Lower Snake Mainstream Subbasin Plan

May 2004 Version

Submitted by: **Pomeroy Conservation District**

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Lower Snake Mainstem Subbasin

Prepared for

Northwest Power and Conservation Council

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PREFACE

This subbasin plan represents the hard work of numerous individuals and organizations to produce a watershed-based approach for protection and restoration of the terrestrial and aquatic habitats found in this subbasin. It complies with the requirements set out by the Northwest Power and Conservation Council for this product and is the best product that could be produced under the required conditions and timeline, and available resources. It is not "perfect," but it does represent a reasonable first-step. It is a snapshot in time. As a living document, it will be improved and refined through implementation and review.

This plan contains considerable, significant areas where the participants in the process (subbasin planners and public) find agreement. This will provide focus for implementation activities in the near future. The plan also identifies areas where issues remain to be addressed. It is expected that over time these issues will be resolved in a manner that is appropriate.

Additional information, and related time and budget for analysis, would have resulted in increased technical support for findings, hypotheses, biological objectives and strategies (the management plan elements) in this subbasin plan. Within the time and resource constraints provided, the best available information and analysis approaches have been used to reach the conclusions in the plan. As noted above, and as outlined in the Research, Monitoring and Evaluation (RM&E) section of the plan, additional information and refined analysis techniques are expected to become available during plan implementation that will add to the technical foundation for this subbasin management plan.

It needs to be recognized that this plan is the product of a process that, with the exception of developing Subbasin summaries, had lain dormant for over 10 years. Most of the participants in the Council's original subbasin planning process were not available for this process for various reasons. In addition, this process was implemented with far more local involvement than earlier subbasin planning efforts. For this reason, this process has required a significant learning curve for all Columbia River subbasins; and this learning curve has occurred simultaneously in all the subbasins with very little opportunity for cross-subbasin sharing of good ideas and approaches during plan development. In addition, necessary work at the state and regional level that has been occurring simultaneous to the subbasin level planning has not always been available for inclusion in individual subbasin plans in a manner that could meet the Council's May 28, 2004 deadline. Finally, it is important to note that the planners involved in this subbasin have not regularly worked together on watershed-based planning. Relationships as well as planning approaches had to be developed to produce a plan. These relationships and approaches will now serve as a solid foundation for the subbasin in ensuring that the plan is effectively implemented, reviewed and revised over time.

The following recommendations address what we learned in putting together this subbasin plan in a coordinated approach with all the southeastern Washington (and part of northwestern Oregon) subbasin plans (Asotin, Lower Snake, Tucannon, Walla Walla subbasin plans). Addressing these recommendations should improve future efforts to update and implement the plans:

PREFACE (Continued)

- **Plan updates should be staggered in time –** Participation was limited by the need for some planners to be involved in more than one subbasin planning effort simultaneously. This especially affected fish and wildlife co-manager staff with state, federal and tribal agencies.
- **Expectations need to be consistent with schedules and funding –** The current subbasin planning effort was on a fast track. The product of this process was limited by the time and funding available to complete the effort. This does not mean that the time and funding were not appropriate for a subbasin planning effort, merely that the expectations for the plans needed to be consistent with these factors. We believe the expectations for the current subbasin plans were ambitious considering the schedule and funding available.
- **Deliberately coordinate implementation and revision of subbasin plans with other planning efforts –** Many planning efforts are occurring, and will occur, around the region that are or should be directly coordinated with the subbasin plans. We have coordinated with several of these efforts in producing the Asotin, Lower Snake, Tucannon, and Walla Walla subbasin plans. These include the Snake River Salmon Recovery Board, watershed resource inventory area, Walla Walla habitat conservation plan for steelhead and bull trout, comprehensive irrigation district management, federal bull trout and salmon recovery, Wy-Kan-Ush-Mi- Wa-Kish-Wit Tribal Recovery, Hatchery Genetic Management and US vs. OR planning efforts. We believe that the content and implementability of our plans have benefited and will continue to benefit significantly from this coordination.
- **Provide appropriate regional direction and assistance –** We agree that the subbasin plans must be locally generated and implemented, but this must occur in an appropriate regional context. The current process could have used more direction in this regard. Likewise, implementation and revision of the subbasin plans will benefit from appropriate regional guidance on expectations that is provided in a timely manner. For instance, we expect that regional guidance will assist us in refining our RM&E plan to be as cost-effective and scientifically-based as possible while meeting the combined needs of all subbasins and avoiding redundancy.
- **Implementation and Revision of Subbasin Plans will require ongoing involvement from subbasin interests –** The subbasin planning effort resulted in more than just plans. It resulted in relationships and processes that allow for technical, policy and public participation in developing and implementing appropriate, agreed-to on-the-ground efforts to restore and maintain fish and wildlife habitat. This will result in the good investments of tribal, local, state, regional and federal funds in watersheds. If these relationships and processes are not maintained, there is a distinct risk that the intent to maintain living plans will be defeated. We highly recommend that the appropriate level of resources (people and funding) continue to be provided to ensure that an adequate subbasin planning and implementation process is maintained.

