habitat surveys will be done on the White Salmon River and its tributaries Spring and Buck creeks.	2.5	21,000
Produce Pisces Status Report. Provide quarterly status reports via PICSES.	USGS	The latest guidelines will be followed to generate these reports.	3	12,000
Analyze/Interpret data & reporting Analysis of raw and summarized data for report	WDFW		3	68,000
Conduct adult spawning ground surveys	WDFW	Collect biological samples from spawning grounds and counts of live fish, carcasses, and redds	3	117,000
Create/Maintain/Manage Counts and Biological Database	WDFW	Maintain database for surveys including count and biological data	3	3,000
Mark adults for mark-recapture population estimates	WFDW	Mark adult salmon for mark-recapture population estimate	3	24,000
Monitor genetics for each hatchery stock that is potentially spawning in the White Salmon River over time.	USFWS	Based on DNA information (USFWS) monitor genetic markers over time for tule fall Chinook, URB fall Chinook, and spring Chinook salmon, and compare to those released respectively from the Spring Creek NFH, Little White Salmon NFH (and Bonneville SH), and Carson NFH? Hatchery populations to be compared: ·tule fall Chinook, Spring Creek NFH ·Upriver bright (URB) fall Chinook, Little White Salmon NFH ·URB fall Chinook Bonneville SH (ODFW) ·Spring Chinook, Carson NFH ·URB fall Chinook Klickitat River Hatchery Program (WDFW)	1	40,000
Determine genetic similarities of unmarked	USFWS	Identify carcasses in the field as spring, URB fall, or tule fall Chinook Salmon. ·Genetic clips from	1	24,000

Actions, Costs, and Time for Foreseeable Reintroduction Monitoring				
Action	**Responsible Party**	**Description**	**Duration (in years)**	**Estimated Budget (in dollars)**
carcasses and natural-origin smolts in the White Salmon River to hatchery baseline populations		fall Chinook salmon carcasses will be collected during September and October 2006-07 spawning ground escapement surveys conducted by WDFW. USFWS staff will accompany WDFW survey crews for the purpose of genetic tissue collection.		
Compare adult and smolt genetic analyses to ongoing adult salmon escapement estimates of WDFW and smolt outmigration estimates of USGS studies conducted during 2006-07 in the White Salmon River	USFWS	U.S. Fish and Wildlife Service staff will use a multiple-stock run reconstruction technique (similar to Templin et al. 1996) or a mixed stock fisheries analysis, in addition to the genetic stock information and population estimates gathered on outmigrant Chinook salmon smolts, to estimate the number of Chinook salmon smolts from each stock produced during 2006-2007 in the White Salmon River.	1	35,000
Update a reintroduction plan	White Salmon Technical Working Group	Information gathered from this study will be used to generate an updated anadromous salmonid reintroduction plan for the White Salmon River.	1	10,000

6.2 Freshwater Habitat Strategies and Actions

This plan proposes a number of freshwater habitat strategies and actions to rebuild the steelhead population in the White Salmon to the desired levels of viability. The suites of management strategies and actions for each population are designed to protect and improve ecosystem functions and restore normative ecological processes. Together, the strategies and actions call for the protection of the highest quality habitats, maintenance of existing unimpaired habitats and ecosystem functions, and habitat restoration through passive and active measures.

- Protection of existing high quality habitats is a broad economical approach of ensuring no net loss in habitat quality and maintenance of normative ecological processes. Many objectives are likely to be met through habitat protection and the associated natural recovery of upland and riparian areas. Land acquisitions, easements, cooperative agreements, and protective land designations are potential tools for protecting high quality habitat.

- Maintaining improved habitats from further degradation, such as through land use practices or changes in land use laws and ordinances, is an important element of habitat management. Comprehensive land-use planning and land-use controls can provide important habitat protection by managing growth and land use so that critical areas and watershed functions are preserved.

- Broad opportunities exist to improve habitat conditions for salmon and steelhead populations through restoration. The success of these strategies is enhanced when actions build from existing restoration efforts and incorporate a range of project types that address the many interrelated habitat impairments.

The Plan defines eight freshwater habitat strategies that are directly linked to the limiting factors: 1) protect and conserve natural ecological processes; 2) gain information needed to identify and prioritize habitat actions that will provide the greatest opportunity to contribute to recovery; 3) restore passage and connectivity; 4) restore floodplain connectivity/function and channel migration processes; 5) restore channel structure and complexity; 6) restore riparian condition and LWD recruitment; 7) restore altered hydrographs to enhance instream flows during critical periods; and 8) improve degraded water quality and reduce summer water temperatures.

The strategies and actions were defined through review and analysis of currently available information. They reflect recent results from EDT analysis. These results indicate that many reaches in the White Salmon subbasin have quality habitat and functional ecological processes that are currently capable of supporting anadromous fish populations, or have moderate habitat quality and quantity and have the potential to be improved to high quality habitat (NPCC 2004). The strategies and actions are consistent with direction in the White Salmon Subbasin Plan, which states that protection of functional ecosystem processes and intact habitats should have the highest priority, and identifies actions to improve degraded habitats (NPCC 2004). The strategies and actions also address risks identified in TRT viability assessments for the populations.

Together, the strategies and actions are designed to protect and improve freshwater habitat in the drainage and, thus, improve the viability of White Salmon historical salmonid populations. Actions to restore passage and habitat are also expected to benefit other anadromous and resident species, including Pacific lamprey (*Lampetra tridentata*), a candidate for ESA listing and an important food source for the Yakama Nation.

6.2.1 High Priority Reaches for Habitat Protection/Restoration and Proposed Actions

The White Salmon Subbasin Plan (NPCC 2004) identifies the following areas as high priority reaches for protection and restoration:

- For steelhead, habitat protection and restoration is needed in the White Salmon mainstem and Rattlesnake Creek. The mainstem from the top of the reservoir to Husum Falls is the geographic area with the highest protection value. Rattlesnake Creek, a good producer of rainbow trout, provides the most significant restoration opportunity.

The following areas rank as the highest priorities for habitat restoration. Reasons for their ranking and actions proposed to address limiting factors and threats are summarized below based on information provided in EDT modeling results, the *White Salmon Subbasin Plan* (NPCC 2004) and *Klickitat Lead Entity Region Salmon Recovery Strategy* (Klickitat Lead Entity 2005).

White Salmon River Mainstem – Site of Condit Dam, RM 3.3

Condit Dam significantly affects potential Middle Columbia steelhead production, along with Lower Columbia spring Chinook, coho, and chum production in the White Salmon River subbasin. Achieving multiple DPS/ESU population recovery goals depends largely on the

success of efforts to restore passage to upriver spawning and rearing habitats and improve flow and habitat conditions in the lower river.

Actions:

- Remove Condit Dam in order to provide unimpeded passage by adult and juvenile salmonids.
- Improve flow and habitat conditions in the lower White Salmon River.

Rattlesnake Creek

Rattlesnake Creek provides significant spawning and rearing habitat for rainbow trout and is expected to be highly productive for salmon and steelhead once passage is restored. Limiting factors in the system include low quality pools, excessive fine sediment in spawning gravels, limited in-stream cover, low summer flows and high peak flows, and high summer stream temperatures. Alders dominate riparian areas and limit long-term wood recruitment potential.

Actions:

- Protect functional riparian areas.
- Place LWD and other in-stream structure as appropriate to create pools, increase cover and retain spawning gravels.
- Restore floodplain connectivity.
- Restore wetlands and other water holding capacity on the plateau through use of check dams and other methods.
- Establish conifers in riparian areas.
- Plant trees to reduce sediment input from banks.

Indian Creek

Indian Creek, a tributary to Rattlesnake Creek, provided historical spawning and rearing habitat for salmon and steelhead. The stream is expected to provide productive habitat for reintroduced anadromous runs. Currently, the system displays low quality pools and spawning habitat. Alders dominate riparian areas along the lower 1.5 miles and limit long-term wood recruitment potential.

Actions:

- Protect functional riparian areas.
- Place LWD and/or other in-stream structure to create pools, increase cover and retain spawning gravels.
- Establish conifers in riparian areas.
- Restore floodplain connectivity.
- Plant trees to reduce sediment input from banks.

White Salmon River Mainstem – Buck Creek to Husum

This reach has high potential for salmon and steelhead spawning, rearing and adult holding. The mainstem White Salmon River up to Husum Falls is also listed as proposed critical habitat for bull trout and provides important habitat for coastal cutthroat trout. Habitat in the reach generally remains in good condition.

Actions:

- Maintain riparian function by encouraging stewardship and land acquisition.
- Re-vegetate any riparian areas that are affected by removal of Condit Dam.
- Place LWD as appropriate and feasible.
- Address wood removal by boaters.

Buck Creek

Buck Creek is currently a major spawning area for rainbow trout. It provides potential spawning and rearing habitat for salmon and steelhead. Habitat quality is currently limited because of limited pools and spawning gravels, low summer flows, high stream temperatures, and agricultural diversion.

Actions:

- Place LWD and other in-stream structure as appropriate to create pools and retain spawning gravels.
- Assess in-stream flows and initiate actions to improve base flow.
- Screen agricultural diversion.

White Salmon River Mainstem – Condit Dam to Buck Creek

This reach currently contains Northwestern Reservoir. It could provide important potential habitat for salmon and steelhead spawning, rearing, migration and adult holding when Condit Dam is removed. Removal of Condit Dam could cause exposed banks to become unstable and increase sediment and wood loads.