EXECUTIVE SUMMARY

In 1980, Congress passed the Pacific Northwest Electric Power Planning and Conservation Act which authorized creation of the Northwest Power and Conservation Council by the states of Washington, Oregon, Idaho, and Montana. The Act directed the Council to develop a program "to protect, mitigate and enhance fish and wildlife…in the Columbia River and its tributaries…affected by the development, operation and management of (hydroelectric projects) while assuring the Pacific Northwest an adequate, efficient, economical and reliable power supply." The Council has established four primary objectives for the Columbia River Fish and Wildlife Program.

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

The Columbia River Basin was divided into 62 subbasins based on Columbia River tributaries. Each subbasin is developing its own plan which will establish locally defined biological objectives to meet the four primary objectives defined by the Council. Plans developed at the subbasin level will be combined into the fourteen province-level plans and will form the framework within which the Bonneville Power Administration will fund proposed fish and wildlife projects. The subbasin planning process is viewed as an on-going effort and is anticipated to occur on a three year cycle. The plans are considered "living documents" which will incorporate new information during their periodic updates.

The subbasin plans will also play a significant role in addressing the requirements of the Endangered Species Act; NOAA-Fisheries and USFWS intend to use the plans to help in recovery of ESA-listed species. In addition, the Council, Bonneville Power Administration, NOAA-Fisheries, and USFWS will use the adopted subbasin plans to help meet subbasin and province requirements under the 2000 Federal Columbia River System Biological Opinion. Other regulatory standards and planning efforts, including the Clean Water Act and various state requirements affect, and are affected by, the subbasin plans. In particular, an interactive relationship is expected to be developed between subbasin planning, watershed plans, and State of Washington salmon recovery plans.

Lower Snake Subbasin Plan

This plan concerns the Lower Snake Subbasin in southeastern Washington. The Lower Snake Subbasin encompasses 1,059,935 acres (1,656 square miles) within portions Adams, Franklin, Walla Walla, Columbia, Whitman, Garfield and Asotin Counties in the southeastern corner of

Washington State. This subbasin includes a portion of the Snake River Mainstem and a number of its tributaries, including Deadman Creek, Almota Creek, Alpowa Creek, and Penawawa Creek. Approximately 5 percent of the Snake River's total watershed is located downstream of the Clearwater River at Lewiston, Idaho, and this region is relatively arid compared to the Snake River's upstream drainage areas. As such, only a small portion of the Snake River mainstem flow is derived from tributaries located within the Lower Snake Subbasin. Vegetation in the subbasin is characterized primarily by grasslands and agricultural lands with some ponderosa pine, shrubsteppe, and wetland areas.

Agriculture is the primary land use in the subbasin, including dryland crops and small areas of irrigated cropland. Limited timber harvest also occurs. Lands adjacent to the Lower Snake River are primarily privately owned; public lands adjacent to the reservoirs are managed by the Army Corps of Engineers, and a few isolated parcels are owned by the State. The Lewiston-Clarkston area and near the mouth of the Snake River represent the only significant industrial, commercial, and residential development in the Subbasin.

The planning process in the Lower Snake subbasin involved a number of organizations, agencies, and interested parties including the Pomeroy Conservation District, Nez Perce Tribe, Washington Department of Fish and Wildlife, private landowners and others. The lead entity for the planning effort was the Pomeroy Conservation District with the Nez Perce Tribe as the co-lead. The technical components of the assessment were developed by the Washington Department of Fish and Wildlife. The planning effort was guided by the Asotin, Lower Snake, and Lower Snake Subbasin Planning Team which included representation from the lead entity, co-leads, local resource managers, conservation districts, agencies, private landowners, and other interested parties. The vision statement and guiding principles for the management plan were formulated by the Subbasin Planning Team through a collaborative and public process. The vision statement is as follows.

The vision for the Lower Snake Subbasin is a healthy ecosystem with abundant, productive, and diverse populations of aquatic and terrestrial species that supports the social, cultural and economic well-being of the communities within the Subbasin and the Pacific Northwest.

Together with the guiding principles, the vision statement provided guidance regarding the assumptions and trade-offs inherent in natural resource planning.

This subbasin plan focuses on the tributaries that are a portion of this subbasin. These plan elements have not been developed by the subbasin planners for the mainstem section of the subbasin. Planning strategies to address mainstem issues are considered beyond the scope of this subbasin plan, and will be addressed through other forums, e.g. mainstem amendment process.

Aquatic Focal Species and Species of Interest

To guide the assessment and management plan, one focal species, steelhead, was selected for aquatic and terrestrial habitats within the Lower Snake Subbasin. This species was chosen based on the following considerations:

- Selection of species with life histories representative of the Lower Snake Subbasin
- ESA status
- Cultural importance of the species
- Level of information available about species' life histories allowing an effective assessment

In addition, white sturgeon was designated as an aquatic "species of interest" for this planning effort. This species is of cultural and ecological significance to stakeholders, but not enough information was available to its selection as focal species.

Terrestrial Focal Species and Priority Habitats

Focal terrestrial species are white-headed woodpecker, flammulated owl, Rocky Mountain elk, yellow warbler, American beaver, great blue heron, grasshopper sparrow, sharp-tailed grouse, sage sparrow, sage thrasher, Brewer's sparrow and mule deer. The criteria for selection of these species are:

- Primary association with focal habitats for breeding.
- Specialist species that are obligate or highly associated with key habitat elements or conditions important in functioning ecosystems.
- Declining population trends or reduction in historic breeding range.
- Special management concerns or conservation status (threatened, endangered, species of concern, indicator species).
- Professional knowledge of species of local interest.

Within the Lower Snake Subbasin, four priority habitats were selected for detailed analyses: ponderosa pine, eastside interior grasslands, interior riparian wetlands, and shrub-steppe. These were selected based upon determination of key habitat needs by local resource managers, the ability of these habitats to track ecosystem health, and cultural factors.

Within this subbasin plan, the role of aquatic focal species differed from the role of terrestrial focal species. The aquatic focal species was used to inform decisions regarding the relative level of enhancement effort required to achieve an ecological response. Due to data limitations, terrestrial focal species did not inform the majority of the management plan, but instead will be used to guide monitoring the functionality of priority habitats. Terrestrial priority habitats were used to guide development of the management plan for terrestrial habitats and species.

Aquatic Habitat Assessment

Assessment of aquatic habitats for steelhead within the Lower Snake subbasin tributaries was accomplished with the Ecosystem Diagnostic and Treatment (EDT) model. The EDT model analyzes aquatic habitat quality, quantity, and diversity relative to the needs of a focal species. The purpose of the analysis is to identify stream reaches that can provide the greatest biological benefit based upon potential improvement in habitat conditions. This is accomplished by comparing historic aquatic habitat conditions in the watershed to those currently existing relative to life history needs of the focal species. The result of the analysis is identification of stream reaches that have high potential restoration and protection values. These values allow prioritization of corrective actions to gain the greatest benefit with the lowest risk for the focal species.