Actions:

- Assess habitat limiting features after dam removal and identify restoration needs.
- Implement projects to restore habitats.

Spring Creek

Spring Creek will provide productive habitat for reintroduced anadromous fish runs. Production potential is currently limited because of decreased habitat diversity and increased sediment.

Actions:

- Protect in-stream wood and functional riparian areas.
- Place LWD as appropriate.

6.2.2 Summary of Habitat Actions

Tables 6-4 and 6-5 summarize the habitat actions for recovery of listed salmon and steelhead populations in the White Salmon subbasin. The tables identify the likely responsible parties for implementation, time frames, feasibility, and approximate costs of implementation. Implementing entities are identified based on land ownership first, then in consideration of area of past interest and activity. Costs are general range summaries and are based on the costs of the specific reach actions identified in Table 6-1.

Table 6-4. Recovery actions for spring Chinook, fall Chinook, coho and Middle Columbia River steelhead within the White Salmon subbasin.

OBJECTIVE	SIGNIFICANCE	SUITE OF ACTIONS	LEAD AGENCY	TIME FRAME	FEASIBILITY	COSTS
Improve salmon and steelhead production potential in White Salmon Mainstem	Improving road maintenance will reduce sediment inputs and reduce water velocities during peak flow events. Restoring wood will increase rearing habitat through pool formation, improved sediment sorting, increased cover habitat and complexity.	Place LWD or other appropriate structures in stream	YN, WDFW, UCD	3-10 years	High, if passage provided at dam	$450-550k
		Provide passage at Condit Dam	FCRPS	2 years	High	$10-12 million
		Conduct public awareness to educate the public about restoration efforts	YN, WDFW, UCD, USGS	0-10 years	High	$250-350k
Increase salmon and steelhead production potential in tributaries	Actions will increase length of channel rearing habitat. Adding LWD will increase pool habitat, provide cover, help sort sediments, and increase habitat complexity. Improved riparian areas will increase cover and channel stability, shade, LWD, litter fall, and terrestrial insect abundance.	Reconnect side channels to mainstem.	YN, WDFW, UCD	3-10 years	High, after dam removal	$400-600k
		Place LWD and other structure in stream.	YN, WDFW, UCD	3-10 years	High, after dam removal	$750-850k
		Re-vegetate riparian areas, including conifers for future LWD recruitment	YN, WDFW, UCD	3-10 years	High	$600-700k
		Control road/stream interactions by reducing erosion potential	County Roads Dept, WDFW, YN	3-10	Medium	$500-700k
	Actions will allow fish access to upstream habitat, decrease peak flows and reduce sediment inputs to stream.	Remove passage barriers to upstream fish movement, screen Buck Creek diversion	YN, WDFW, UCD	3-10 years	Medium	$700-800k
		Hydrologically disconnect roads from stream	County Roads Dept., WDFW, YN	3-10 years	Medium	$1-2 million

6.3 Hatcheries

Artificial production may play a role in the recovery of salmon and steelhead populations in the White Salmon. The White Salmon River Working Group has proposed a strategy to allow for the natural recolonization of the White Salmon River after Condit Dam is removed. As described above, the natural recolonization of the newly accessible habitat will be evaluated and if escapement and productivity goals are not being achieved, then additional strategies using artificial propagation will be considered. Innovative programs, such as those employed by the Yakima Klickitat Fisheries Project, as described in the Klickitat Anadromous Fisheries Master Plan, would be consulted and appropriate methodologies adopted.

6.4 Harvest-Related Strategies and Actions

WDFW will continue to manage tributary fisheries for selective fisheries that target marked hatchery steelhead, requiring the release of unmarked (wild) fish. Overall impacts are very low for these tributary fisheries, with impacts generally less than 5 percent of the naturally produced fish (NPCC 2004).

Mainstem harvest will continue to be managed through the *U.S. v. Oregon* process, and will be subject to consultation with NMFS. Enhanced public education and fisheries enforcement will be incorporated along with new selective fisheries regulations to ensure understanding and compliance.

Treaty Indian fishing rights in the Columbia basin are under the continuing jurisdiction of the U.S. District Court for the District of Oregon in the case of *United States v. Oregon*, No. 68-513 (filed in 1968). The parties to *U.S. v. Oregon* are the United States acting through the Department of Interior (USFWS and Bureau of Indian Affairs) and Department of Commerce (National Marine Fisheries Service), the Warm Springs, Umatilla, Nez Perce, Yakama, and Shoshone-Bannock Tribes, and the states of Oregon, Washington, and Idaho. In *U.S. v Oregon*, the Court affirmed that the treaties reserved for the tribes 50 percent of the harvestable surplus of fish destined to pass through their usual and accustomed fishing areas.

Starting in 1977, tribal and state fisheries subject to *U.S. v Oregon* have been regulated pursuant to a series of court orders reflecting court-approved settlement agreements among the parties. The last long-term agreement, known as the Columbia River Fishery Management Plan (CRFMP) was adopted and approved by the Court in 1988 and expired in 1999. Since 1999, Columbia River mainstem fisheries have been managed via short term settlement agreements adopted by the Court. Artificial propagation programs upstream of Bonneville Dam have also been incorporated into these agreements, because of their importance to providing fish for harvest. Harvest plans for tributary fisheries are developed cooperatively by the management entities with primary management responsibility in the respective subbasin. The current agreement (2005-2007 Interim Management Agreement for Upriver Chinook, Sockeye, Steelhead, Coho and White Sturgeon) expired at the end of 2007.

A new *U.S. v. Oregon* Management Agreement has been completed and NMFS has recently completed a section 7 Biological Opinion addressing the impacts of the fisheries management action and hatchery production in the new agreement (https://pcts.nmfs.noaa.gov/pls/pcts-pub/biop_results_detail?reg_inclause_in=('NWR')&idin=107547). The new management agreement will cover Columbia River fisheries management and hatchery production actions from 2008 to 2017.

During the last 10-15 years, harvest has been managed pursuant to the CRFMP and successor agreements that contain restraints on the fisheries necessitated by ESA listings. The agreements quantify and allocate between tribal and non-tribal fishing subject to ESA-imposed constraints for listed species. The interim *U.S. v Oregon* harvest constraint for steelhead is set to protect Group "B" index fish returning to Idaho with impacts from Non-Indian fisheries limited to 2 percent and tribal fisheries to 15 percent. Group "A" index fish are affected by tribal fisheries at a substantially lower rate than Group "B" index fish. The new agreement set an impact limit on naturally produced Mid-Columbia River steelhead of no more than 2 percent in non-treaty fisheries, but it does not set a limit for treaty fisheries. NMFS expects impacts from the treaty fisheries to continue to be in the range observed since 1998, averaging around 6.64 percent.

6.5 Hydro-Related Strategies and Actions

Actions to address out-of-subbasin hydro-related limiting factors and threats are included in the recently released 2008 FCRPS Biological Opinion (NMFS 2008b).

Within the White Salmon subbasin, removal of Condit Dam will achieve the goals of restoring flows to the 1.1-mile bypass reach and will begin to recruit gravel to the lower 3 miles of river and restore Middle Columbia River steelhead spawning habitat in the long term. Removal will also provide unimpeded movement of adult and juvenile Lower Columbia salmonids (fall Chinook, coho, and chum) in the White Salmon River.

7. Implementation and Cost Estimates

The scale of human activities that limit or threaten White Salmon steelhead populations throughout their life cycle is broad and pervasive. Recovery can be achieved only through the combined and coordinated actions of Federal and state agencies, tribes, and local governments, and with the participation of nonprofit organizations, the business sector, and citizens. Collectively, these parties are referred to as implementing partners.

7.1 Implementation

This plan provides specific management strategies and actions needed to address all threats and identifies the partners with the authority, jurisdiction, or resources needed to implement each action (see Table 6-4 of the Plan). These actions represent activities with the greatest potential for protecting and recovering steelhead. Implementation of recovery actions will not be a one-time or short-term initiative. Programs and actions will likely need to be sustained, evaluated, adjusted, and augmented over the recovery period.

Prioritizing recovery actions for steelhead in the Washington Gorge Management Unit, including the White Salmon subbasin, would be a primary task of a Washington (WA) Gorge Area Regional Board. NMFS would support creation of such a Regional Board to coordinate implementation of plans for the Washington Gorge Management Unit in 2008-2009, subject to concurrence by state, tribal and local governments.

The Board could consist of representatives from Klickitat, Yakima and Benton counties, local landowners, and the Yakama Nation. The WA Gorge Area Regional Board could also create an opportunity for coordination with the Lower Columbia River Fish Recovery Board (LCFRB) to participate. The Board would use the considerations identified above to prioritize recovery actions in the White Salmon subbasin, and other areas within the Washington Gorge Management Unit, that build upon direction adopted by various stakeholders in the area.

In short, the prioritization of projects for funding should be based on a balance between the biological benefit of the project, its cost, and feasibility of implementation. Projects that address primary limiting factors, have high biological benefit, are relatively inexpensive, and are feasible should receive highest funding priority. Projects that are expensive, have low biological benefit to listed fish species, and have relatively low feasibility should receive lowest funding priority.

7.2 Costs

This section provides cost estimates developed by the Yakama Nation for implementing the proposed habitat actions for the White Salmon drainage. These costs are general range summaries and are based on the costs of specific reach actions identified in tabular form. Habitat action costs for recovery over a 10-year time period are estimated to be $6.5 million ($2.17 million for years 1-3 and $4.33 million for years 4-10).

Actions would be funded according to the prioritization framework and project ranking previously discussed. In short, the prioritization of actions for funding would be based on a balance between the biological benefit of the project, its cost and feasibility of implementing the project. Projects that address primary limiting factors, have high biological benefit, are relatively inexpensive, and are feasible to implement will receive highest funding priority. Projects that are expensive, have low biological benefit to listed fish species, and have relatively low feasibility will receive lowest funding priority.

7.3 Reach-Related Habitat Actions and Costs

Table 7-1 identifies some of the specific habitat actions and associated costs for recovery of White Salmon historical salmon and steelhead populations. The table provides information on reach-specific restoration needs, such as large woody debris, in-stream structures, and riparian vegetation. It does not identify reach-related actions and costs associated with dam removal, culvert replacement, road maintenance, installing sediment basins, or a number of other types of actions identified in Chapter 6.

The costs associated with the actions identified in Table 7-1 were estimated based on the Oregon NRCS 2006 Conservation Practice Component Cost List or the 2006 Fiscal Year Conservation Practices Cost List. EDT was used to define potential project areas. The EDT reach breaks presented in this estimate were identified through the Subbasin Planning process. They were agreed to by multiple parties, including USGS, WDFW, and the Yakama Nation. These geographical designations generally represent useful units of analysis for limiting factors, and consequently, for actions to address limiting factors.

Several important factors will influence some of the specific actions and costs associated with recovery. First, the mainstem White Salmon River above Condit Dam is heavily used by recreational boaters. These rafters and kayakers yearly remove wood from the river which they consider hazardous to their recreational pursuit. The use of wood in in-stream structures and the placement of rootwads will likely need to consider boater safety. Second, much of the area analyzed is in small canyons, or is otherwise difficult to access for the purpose of restoration efforts. Third, it is relatively unknown what habitat conditions will exist directly above and below Condit Dam after the dam has been removed.

Table 7-1. Reach-specific habitat actions and costs for recovery of White Salmon populations (Yakama Nation 2006).

White Salmon Habitat Actions and Costs					
Reach	**Action**	**Unit**	**Unit cost**	**#Units**	**Cost**
Buck Creek, mouth to diversion (B1)	Rootwad #	Each	600	4	2400
	Instream structures *	Each	2000	4	8000
Buck Cr., diversion intake to Buck Creek Falls 1 (B2)	Rootwad #	Each	600	4	2400
	Instream structures *	Each	2000	4	8000
B3 Buck Cr., Falls 1 to Falls 2 (B3)	Rootwad #	Each	600	2	1200
Buck Cr., Falls 2 to end of anadromous distribution (B4)	None at this time				
Indian Creek, mouth to Indian Creek culvert (I1)	Rootwad #	Each	600	2	1200
Indian Creek, culvert 1 to culvert 2 (I2)	Rootwad #	Each	600	2	1200
Indian Creek, culvert 2 to culvert 3 (I3)	Rootwad #	Each	600	2	1200
	Riparian planting #	Per tree	11	100	1100
Indian Creek, culvert 3 to culvert 4 (I4)	None at this time				
Indian Creek, culvert 4 to end of anadromous (I5)	Rootwad #	Each	600	2	1200
	Riparian planting #	Per tree	11	100	1100
Historical Little Buck Creek, mouth to top of reservoir (LB1)	None at this time				
Little Buck Cr., Top of reservoir to reach break (LB2)	None at this time				
Little Buck Cr., Reach break to end of anadromous distribution (LB3)	None at this time				
Historical Mill Creek mouth to top of reservoir (M1)	None at this time				
Mill Cr., Top of reservoir to culvert 1 (M2)	None at this time				
Mill Cr., culvert 1to culvert 2 (M3)	None at this time				
Mill Cr., culvert 2 to end of anadromous distribution (M4)	None at this time				
Rattlesnake Cr., mouth to Indian Creek confluence (R1)	Rootwad #	Each	600	2	1200
	Instream structures *	Each	2000	1	2000

White Salmon Habitat Actions and Costs					
Reach	**Action**	**Unit**	**Unit cost**	**#Units**	**Cost**
	Riparian planting #	Per tree	11	100	1100
Rattlesnake Cr., Indian Creek confluence to Falls 1 (R2)	Rootwad #	Each	600	4	2400
	Instream structures *	Each	2000	4	8000
	Riparian planting #	Per tree	11	100	1100
Rattlesnake Cr., Falls 1 to end of confinement (R3)	Rootwad #	Each	600	2	1200
	Instream structures *	Each	2000	3	6000
	Riparian planting #	Per tree	11	300	3300
Rattlesnake Cr., End of confinement to upper confinement (R4)	Rootwad #	Each	600	2	1200
	Instream structures *	Each	2000	3	6000
	Riparian planting #	Per tree	11	300	3300
Rattlesnake Cr., upper confinement to Falls 2 (R5)	Rootwad #	Each	600	2	1200
	Instream structures *	Each	2000	3	6000
	Riparian planting #	Per tree	11	300	3300
Rattlesnake Cr., Falls 2 to end of anadromous (R6)	None at this time				
Spring Creek, mouth to dam (S1)	Dam removal				Unknown
Spring Cr., Pond behind Spring Creek dam (S2)	Rootwad #	Each	600	2	1200
	Riparian planting #	Per tree	11	100	1100
Spring Cr., Top of Spring Creek Pond to forks (S3)	Rootwad #	Each	600	2	1200
	Riparian planting #	Per tree	11	100	1100
White Salmon R., Mouth to first riffle-end of Bonneville Dam pool influence (WS1)	None at this time				
White Salmon R., End of Bonneville Dam pool influence to Condit Powerhouse (WS2)	Rootwad #	Each	600	2	1200
	Instream structures *	Each	2000	2	4000
	Riparian planting #	Per tree	11	300	3300
White Salmon R., Condit Powerhouse to Steelhead Falls (WS3)	Rootwad #	Each	600	2	1200
White Salmon R., Steelhead Falls to Condit (WS4)	Rootwad #	Each	600	2	1200
White Salmon R., Condit Dam to Little Buck Ck (WS5)	None at this time; need dam removal				
White Salmon R., Little Buck Cr. to Mill Cr. (WS6)	None at this time; need dam removal				
White Salmon R., Mill Creek to end of deep reservoir (WS7)	None at this time; need dam removal				

White Salmon Habitat Actions and Costs					
Reach	**Action**	**Unit**	**Unit cost**	**#Units**	**Cost**
White Salmon R., End of deep reservoir to Buck Creek (WS8)	None at this time; need dam removal				
White Salmon R., Buck Creek to Sandy Beach (first riffle) (WS9)	Instream structures *	Each	2000	2	4000
White Salmon R., Sandy Beach (first riffle) to Spring Creek (WS10)	Instream structures *	Each	2000	2	4000
White Salmon R., Spring Creek to Deadman's Corner (WS11)	Instream structures *	Each	2000	2	4000
White Salmon R., Deadman's Corner to Rattlesnake Cr. (WS12)	None at this time				
White Salmon R., Rattlesnake Creek to Husum Falls (WS13)	None at this time				
White Salmon R., Husum Falls to Sunshine (Big) Eddy (WS14)	Rootwad #	Each	600	2	1200
White Salmon R., Sunshine (Big) Eddy to Diversion Hole (WS15)	Rootwad #	Each	600	2	1200
White Salmon R., Diversion Hole to BZ Falls (WS16)	None at this time				
White Salmon R., BZ Falls to Double Drop Falls (WS17)	None at this time				
White Salmon R., Double Drop Falls to Big Brother Falls (WS18)	None at this time				

* Utilized Oregon NRCS 2006 Conservation Practice Component Cost List
\# Utilized Fiscal Year 2006 Montana NRCS Conservation Practices Cost List
Reach designations (in parentheses) are from EDT analysis (Allen and Connolly 2005).

Table 7-2 summarizes estimated costs, including all foreseeable administrative costs by agency, associated with the proposed reintroduction activities in the White Salmon subbasin.

Table 7-2. Itemized estimated budget for reintroduction plan (Yakama Nation 2006).