For summer steelhead, the EDT analysis identified areas that currently have high production and should be protected (High Protection Value) and areas with the greatest potential for restoring life stages critical to increasing production (High Restoration Value). These initial EDT results were then reviewed in light of the following four considerations: 1) results of related assessment and planning documents (Limiting Factors Analysis, Lower Snake Subbasin Summary, etc.); 2) the necessary trade-offs between the biological benefits provided by enhancement potential of one geographic area versus another to achieve geographic prioritization; and 4) physical and socioeconomic limitations. This type of review was necessary given the data gaps currently present in the EDT model and the fact that EDT is an ecologically-based model that does not incorporate factors such as limited access to wilderness areas. Through this review, the initial EDT results were modified in a limited number of instances to develop a group of priority restoration geographic areas and a group of priority protection geographic areas. These geographic areas include the stream reaches themselves and the upland areas that drain to these reaches. Due to limited information present for Alpowa and Penawawa Creeks, Almota and Deadman Creeks, respectively, were used as reference reaches.

In the Lower Snake Subbasin, all areas with the highest restoration value were the same areas that had the highest protection value. Thus, priority reaches are discussed as priority restoration/protection geographic areas. These areas were identified as follows: Almota Creek, Deadman Creek, Alpowa Creek, and Penawawa Creek. Within these priority areas, the most negatively impacted life stages were identified for steelhead and the key environmental factors that contribute to losses in focal species performance, i.e. limiting factors, were also identified. Key limiting factors for steelhead included the following: sediment, large woody debris, key habitat (pools), riparian function, stream confinement, summer water temperature, bedscour and flow.

Terrestrial Habitat Assessment

The terrestrial assessment occurred at two levels: Southeast Washington Ecoregion and subbasin level. Several key databases, i.e. Ecosystem Conservation Assessment (ECA), the Interactive Biodiversity Information System (IBIS), and the GAP analyses, containing information on historic and current conditions were used in the assessment. The ECA data identified areas that would provide ecological value if protected and are under various levels of development pressure. The IBIS database provided habitat descriptions and historic and current habitat maps. GAP data classifies terrestrial habitats by protection status based primarily on the presence or absence of a wildlife habitat and species management program for specific land parcels. The classification ranges from 1 (highest protection) to 4 (little or unknown amount of protection).

The nature and extent of the focal habitats were described as well as their protection status and threats to the habitat type. From historic to current times, there has been an estimated 85 percent decrease in riparian wetland habitat, 56 percent decrease in interior grassland habitat, and an 80 percent decrease in shrubsteppe habitat. However, ponderosa pine habitat has increased by 106 percent in the subbasin. Little information was available regarding the functionality of remaining habitats. Most ponderosa pine forest and eastside grassland habitats in the subbasin are afforded "low" protection status, while most interior wetlands receive no protection. In total, 1 percent of the subbasin is considered to be in high protection status, 1 percent is in medium protection status, 6 percent in low protection status, and 92 percent has no protection status or is area for which this information was not available.

Inventory

Complementing the aquatic and terrestrial assessments, information on programmatic and project-specific implementation activities within the subbasin is provided. A wide variety of agencies and entities are involved in habitat protection and enhancement efforts within the Lower Snake Subbasin, including the Columbia Conservation District, Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation, U.S. Fish and Wildlife Service (USFWS), NOAA-Fisheries, Washington Department of Fish and Wildlife (WDFW), Washington Department of Ecology, cities, counties, and others. Key aquatic and terrestrial programs include the following:

- USDA Programs (e.g. Conservation Reserve Enhancement Program, Conservation Reserve Program)
- Harvest regulations (tribal and sport fishing)
- Priority Habitats and Species Program (WDFW)

Project-specific information was only available for aquatic habitats. Since 1996, projects implemented within the subbasin focused on several key project types:

Practice	Number	Units
2 pass seeding	2,809	Acres
Direct Seed	2,002	Acres
Fencing	12,697	Feet
Grasses and Legumes in Rotation	113	acres
No-till seeding	8,552	acres
Pasture and Hayland planting	15	acres
Sediment Basins	54,270	cyds
Strip Cropping	1,073	acres
Subsoiling	3,878	acres
Terraces	80,734	feet
Grassed Waterways	23,866	feet

Management Plan

The management plan consists of three components: working hypotheses, biological objectives, and strategies. Working hypotheses are statements about the identified limiting factors for aquatic species and terrestrial habitats. The hypotheses are intended to be testable, allowing future research to evaluate their accuracy. Biological objectives are measurable objectives for selected habitat components based upon what could reasonably be achieved over the 10 to 15 year planning horizon. Quantitative biological objectives were identified where supporting data was available. Where such data was not present, qualitative biological objectives based on desired trends were proposed. Strategies identify the types of actions that can be implemented to achieve the biological objectives.