Item	Party	Year 1	Year 2	Year 3
Personnel	USFWS	$18,157	$18,668	$0
Fringe Benefits	USFWS	$5,442	$6,533	$0
Supplies	USFWS (Abernathy Genetics Lab)	$24,636	$0	$0
Overhead	USFWS	$14,904	$10,426	$0
Personnel	UCD	$13,213	$12,215	$13,213
Fringe Benefits	UCD	$5,500	$5,226	$5,500
Supplies	UCD	$1,750	$6,950	$1,750
Travel	UCD	$1,009	$759	$1,009

Item	Party	Year 1	Year 2	Year 3
Overhead	UCD	$5,122	$6,122	$5,122
Other	UCD (Gauge maint. and Engineering contracts)	$12,800	$8,800	$12,800
Personnel	WDFW	$33,609	$35,290	$37,055
Fringe Benefits	WDFW	$13,381	$14,049	$14,752
Supplies	WDFW	$12,061	$10,775	$11,313
Overhead	WDFW	$17,060	$17,368	$18,239
Personnel	YN	$16,458	$17,699	$26,295
Fringe Benefits	YN	$3,262	$3,512	$5,280
Supplies	YN	$1,380	$480	$540
Travel	YN	$2,600	$2,730	$2,870
Overhead	YN	$4,477	$4,613	$6,609
Supplies	USGS	$24,500	$2,500	$2,500
Travel	USGS	$5,862	$5,862	$5,862
Overhead	USGS	$38,103	$32,486	$43,637
Personnel	USGS	$46,697	$53,574	$73,662
Fringe Benefits	USGS	$11,961	$13,962	$19,925
Other	USGS- 2000 PIT tag (@2.25 each) purchased by BPA, facilities direct	$7,171	$6,777	$7,558
Personnel	WDFW- Create reintroduction plan.	$0	$4,700	$4,700
Fringe Benefits	WDFW- Create reintroduction plan.	$0	$1,551	$1,551
Overhead	WDFW- Create reintroduction plan.	$0	$2,062	$2,062
Totals		**$341,115**	**$305,689**	**$323,804**

8. Monitoring, Research, and Adaptive Management

The various research and monitoring efforts underway in the White Salmon subbasin surrounding steelhead supplementation, habitat restoration and other activities require comprehensive empirical monitoring data on fish populations and habitat to identify appropriate project actions and strategies, select suitable sites and priority locations for actions, populate habitat/production capacity modeling efforts (such as Ecosystem Diagnosis and Treatment [EDT] and All H's Analyzer [AHA]), and inform adaptive management for the salmonid recovery plan. Information on fish distribution, abundance, productivity, habitat conditions, genetic diversity, pathogen levels, and other population parameters, as well as on population limiting factors, is necessary to help direct and evaluate these efforts. A coordinated monitoring program is needed to ensure that these various needs, including salmonid recovery planning, are met.

8.1 Designing a Monitoring and Evaluation Program to Support Adaptive Management

Because of the length and complexity of the salmonid life cycle, there are many uncertainties involved in improving salmonid survival. Simply identifying cause-and-effect relationships between any given management action and characteristics of salmon populations can be a scientific challenge. It is essential to design a monitoring and evaluation program that will answer these basic questions: How will we know we are making progress? How will we get the information we need? And how will we use the information in decision-making?
Designing an effective monitoring program for salmon recovery involves the following initial steps:

1. Clarify the questions that need to be answered for policy and management decision making. Include the full ESU and the full salmonid life cycle.
2. Identify entity or entities responsible for coordinating development of this program.
3. Identify:
    - Which populations and associated limiting factors to monitor
    - Metrics and indicators
    - Frequency, distribution, and intensity of monitoring
    - Tradeoffs and consequences of these choices
4. Assess the degree to which existing monitoring programs are consistent with NMFS guidance.
5. Identify needed adjustments in existing programs, additional monitoring needs, and strategy for filling those needs.
6. Develop a data management plan (See Appendix B of *Adaptive Management for ESA-Listed Salmon and Steelhead Recovery: Decision Framework and Monitoring Guidance (May 1, 2007)* http://www.nwr.noaa.gov/Salmon-Recovery-Planning/ESA-Recovery-Plans/upload/Adaptive_Mngmnt.pdf.
7. Prioritize research needs for critical uncertainties, testing assumptions, etc.
8. Identify entities responsible for implementation.

8.2 Adaptive Management

Adaptive management means taking an experimental approach to a complex task, making one's assumptions clear, and continuously evaluating them in the light of new information. It works best when the collection of performance data and methods of evaluation are designed to get the information managers need to make sound decisions. As outlined in the NMFS *Adaptive Management* guidance document, several types of monitoring are needed: (1) implementation and compliance monitoring, which is used to evaluate whether the recovery plan is being implemented; (2) status and trend monitoring, which assesses changes in the status of an ESU and its component populations, as well as changes in status or significance of the threats to the ESU; and (3) effectiveness monitoring, which tests hypotheses and determines (via research) whether an action is effective and should be continued. In addition, it's important to build in some research to illuminate the many unknowns in salmon recovery—the "critical uncertainties" that make management decisions all the harder. Critical uncertainty research may seem expensive or unnecessary in light of basic information needs; however, in the long run, it may reduce monitoring and implementation costs.

NMFS' guidance document presents a decision framework (Figure 8.1), that can guide the design of a research, monitoring, and evaluation plan. The framework contains two basic sorts of questions: (1) questions regarding DPS status (biological viability criteria) and (2) questions regarding statutory listing factors and factors limiting recovery (limiting factor and threats criteria). Evaluating a species for potential delisting requires an explicit analysis of both types of criteria.

The guidance document contains a more detailed discussion of the framework and identifies the specific questions that should be answered to evaluate DPS status. These specific questions take the form of a series of decision-question sets that address the status and change in status of a salmonid DPS and the risks posed by threats to the DPS. The decision-question sets are designed to elicit the information NMFS needs to make delisting decisions. For recovery planners, the framework can guide future decisions about management strategies and actions aimed at achieving recovery goals.

The White Salmon monitoring and evaluation program will build on existing programs designed for monitoring tributary habitat in the White Salmon. The White Salmon monitoring and evaluation program will provide (1) a clear statement of the metrics and indicators by which progress toward achieving goals can be assessed, (2) a plan for tracking such metrics and indicators, and (3) a decision framework through which new information from monitoring and evaluation can be used to adjust strategies or actions aimed at achieving the Plan's goals.

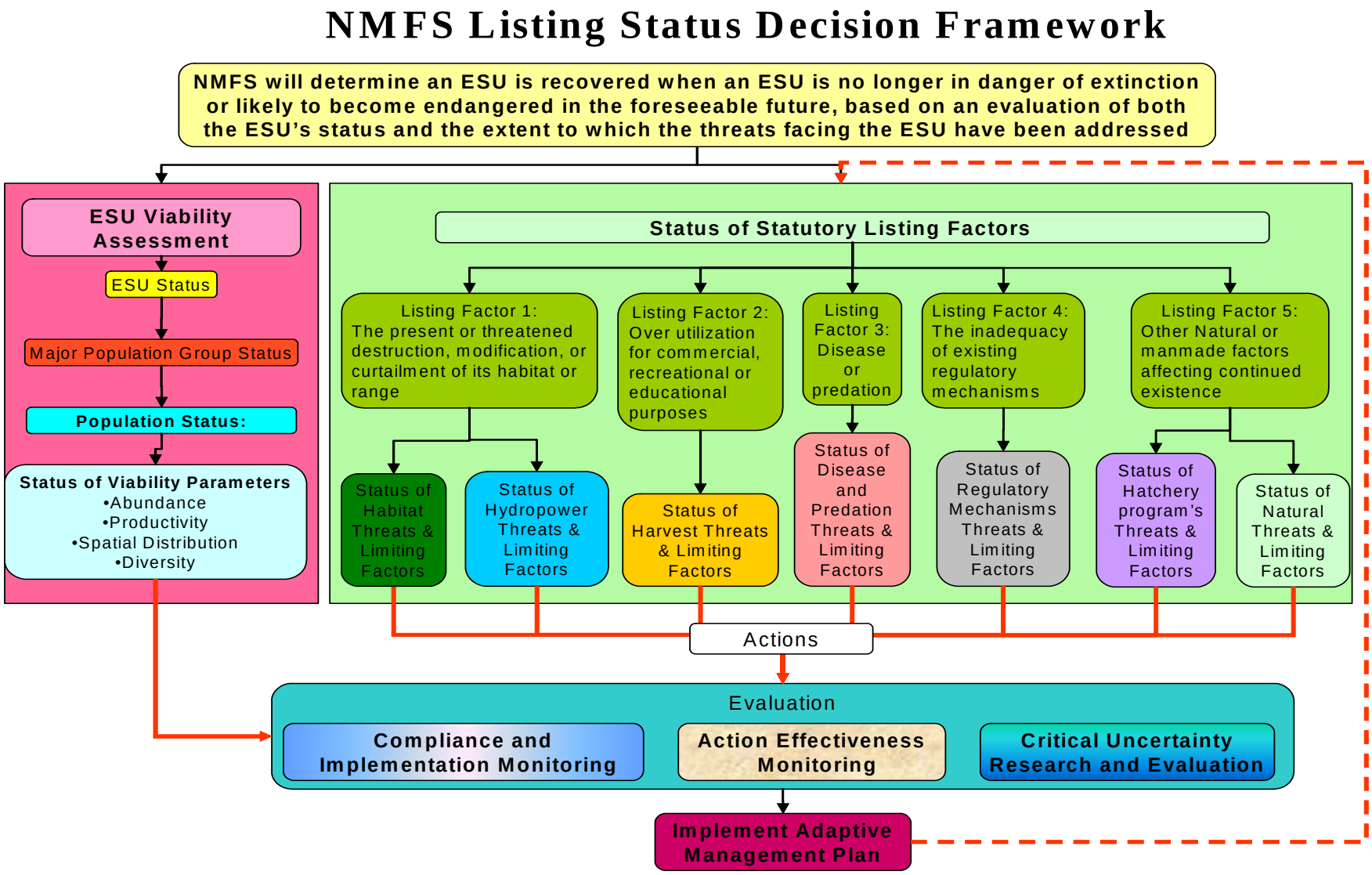

Figure 8-1 NMFS Listing Status Decision Framework.

8.3 Critical Uncertainties

Data gaps important to recovery can be divided into two major categories: (1) those that deal with critical uncertainties; and (2) gaps in knowledge about the linkages between specific actions and their effects on habitat factors and VSP parameters. Some of the data gaps can be filled through monitoring and evaluation; others should be filled through research.

Critical uncertainties, the unknown aspects of environmental conditions vital to salmonid survival, are a major focus of the research, monitoring, and evaluation program. Monitoring is needed to establish linkages between specific actions and resultant environmental effects. Those linkages are complex and often not well understood. Understanding them requires input from experts from various fields. It is important that the actions recommended in the Plan to benefit listed fish species in the White Salmon subbasin be reviewed by fish ecologists, geologists, hydrologists, and other experts familiar with the recovery region.

The Plan expects that specific benchmark values for the VSP parameters will be refined during Plan implementation based on new information that addresses current uncertainties.

There are numerous out-of-basin uncertainties. The geographic areas that constitute the multiple ESUs encompass a large part of north-central Oregon and a large part of south-central Washington draining into the Columbia River. There are multiple populations across species. This context is significant in terms of uncertainties:

- Under the ESA, successful recovery of listed species as defined by NMFS requires achieving specific levels of productivity for populations within the entire ESU, not only acceptable productivity within any single basin that is a part of the ESU. Local communities in different watersheds/basins across local and state boundaries are dependent upon each other for successful delisting of these species.

- Of the seven necessary components of an ESA recovery plan, only three are the responsibility of in-basin parties—for which there is currently no collaborative governing board. The other components (e.g., hydropower operations, harvest, hatcheries, macro-economics, estuarine conditions), though significant to impacts on overall mortality, involve factors that are outside of, and cannot be directly affected by, actions taken within the White Salmon subbasin. Monitoring is needed to measure the increases/decreases in productivity of the target populations within the subbasin, before they migrate out of the subbasin.

8.4 Research

As noted earlier, unknown aspects of environmental conditions vital to salmonid survival are termed "critical uncertainties." Critical uncertainty research targets specific issues that constrain effective recovery plan implementation. This includes evaluations of cause-and-effect relationships between fish, limiting factors and actions that address specific threats related to limiting factors. Listed below are research actions that are needed to assess the effects of the uncertainties on recovery of listed fish species in the White Salmon subbasin. Research actions address both in-basin and out-of-basin factors, and are not all inclusive. The following in-subbasin and out-of-subbasin research needs have been identified from a longer list of potential research needs that were applied to other basins within the DPS.

8.4.1 In-Subbasin Research Needs

- Identify data needs that are easily comparable pre- and post-dam removal.
- Fish abundance, origin, and production data before and after removal of Condit Dam.
- Collect baseline pre-dam-removal information, e.g., cross-sectional habitat data.
- Pre-dam-removal monitoring of fish and habitat above and below Condit Dam through the NPCC process.
- Conduct habitat/population assessment work in Buck Creek tributary above Condit Dam.
- Track sediment through time.
- Post-dam-removal water quality and sediment monitoring.
- Address potential issues at in-lieu fishing site post-dam-removal.
- The White Salmon River is a thermal refuge. How important is this? What impact will this have on steelhead? Steelhead move into the White Salmon River to seek cold water refuge when mainstem Columbia River temperatures increase. What impact will dam-removal have on this condition?
- Arrive at a common understanding of what the current fish community in the White Salmon River consists of.
- Implement genetic research to identify genotypic variation, help establish presence of runs in White Salmon subbasin.
- Increase understanding of linkages between physical and biological processes so managers can predict changes in survival and productivity in response to selected recovery actions.
- Perform additional EDT and other modeling, and test assumptions and sensitivity of EDT and other model runs.
- Determine relative performance (survival and productivity) and reproductive success of naturally producing species.
- Assess population structure.
- Determine the effects of exotic species on recovery and the feasibility of actions to eradicate or control numbers of exotic species.

8.4.2 Out-of-Subbasin Research Needs

- Evaluate innovative techniques (e.g., terminal fisheries and tangle nets) to improve access to harvestable stocks and reduce undesirable direct and indirect impacts to naturally produced steelhead.
- Develop better methods to estimate harvest of naturally produced steelhead and indirect harvest mortalities in freshwater and ocean fisheries.
- Assess the interactions between hatchery and naturally produced steelhead.
- Assess if hatchery programs increase the incidence of disease and predation on naturally produced fish.
- Evaluate if passage through hydroelectric projects affects reproductive success of listed fish species.
- Assess baseline survival estimates for juvenile listed fish species as they pass hydroelectric projects.
- Evaluate increased predation risks from native and non-native fish, birds and mammals.

These should be coordinated with NOAA's Columbia River Estuary Recovery Plan Module, Columbia River Harvest Recovery Plan Module, and the 2008 FCRPS Biological Opinion.

8.5 Monitoring

The Plan includes direction for research, monitoring and evaluation (RM&E) to define unknown population characteristics, contribute to regional monitoring efforts, better direct efforts within the subbasin, and assess the effectiveness of future actions.

Research and monitoring are designed to test implementation, validation, status/trend, and effectiveness. Implementation monitoring determines if planned actions were implemented as intended and whether all implementation objectives are on schedule. Validation monitoring determines whether the fundamental ecological assumptions underlying the recovery plans are true. Prominent among these assumptions are the effects of specific environmental conditions on survival and abundance of listed fish species embodied in the EDT model. Status/trend monitoring determines the current conditions (status) of the populations and their habitats and their changes over time. Effectiveness monitoring focuses on whether the recovery actions changed the environment and/or the VSP parameters.

Conditions outside the subbasin will affect and inform actions, research and monitoring within the subbasin. Out–of–basin conditions do, and will, have a significant effect on the success of recovery of species within the subbasin. These factors include commercial harvest, sport and tribal harvest, conditions in the mainstem Columbia River (including hydroelectric operations), and conditions in the estuary and ocean including short and longer term cycles in ocean conditions. The regional RM&E program developed under the FCRPS Biological Opinion will measure status, trends, and effectiveness of actions in this area.

A recently formed multi-agency Condit Technical Working Group met in early 2007 to discuss R, M&E issues (and actions to resolve them) in light of the proposed removal of Condit Dam. The RM&E questions that were drafted curing this meeting are detailed further in the "In-Subbasin Research Needs" section, below.

Key Question #1: What is the source of colonizing salmon and steelhead?
Obtain genetic samples of coho, Chinook, and steelhead before dam removal. Collect smolts (USGS juvenile trap) in 2006 and 2007. Collect genetic samples after dam removal and compare using genetic analysis.

Key Question #2. Has the abundance and origin of salmon, steelhead and bull trout spawners changed between pre- and post- dam removal?
Obtain pre-removal abundance of spring Chinook, steelhead, and coho and improve the accuracy of fall Chinook estimates.

Key Question # 3. Has smolt production increased after dam removal?
Develop smolt estimates in 2007 for Chinook fry, and Coho, Chinook, and steelhead smolts (USGS). Compare to smolt population estimates after dam removal.

Key Question #4. Has the habitat changed after dam removal?
Compare bathymetric surveys below Condit in the early 1990s with post-removal surveys. Conduct cross-sectional profiles just above reservoir and near mouth to document downcutting and sediment transport.

A general framework for monitoring within the White Salmon subbasin is described below.

8.5.1 Implementation Monitoring

Implementation and compliance monitoring simply check on whether activities were carried out as planned, and whether specified criteria are being met as a direct result of an implemented action. Recovery actions implemented within the White Salmon subbasin will be monitored to assess whether the actions were carried out as planned. This will be carried out as an administrative review and will not require environmental or biological measurements.

Implementation monitoring will address the types of actions implemented, how many were implemented, where they were implemented, and how much area or stream length was affected by the action. Indicators for implementation monitoring will include visual inspections, photographs, and field notes on numbers, location, quality, and area affected by the action. For example, if a fence is planned for 20 miles of stream corridor to keep livestock off the stream banks so that riparian vegetation will rebound, implementation monitoring would verify the presence of the fence. Compliance monitoring would take note of the presence or absence of livestock in the fenced-off area.

Success will be determined by comparing field notes with what was specified in the plans or proposals (detailed descriptions of engineering and design criteria). Thus, design plans

and/or proposals will serve as the benchmark for implementation monitoring. Any deviations from specified engineering and design criteria will be described in detail.

8.5.2 Status/Trend Monitoring

Status and trend monitoring is a simple compilation of data-based descriptions of existing conditions. To be useful in decision-making, the raw data, or metrics, should be reduced to a more directly applicable form or indicator. For example, if the question is "What is the annual spawning population-size of steelhead in the White Salmon River?" the indicator would be total spawning numbers of steelhead over one season for the entire river basin; however, the metric, or directly measured thing, would be something quite different, perhaps steelhead redds sighted on weekly passes over known spawning grounds. Thus, the metric should be processed to translate it from the metric data type (e.g., redds) into the indicator data type (e.g., spawners), and then reduced to generate the indicator required (e.g., list of weekly counts on spawning grounds to annual total for watershed).

A future collaborative board directing implementation will develop a program to monitor the status and trend of steelhead and their habitats throughout the White Salmon subbasin. The program will utilize guidelines developed in the Pacific Northwest Aquatic Monitoring Partnership (PNAMP) and the Collaborative, and the Systemwide Monitoring and Evaluation Project (CSMEP).