For terrestrial species and habitats, the limited information available precluded development of biological objectives and strategies for individual focal species. Instead, terrestrial strategies focus on enhancement of priority habitat types, under the general assumption that improvements to terrestrial habitats will benefit terrestrial species. Both protection and enhancement strategies were developed.

Aquatic strategies focus on methods to achieve improvements in aquatic habitat. Both restoration and protection strategies were developed. Restoration strategies focus on enhancing the current habitat conditions while protection strategies focus on maintenance of current conditions.

For each priority restoration/protection geographic area within the subbasin, working hypotheses were developed for each limiting factor, causes of negative impacts were listed, biological objectives were delineated, and strategies were proposed. For example, in the lower Almota Creek area, Working Hypothesis 4 states that an increase in riparian function and a decrease in stream confinement will increase the survival of steelhead, in selected life stages. Biological objectives in this geographic area are as follows:

- Sediment – achieve less than 50% mean embeddedness
- Large Woody Debris – at least 1 piece should be present per 3 channel widths
- Pools – 8% or more of the stream surface area should be pools
- Riparian Function – the riparian function should be at least 50% of maximum
- Confinement – no objective established due to infrastructure limitations
- Summer Maximum Water Temperature – no objective established because temperature was not identified as a limiting factor in this geographic area
- Bedscour – bedscour should be limited to 15 cm or less
- Instream Flow – an upward trend in flow should be achieved

Strategies were identified specific to each biological objective and include enhancing riparian buffers, implementing conservation easements, developing off-stream livestock watering facilities and public outreach. These and similar strategies were applicable across all priority geographic areas. Achieving the biological objectives in the restoration/protection geographic areas is considered a priority within the subbasin.

Aquatic strategies were also developed for imminent threats. Imminent threats are those factors likely to cause immediate mortality to the aquatic focal species and include the following three categories: fish passage obstructions, inadequate fish screens, and stream reaches that are dewatered due directly to man-caused activities. Addressing imminent threats throughout the subbasin is also considered a priority within this subbasin plan.

Working hypotheses for terrestrial habitats are based on factors that affect (limit) focal habitats. Hypotheses were defined for riparian/riverine wetlands, ponderosa pine habitats, and interior grasslands. Factors affecting the habitats were identified and biological objectives reflecting habitat protection as well as enhancement and maintenance of habitat function were formulated. Terrestrial habitat biological objectives are focused on protecting and enhancing functionality in areas that are have a high or medium protection status, and private lands that meet one or more of the following conditions:

- Directly contribute to the restoration of aquatic focal species
- Have high ecological function
- Are adjacent to public lands
- Contain rare or unique plant communities
- Support threatened or endangered species/habitats

- Provide connectivity between high quality habitat areas
- Have high potential for re-establishment of functional habitats

Terrestrial strategies are based on a flexible approach which takes into account a variety of conservation “tools” such as leases and easements and cooperative projects/programs. The efficacy of focusing future protection efforts on large blocks of public and adjacent lands is recognized.

The specific strategies are focused entirely on improvements in functional habitat. Strategies for achieving the biological objectives include upholding existing land use and environmental regulations, , completing a more detailed assessment of the focal species, providing outreach opportunities, and identifying functional habitat areas.

Agriculture is considered a “cover type of interest” due to its predominance in the subbasin and its potential to both positively and negatively impact terrestrial wildlife. Proposed enhancement efforts in this area focus on limiting elk and deer damage on private agricultural lands.

Additional components of the management plan include the following:

- Comparison of the relative ecological benefit of achieving the biological objectives.
- Research, monitoring, and evaluation priorities for aquatic and terrestrial species and habitats.