8.5.3 Effectiveness Monitoring

Effectiveness monitoring specifically addresses cause-and-effect questions. Demonstrating the direct and indirect impact of management actions requires supporting all steps in the logical chain that connects the action to its expected impact. This chain is rarely short and usually contains several hypotheses. For this reason, it's better to build the effectiveness monitoring into the recovery action strategies, with, for example, pilot-scale tests or other methods carefully thought out beforehand.

Not all recovery actions recommended in the Plan need to be monitored for effectiveness. However, it is important that a sufficient number of replicates of each "type" of action be assessed for effectiveness. To the extent possible, effectiveness of recovery actions will be monitored using the Before-After-Control-Impact (BACI) design with stratified random sampling, as described in the Comprehensive Statewide Monitoring Strategy (Monitoring Oversight Committee 2002). This strategy describes in detail the approach, indicators, and protocols needed to assess effectiveness of habitat restoration classes. It is critically important to coordinate these effectiveness monitoring programs with status/trend monitoring and effectiveness monitoring within the Hydro sector.

Monitoring and evaluation will only provide the answers to the questions they were designed to address; they do not provide the framework for revising these questions if they are ill-posed, evaluating the assumptions upon which the strategy was built, or incorporating learning into future decisions on actions and strategies—this is the role of adaptive management.

8.6 Consistency with Other Monitoring Programs

This recovery plan will utilize existing monitoring programs to evaluate the status/trend and effectiveness of recovery actions within the White Salmon subbasin. Specifically, this approach will incorporate strategies, indicators, and protocols described in the Yakima/Klickitat Fisheries Project, the Upper Columbia Monitoring Strategy, the Comprehensive Statewide Monitoring Strategy, and CSMEP. The development of other regional monitoring programs may result in modifications to the monitoring programs used in the White Salmon subbasin. These other programs, in various states of development, include such approaches as PNAMP. As these programs develop more fully, they will provide guidance on valid sampling and statistical designs, measuring protocols, and data management. This information may be used to refine and improve the existing monitoring and evaluation programs in the White Salmon subbasin. The intent is to make monitoring and evaluation programs in the White Salmon subbasin consistent with programs throughout the ESUs and Columbia basin.

8.7 Coordination

Many entities have been or will be implementing recovery actions within and downstream from the White Salmon subbasin. Monitoring programs to coordinate with include:

- Yakima/Klickitat Fisheries Project,
- Yakama Nation Monitoring,
- NOAA Fisheries RM&E Program,
- Washington Salmon Recovery Funding Board Program,
- PACFISH/INFISH Monitoring Program,
- Pacific Northwest Interagency Regional Monitoring Program,
- USFWS, USGS, and BOR monitoring programs,
- WDFW and Department of Ecology monitoring programs, and
- Local Underwood Conservation District monitoring.

It is critical that these programs be consulted to emphasize utility, reduce redundancy, increase efficiency, and minimize costs.

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8.8 Evaluation Schedule

The White Salmon subbasin currently has no collaborative regional board guiding work, however a regional board for the Washington Gorge Management Unit could be developed as a follow-up to recovery planning. An appropriate first check-in for the watershed is 3 years from the adoption of the Plan. At this time, the board or co-managers should review efforts within the subbasin—whether funding has been obtained and actions initiated. At years 5, 8, and 12 further evaluations should occur in order to coordinate with other subbasin in the ESU. Reviews at this time should start with funding and implementation effectiveness. If funding and implementation have taken place previously, their effectiveness should be reviewed and progress toward the overall

implementation of projects within White Salmon should be measured. Progress, or the lack thereof, should be put within context of the entire ESU.

The first major step in the adaptive management program is to obtain 6-year implementation schedules from each of the partners that will describe the tasks, schedules, priorities, and estimated cost to implement the recovery actions. Each of the Federal and state agencies, tribal and local governments, and non-governmental entities identified as partners will be requested to prepare an implementation schedule for their recovery actions. These individual schedules will be combined into a regional implementation schedule which will cover the entire management unit. The initial schedules are expected to be completed in the summer of 2005, and new schedules will be prepared on 6-year intervals, which will coincide with the 6-year adaptive management checkpoints and, along with the 2-year checkpoints, will allow the schedules to incorporate changes or modifications based on implementation and effectiveness evaluations. Additional evaluation of the status of viability attributes limiting factors and new information critical uncertainties should be coordinated with NOAA Fisheries 5-year ESA status reviews. Results of these programs should be incorporated into adaptive management of the White Salmon recovery plan, and coordinated with other Middle-Columbia steelhead recovery plans and the recovery plan estuary and harvest modules for the Columbia River, as well as the 2008 FCRPS Biological Opinion.

8.9 Monitoring and Evaluation Plan

The information in this chapter provides a framework for the development of a salmonid RM&E and adaptive management plan for the White Salmon basin. When the recovery plan's goals and objectives are finalized, a process will be initiated to fully develop a RM&E plan and append it to the recovery plan when it is completed. A multi-agency salmonid reintroduction plan for the White Salmon River will rely heavily on results of research, and be guided by ongoing monitoring and evaluation.

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Appendix I. Options for Steelhead Reintroduction

The following reintroduction plan for steelhead in the White Salmon River was developed by the White Salmon River Working Group made up of Federal, state, and tribal fisheries managers, as well as representatives of the PaciCorp (Condit Dam operators). The White Salmon River Working Group developed a number of options for the reintroduction of steelhead into the White Salmon River in anticipation of the removal of Condit Dam in the fall of 2009. Each option developed includes a description of the biological basis for the approach, operational and maintenance needs, and the monitoring and evaluation needs to support the approach. Each of the options that were developed are listed below.

There are indications that the population of O. mykiss in the White Salmon River above Condit Dam is still producing smolts even though anadromy has been eliminated since the construction of Condit Dam and the end of passage in the 1919. Pre-removal monitoring in the White Salmon River above Condit Dam has identified O. mykiss juveniles displaying smolt behavior and morphology, and PIT-tagged juveniles have been detected passing Bonneville Dam with one being recovered at the tern colony on East Sandy Island (B. Allen, Personal Communication, 2007). In addition, a juvenile O. mykiss PIT-tagged above Condit Dam September of 2004 at 98 mm was detected ascending Bonneville Dam on in July of 2006. Genetic analysis of juvenile O. mykiss collected in the upper watershed above Hussum Falls are different from hatchery trout released in the basin, however additional samples are needed to confirm this finding (Allen et al. 2006). This information supports the theory that even though the population is functionally extirpated there is still the potential for reestablishing anadromous steelhead in the White Salmon River basin.

Based on the potential to reestablish natural production of steelhead in the basin, the White Salmon Working Group decided that Option 1, the Natural Recolonization approach, was the best suited for the status of O. mykiss in the basin. The key to the success of this option is to implement all of the proposed monitoring and evaluation activities, including screw trap operations and the installation of a weir on Rattlesnake Creek to monitor adult escapement, adult movement, and presence/absence of stray hatchery origin steelhead. In the future, if the need arises, the weir could be used to exclude hatchery origin adults creating a refuge for naturally produced steelhead. Another reason that the White Salmon Working Group supported option 1 was that the removal of Condit Dam provides a rare opportunity to study the natural recolonization of newly available habitat without using hatchery intervention. Option 1 will be evaluated and an assessment made after 5 years to determine if the approach should continue or if the other proposed options should be considered.

Options for Reintroduction of Steelhead to White Salmon River After Removal of Condit Dam

1. Natural recolonization – no reintroduction efforts from outside sources
   d. Biological Basis
      i. Potentially a small number of returning native adults but may not be sufficient number to restart population.
      ii. Recent USGS studies identify PIT-tagged resident *O. mykiss* migrating from the White Salmon above Condit Dam. One PIT tag collected at East Sand Island, and one detected passing back upriver through the Bonneville Dam fishway (steelhead life history may still be present in upper watershed).
   e. O & M Needs
      i. Maintenance of weir(s) in tributary stream(s).
   f. M & E Needs
      i. Monitor all natural spawner escapement.
      ii. Monitor hatchery stray steelhead on the spawning grounds.
      iii. Juvenile fish surveys for abundance and growth (via PIT tagging)
      iv. Rotary Screw Trap (both in lower river and above current reservoir site) to collect out migrants for DNA analysis, and juvenile production.
      v. Adult and juvenile weir trap and/or instream PIT tag detector for monitoring in Rattlesnake Creek.
      vi. Redd capping to conduct DNA analysis.

2. Wild donor from local subbasin as brood source for juvenile release into the White Salmon River. Eggs collected and reared at suitable hatchery, juveniles acclimated and released at White Salmon Ponds
   a. Biological Basis
      i. Would emphasize collection of wild steelhead from locally adjacent watershed, with similar geomorphologic characteristics and flow regime
      ii. Marking to minimize harvest and still provide monitoring information on returning adults
   b. O & M needs
      i. White Salmon Pond rehabilitation and O&M.
      ii. Juvenile transport at fry or smolt stage
      iii. Possible identification and development of upriver acclimation site.
   c. M & E Needs
      i. Monitor natural and hatchery escapement to spawning grounds
      ii. Monitoring natural escapement in brood source river and any impacts to natural population from broodstock collection

3. White Salmon resident *O. mykiss* as brood source with locally suitable anadromous wild donor stock spawned for juvenile release into upper White Salmon River.
   a. Biological Basis
      i. Would emphasize both local (resident) and from locally adjacent watershed
      ii. Possible concerns of ESA status of new population.

b. O & M Needs
   i. Upper White Salmon release site identified/developed and O&M.
   ii. Possible identification and development of upriver acclimation site.
c. M & E Needs
   i. Fish Health monitoring (BKD/IHN concerns)
   ii. Assessment of possible effects of use of genetically mixed local donor stock

4. Develop White Salmon captive brood program using captured outmigrating juveniles
   a. Biological Basis
      i. Capture genetically unique White Salmon steelhead for captive brood program development.
   b. O & M Needs
      i. Transport equipment.
      ii. Spawning, incubation, rearing and adult holding facilities.
      iii. Possible identification and development of upriver acclimation site.
   c. M & E Needs
      i. DNA analysis to ensure White Salmon population.

5. White Salmon Steelhead Kelt Reconditioning. Recondition local spawners to enhance survival to repeat spawning stage.
   a. Biological Basis
      i. Maximize survival of White Salmon steelhead to bolster early stages of White Salmon re-colonization effort.
   b. O & M Needs
      i. Adult downstream weir trap to collect females.
      ii. Holding area and feed.
      iii. Direct stream release locations identified/developed (for release of reconditioned adults)
   c. M & E Needs
      i. Monitoring holding/release methods (i.e. release below Bonneville, or release into White Salmon, hold and release into White Salmon just prior to spawning).
      ii. PIT-tag adults for Bonneville Dam detection.
      iii. Rotary Screw Trap (both in lower river and above current reservoir site) to collect out migrants for DNA analysis.
      iv. Acoustic tag monitoring in White Salmon and Columbia plume to track kelt movement.

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Appendix II. Current Efforts Addressing Limiting Factors and Threats

As discussed in Chapter 5, a number of factors limit steelhead production in the White Salmon drainage. These factors need to be addressed to improve population abundance, productivity, spatial structure and diversity. Key factors identified in the White Salmon Subbasin Plan (NPCC 2004) and the recently conducted EDT analysis (Allen and Connolly 2005) include:

- Blocked or impaired fish passage (presence of obstructions, particularly Condit Dam)
- Degraded channel structure and complexity (lack of habitat diversity, including loss of large wood; reduced channel stability)
- Degraded floodplain connectivity (loss of off-channel habitat, side channels, hypotheic zone)
- Degraded riparian condition (lack of native riparian vegetative communities, LWD recruitment)
- Altered hydrology (increased peak and diel flow variations)
- Altered sediment routing (increased sedimentation and percent of fines in spawning gravel)
- Degraded water quality (abnormally high water temperatures)
- Illegal harvest (harassment/poaching)
- Predation, competition and disease

The removal of Condit Dam in October 2009 is expected to provide access to as much as 33 miles of river and tributary habitat for anadromous steelhead and salmon. The removal also would restore natural bed load movement processes, allowing transportation of sediments, spawning gravels and large wood through the mainstem, and improving flows in the lower river. Combined with a stable and natural flow regime, dam removal would significantly increase steelhead and salmon production potential. Dam removal would also restore the marine derived nutrients cycle that benefits fish, wildlife and vegetation (NPCC 2004).

Providing salmon and steelhead passage to historical spawning and rearing habitats, however, is only part of the solution. As discussed in Section 6, many of the ecosystems that once supported salmon and steelhead production now display degraded habitat conditions. Above Condit Dam, the hydrological characteristics (peak flows and intra-annual flow) and sediment load (percentage of fines in spawning gravel, embeddedness and turbidity) have increased because of roads, clearing of forestlands, and removal of trees from stream banks (NPCC 2004). While water quality in the mainstem remains very good, with maximum temperatures and dissolved oxygen near optimum levels for salmonids, maximum temperatures in tributaries have increased, primarily from water withdrawals and lack of mature conifers in riparian areas. Riparian condition also remains good along much of the mainstem White Salmon River, but is more degraded in the tributaries. Degraded riparian condition and wood removal from streams has

decreased critical habitat for juvenile rearing (NPCC 2004). Nutrient enhancement has also increased slightly from historical levels in both the mainstem and tributaries because of agricultural practices and failing septic systems. While landowners and managers are currently addressing many of these problems, more improvements are needed to increase abundance, productivity, spatial structure and diversity of White Salmon River steelhead, Chinook, coho and chum populations.

Numerous projects have been completed recently or have been initiated to address these and other factors affecting salmonid production in the White Salmon subbasin. Additionally, there are numerous rules and regulations in place that will prevent or minimize future effects on salmonid production. The Yakama Nation supports the dedication of additional resources to ensure the preservation of in-stream, riparian, and upland habitats through enforcement of existing state and planning ordinances. These actions and regulations are described in the following sections.

II.1 Regulatory Protection

Various state, tribal and county regulatory mechanisms are in place to protect riparian areas from current and future threats posed to listed species through habitat loss and degradation caused by human land uses and development. These mechanisms include Washington State forest and fish regulations, state and county shoreline development regulations and the Yakama Nation Forest Management Plan. In addition, some areas receive special protection through designation, such as Wild and Scenic River reaches, primitive areas, and wildlife refuges.

Forest and Fish Regulations (Washington State)

The Washington Forests & Fish Law (ESHB 2091) was signed into law in 1999 as part of The Washington State Forest Practices Act (Title 76.09 RCW), passed in 1974. The Forests & Fish Law, based on the Forests & Fish Report, mandated changes to forest practices rules to protect riparian and aquatic resources on more than eight million acres of private forestland. The consensus from the Forests and Fish report recommended:

- Establishment of a scientifically based adaptive management and monitoring process for evaluating the impact of forest practices on aquatic resources;
- Establishment of a process for amending the forest practices rules to incorporate new information as it becomes available;
- Protection of aquatic resources to the maximum extent practicable, consistent with maintaining commercial forest management as an economically viable use of lands; and
- A regulatory climate more likely to keep landowners from converting forestland to other uses that would be less desirable for salmon recovery. http://www.forestsandfish.com/Law/washington.php?cPage=Law#Anchor-Washington-35882

Timber, Fish and Wildlife (Washington State)

In 1975, the Washington Department of Natural Resources (WDNR) developed the process of classifying streams into one of five types, depending on their physical, biological, and human-use characteristics as part of the Forest Practices Rule (WAC 222-16-031). The Forest Practices Rules give directions on how to implement the Forest Practices Act (Title 76.09 RCW) to regulate forest practices that impact Washington's surface waters. As of spring 2005, WDNR has changed the Types 1-5 designations to S-F-N water types on the West side of the state; the change will take effect in water typing maps as of March 2006 on the East side.

Western Washington	Eastern Washington
Type "S" – Shorelines	Type 1 Water
Type "F" – Fish	Type 2 and 3 Water
Type "Np" – Non-Fish Perennial	Type 4 Water
Type "Ns" – Non-Fish Seasonal	Type 5 Water
Letter "U" – Unknown	Number 9

Accurate water typing is essential to protecting fish and their habitats because the type and proximity of human activities allowable in areas adjacent to streams and other surface waters is dictated by water type. For example, riparian buffer zones required on fish-bearing streams are greater than those required on non-fish bearing perennial streams.

The Forest Practices Rules prescribe how forest practices such as logging, road building, and chemical applications are conducted to protect public resources. When operators or landowners do not follow the rules, the WDNR issues enforcement orders and may also issue a civil (monetary) penalty. A civil penalty is most often issued when the violation caused significant environmental damage, when an operator or landowner does not comply with the department's enforcement orders, or when the operator or landowner has a history of repeated violations. All civil penalties become final orders of the department unless appealed.

Klickitat County Shorelines Master Plan

The Klickitat County's Shorelines Master Plan (SMP) regulates "development" within the "shorelines" of the White Salmon watershed and other watersheds in Klickitat County's jurisdiction. "Development" is broadly defined as: construction or exterior alteration of existing structures; dredging; drilling; dumping; filling; removal of any sand, gravel or minerals; bulkheading; driving of piling; placing of obstructions; or any project of a permanent or temporary nature which interferes with the normal public use of the surface of the waters overlying lands subject to the SMP regulations at any state of water level. "Shorelines" are those lands extending landward for 200 feet in all directions as

measured from the ordinary high water mark, floodways and contiguous floodplain areas landward 200 feet from such floodways; and all wetlands and river deltas associated with the streams and lakes.

The SMP designates various reaches of White Salmon River and its tributaries as "environments," which determine the level of protection that is warranted. Much of the White Salmon River is designated either "Conservancy Environment" or "Rural Environment." Both Environments allow a limited scope of development, subject to conditions (i.e. shoreline conditional use permit).

Each development proposal is subject to review pursuant to the shoreline environment within which it is to be located. One or more shoreline permits must be secured before implementation: Substantial Development Permits (SDP) are required for any development for which the total cost or fair market value exceeds $5,000, or any development which materially interferes with the normal public use of the water or shorelines; Shoreline Conditional Use Permits (CUP) are required for development types that warrant conditions to ensure consistency with the SMP; and Variances (VAR) are issued to grant relief from specific bulk, dimensional, or performance standards of the SMP in order to avoid unnecessary hardship, provided that extraordinary circumstances are shown to exist and the public interest shall suffer no substantial detrimental effect. Some types of development, such as a single-family residence, normal maintenance and repair, or construction of a normal protective bulkhead for a single family residence, are exempt from the requirement of a substantial development permit, but are still subject to all other provisions of the SMP.