Integration of the aquatic and terrestrial strategies and integration of the subbasin strategies with those of the Endangered Species Act and the Clean Water Act are addressed in the plan. These aspects are expected to develop further as the plan is implemented and related efforts such as the Snake River Salmon Recovery Plan are developed. This plan will evolve over time through use of an adaptive management strategy that will allow funding to consistently be applied to those projects that can achieve the greatest benefits.

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APPENDICES

ACRONYM LIST

BiOp	2000 Federal Columbia River System Biological Opinion
BMP	Best Management Practice
BPA	Bonneville Power Administration
CRITFC	Columbia River Inter-tribal Fish Commission
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
CW	Channel width
CWA	Clean Water Act
ECA	Ecoregion Conservation Assessment
EDT	Ecosystem Diagnosis and Treatment
EQIP	Environmental Quality Improvement Program
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FSA	Farm Services Agency
IBIS	Interactive Biodiversity Information System
ISRP	Independent Scientific Review Panel
LIP	Washington Department of Fish and Wildlife Landowner Incentive Program
LWD	Large woody debris
MBI	Mobrand Biometrics, Inc.
N(eq)	Equilibrium abundance of returning adult spawners
NF	North Fork
NGO	Non-Governmental Organization
NOAA	National Oceanographic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NPT	Nez Perce Tribe
NWPCC	Northwest Power and Conservation Council
OOSE	Out of Subbasin Effects
PFC	Properly Functioning Conditions
PHS	Priority Habitats and Species

ACRONYM LIST (Continued)

SF	South Fork
SH	Steelhead
SOI	Species of Interest
SPCK	Spring Chinook
SPT	Subbasin Planning Team
TMDL	Total Maximum Daily Load
TOAST	Oregon Technical Outreach and Assistance Team
TRT	Technical Recovery Team
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
VSP	Viable Salmonid Population
WDFW	Washington Department of Fish and Wildlife
WLRIS	Washington Lakes and Rivers Information System
WQMA	Water Quality Management Area
WRIA	Water Resource Inventory Area

GLOSSARY

Active Restoration: Active restoration is the use of a structural improvement or direct instream work for the benefit of instream habitat. Examples include installation of large woody debris, rock weirs, and J-hook vanes. Activities such as riparian planting and upland infiltration enhancement are not considered active restoration actions. Note that this is the definition of passive restoration for the terms of this subbasin plan, and may not be consistent with the typical conception of what constitutes passiveactive restoration.

Adult Abundance: Adult abundance is the number of adult fish that the EDT model predicts would be present, given a set of habitat conditions and incorporating a factor for calculating out of subbasin effects.

Capacity: Capacity is the number of adult and juvenile(adult?) fish that could potentially be supported by a stream under a defined set of habitat conditions (e.g. historic or current).

Hard Bank Stabilization: Includes rip rap, concrete, and similar structures placed on the bank. Use of such structures is discouraged throughout the subbasin. Bank stabilization through the use of instream structures (e.g. J-hook vanes, vortex rock weirs), vegetation planting, fascines, and similar bio-engineered structures are the preferred methods of bank stabilization, where such activity is deemed appropriate.

Large Woody Debris (LWD): Woody debris of large enough size relative to stream characteristics to generate pools, provide rearing habitat, influence sediment transport, and manage stream morphology (e.g. pieces greater than 0.1m diameter and greater than 2m in length).

Life History Diversity: Life history diversity refers to the numerous potential paths a fish can use to move through its life cycle, including geographic options for habitat to support egg incubation, emergence, rearing, downstream migration, maturation, upstream migration, and spawning. Habitat degradation can limit the number of potential paths available, and as such leave population at-risk if a catastrophic event were to occur affecting the remaining life history pathways.

Overgrazing: Historic and/or current grazing by livestock and/or wild ungulates that is inconsistent with desired ecological conditions through its timing, intensity, duration, and utilization.