Klickitat County's SMP was first adopted in the mid-1970s pursuant to the Washington State Shoreline Management Act of 1971, and has been updated periodically since then. Existing structures and developments that were established before adoption of the SMP are considered legally established "nonconforming" uses. Since adoption of the SMP, all developments within shorelines, including modifications to nonconforming uses, have been reviewed by the County and Washington Department of Ecology (Ecology) to ensure compliance with the goals and requirements of the SMP.

The Department of Ecology reviews the County's permit decisions and has final authority to approve or deny conditional use permits and variances. Persons may appeal the final decision to the Shorelines Hearings Board. In Klickitat County, only one appeal case occurred out of all 121 applications between 1972 and 2004. Cases are rarely appealed.

A study by the University of Oregon indicates that implementation of the SMP may be hindered by lack of funding, lack of public awareness in the permitting process and SMP regulations, and lack of enforcement (University of Oregon 2005, Community Planning Workshop). Study findings suggest that restricted funds have hampered efforts to implement the SMP. For example, at the time the study occurred the State Department of Ecology staff lacked funding for site visits to review site conditions, and in recent years had only been able to monitor variances. The study also found that the public was not

aware of the types of developments that required permitting; therefore the majority of permitted projects were larger developments. Wetland alterations were only required to be self-reported by permit applicants and delineation was not required, thus wetland alterations were typically underreported. In addition, the study found that implementation of the SMP was impeded because the County could only take enforcement actions after a complaint was filed by a neighboring resident, and residents rarely complained about neighboring properties (University of Oregon 2005, Community Planning Workshop).

Klickitat County Critical Areas Ordinance

Klickitat County adopted a Critical Areas Ordinance (CAO) in 2001 and, with the concurrence of Washington Departments of Fish and Wildlife, Community Trade and Economic Development, and Ecology, amended it in 2004. The CAO extends beyond the geographical scope of the County's SMP to protect wetlands, critical fish/wildlife habitat, geologically hazardous areas, aquifer recharge areas, and frequently flooded areas. The CAO provisions apply to all activities, unless exempted, in unincorporated areas of Klickitat County; they are, in effect, an overlay on existing land use regulations. The CAO requires setbacks of 300' from Category I wetlands; 200' from Category II; and 75' from Category III and IV. The CAO requires buffers of 200' from Type 1 & 2 waters; 150' from Type 3 waters; 50' from Type 4 waters; and 25' from Type 5 waters. A wildlife habitat management plan is required for new development that will likely impair habitat functions and values. As with the SMP, developments and uses that existed prior to the adoption of the CAO are considered legally established "nonconforming" uses.

Klickitat County Floodplain Management Ordinance

The Klickitat County Floodplain Management Ordinance (FPO) regulates all development and activities that may increase flood elevations/velocities. Development within floodways is prohibited; development within floodplains is subject to review of a flood analysis conducted by a professional engineer. Development that will increase flood potential or endanger public health or safety will be denied.

Klickitat County Zoning Ordinance

The Klickitat County Zoning Ordinance (CZO) was adopted in 1979 and has been amended over time. Much of the White Salmon River watershed is zoned by the CZO "extensive agriculture" and "forest resource." Both zones require a 20-acre minimum lot size for the purpose of dividing properties, and new development/uses are restricted to resource management uses/activities and other compatible uses. One permanent residential dwelling is allowed per lot. Some areas of the watershed are zoned for residential development. The allowable minimum lot size for new lots is either one or two acres; and one residential dwelling is allowed per lot. Other than residential development, most new development/uses in these zones is either prohibited or allowed per a zoning conditional use permit.

Klickitat County Environmental Ordinance (CEO)

The Klickitat County Environmental Ordinance (CEO) was adopted pursuant to the State Environmental Policy Act (SEPA). The CEO and SEPA require an analysis of probable significant adverse environmental impacts that may be the result of a proposed development. The CEO and SEPA require a threshold determination for each proposed development that is not exempt. The threshold determination is a determination that a project will or will not have probable significant adverse environmental impact. Any proposed development/use that is not specifically exempt in SEPA (Chapter 197-11 WAC) is required to comply with SEPA. Klickitat County provides applicable state agencies and tribes, as well as the public, the opportunity to review threshold determinations.

Yakama Reservation Forest Management Plan

The Yakama Nation has a variety of protective land use regulations in effect on reservation lands. One of these is the Forest Management Plan (FMP). Under the 1993-2002 FMP, the Yakama Administrative Forest was divided into 11 Land Use Management Areas (LUMA). Each LUMA was managed for multiple uses with emphasis on dominant resource features and objectives. The draft FMP soon to be ratified changes the designation of LUMAs to Management Emphasis Areas (MEA), which will be managed within the forest habitat types (USDI Bureau of Indian Affairs (BIA) and Yakama Indian Nation 2004). The forestry program is using historical species composition and stand densities as references for the desired future stand conditions. Just as with the health of aquatic systems, forest health describes the ability of a forest ecosystem to remain productive, to maintain a diversity of plants and animals, aesthetic appeal, and resource sustainability, and to withstand disturbances over time. In addition, a healthy forest is resilient to periodic disturbances such as drought, insects, diseases, fires, climatic change, and management practices.

The Forest Management Plan prescribes the number of miles and density of roads allowed to be built for the purpose of harvesting timber from the Administrative Forest, and forest treatments such as thinning and prescribed burns are being put into place to move the forest vegetation more toward the historical condition of seral stands rather than dense, late successional forest cover. Streams are classified according to their flow, use for domestic purposes and use by fish for spawning, rearing and migration, and buffers and harvest restrictions are set accordingly. The objectives are the preservation of stream bank and riparian cover, water quality and flow maintenance and soil stabilization (USDI BIA and Yakama Indian Nation 1993).

Fisheries Management and Evaluation Plan

Recent policy changes will reduce potential harvest impacts. A Fisheries Management and Evaluation Plan (FMEP) for tributary fisheries in the Washington portion of the Lower Columbia River Chinook, steelhead, and chum salmon ESUs (WDFW 2002) has been approved by NMFS. WDFW has also requested NMFS approval on a proposed supplement to the FMEP that covers tributary fisheries impacts on listed Lower Columbia

River coho salmon. The agency has also submitted a Fisheries Management and Evaluation Plan (FMEP) for Middle Columbia River steelhead to NMFS that includes management for recreational fisheries in the White Salmon River. The FMEP minimizes harvest impacts to listed steelhead through the use of selective fisheries that target marked hatchery steelhead and requires the release of all unmarked steelhead. The FMEP also includes management actions that limit impacts to juvenile steelhead through fishing seasons, area closures, and gear restrictions. NMFS is currently reviewing the FMEP to determine if it can be approved under the 4(d) Rule limit 4 for Middle Columbia River steelhead.

Hatchery and Genetic Management Plans

The USFWS has submitted Hatchery and Genetic Management Plans (HGMPs) to NMFS for approval under Section 7 of the ESA. NMFS issued a Section 7 Biological Opinion on November 27, 2007 for these hatchery programs (http://www.nwr.noaa.gov/Salmon-Harvest-Hatcheries/Hatcheries/Sec-7-USFWS-Columbia.cfm). Many actions and measures in the HGMPs have already been implemented. These HGMPs cover programs that release fish into the Little White Salmon River and at the Spring Creek NFH. WDFW has also submitted an HGMP to NMFS for the releases of summer and winter steelhead into the White Salmon River. These programs may adversely affect listed populations in the White Salmon River and are being evaluated in a Biological Opinion. All of these programs are funded in whole or partially through the Mitchell Act, which is administered by NMFS. An Environmental Impact Statement for NMFS' funding of the Mitchell Act and its hatchery programs is being drafted and will include evaluation of the programs listed above.

II.2 Special Land Use Areas

Several areas in the White Salmon drainage have received special Federal protection**.**

Columbia River Gorge National Scenic Area

"The National Scenic Area was created to protect and enhance the scenic, natural, cultural and recreational resources of the Columbia River Gorge while encouraging economic development" (www.fs.fed.us/r6/columbia/). The White Salmon River downstream of Condit Dam (RM 3.3-mouth) is within the boundaries of the Gorge National Scenic Area. All new development and land uses must be reviewed in the National Scenic Area to determine if they are consistent with the Act and the implementing land-use ordinances. The development guidelines of the management plan are implemented through land-use ordinances which must be consistent with the management plan.

Wild and Scenic Rivers

The Wild and Scenic Rivers Act was created by Congress to preserve in a free-flowing condition selected rivers of the nation which, with their immediate environments, possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historical,

cultural, or other similar values. The nine-mile reach from confluence of Gilmer Creek near BZ Corner to Buck Creek is a Federal Wild and Scenic River. A twenty-mile stretch of the upper White Salmon and Cascade Creek received Senate approval for Wild and Scenic designation and awaiting presidential approval. The Act restricts the construction of any dam or other water resource project on or directly affecting a designated river, or that would have a direct and adverse effect on the values for which such a river was established, such as its free-flowing nature. The Act directed the Forest Service to develop management plans for these portions. The Wild and Scenic Rivers Act on the White Salmon River does not supersede local Shoreline Management Plans.

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