Passive Restoration Activities: Passive restoration takes advantage of natural processes and out-of-stream activities to achieve instream habitat enhancement without requiring direct modification of the streambed or channel. Examples include planting riparian vegetation, implementing conservation easements, increasing upland infiltration (e.g. direct seed/no-till), use of sediment basins, developing alternative livestock watering facilities, and water conservation. Note that this is the definition of passive restoration for the terms of this subbasin plan, and may not be consistent with the typical conception of what constitutes passive restoration.

GLOSSARY (Continued)

Primary Pools: Large, relatively stable pools that provide critical habitat for several salmonid life stages (e.g., log or rock plunge pool or pools at meander bends that are at least 50% the width of the stream).

Productivity: Productivity refers to the number of adults that return to a stream per spawning fish.

Riparian Function: The riparian corridor provides a variety of ecological functions, which generally can be grouped into energy, nutrients, and habitat as they affect salmonid performance. Some aspects of these functions are expressed through specific environmental attributes within EDT, such as wood debris, flow characteristics (several attributes), temperature characteristics (several attributes), benthos, pollutant conditions, and habitat type characteristics (e.g., pool-riffle units). Not all functions are identified and treated as separate environmental attributes. Functions specifically not covered include the following:

- Terrestrial insect input (affects fish food abundance)
- Shade (provides a form of cover, temperature covered by specific attributes)
- Source of fine detritus (affects fish food abundance, large wood covered by specific attribute)
- Bank and channel stability (affects suitability of fish habitat as well as micro-habitat)
- Bank cover (affects suitability of fish habitat as well as micro-habitat)
- Secondary channel development (affects channel stability, flow velocities, and habitat suitability)
- Groundwater recharge and hyporheic flow characteristics (affects fish food abundance, strength of upwelling, and micro temperature spatial variation)
- Flow velocity along stream margins (affects suitability of fish habitat)
- Connectivity to off-channel habitat (affects likelihood of finding off-channel sites)

1. Introduction

The Lower Snake Mainstem Subbasin Plan was developed through cooperation of a multitude of stakeholders including the Pomeroy Conservation District, Nez Perce Tribe, local landowners, Washington Department of Fish and Wildlife, United State Forest Service, United State Fish and Wildlife Service, and others. The vision guiding the development of this plan was defined as follows:

> *The vision for the Lower Snake Mainstem Subbasin is a healthy ecosystem with abundant, productive, and diverse populations of aquatic and terrestrial species that supports the social, cultural and economic well-being of the communities within the Subbasin and the Pacific Northwest.*

This plan provides direction to facilitate the expenditure of habitat-enhancement and protection funding in the subbasin in the most effective manner. The plan is focused on aquatic tributaries and priority terrestrial habitats within the subbasin, and provides objectives and strategies for enhancement of aquatic and terrestrial habitats. Given this focus on habitat enhancement, objectives regarding numeric species population goals were not developed. This plan was developed to meet requirements of the Norhtwest Power and Conservation Council (formerly Northwest Power and Planning Council), created across the states of Idaho, Montana, Oregon and Washington when Congress passed the 1980 Pacific Northwest Electric Power Planning and Conservation Act. In 1980, Congress passed the Pacific Northwest Electric Power Planning and Conservation Act, which authorized the states of Idaho, Montana, Oregon, and Washington to create the Northwest Power and Conservation Council (Council/NWPCC; formerly the Northwest Power Planning Council). The act directs the Council to develop a program to "protect, mitigate and enhance fish and wildlife, including related spawning grounds and habitat, on the Columbia River and its tributaries... affected by the development, operation and management of [hydroelectric projects] while assuring the Pacific Northwest an adequate, efficient, economical and reliable power supply" (NPPC 2000).

The Council has stated the following four overarching objectives for the Columbia River Fish and Wildlife Program (Program):

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

To achieve these program-level objectives, the Council intends to establish specific biological objectives at the subbasin level that will then be combined into objectives at the province level.

The Council will integrate locally developed plans for the 62 tributary subbasins of the Columbia River and a plan for the mainstem into the Program. Plans developed at the subbasin level will provide a framework within which fish and wildlife projects are proposed for Bonneville Power Administration (BPA) funding to implement the Program. Subbasin plans will be the context, for review of proposals for BPA funding by the fish and wildlife agencies and tribes, the Independent Scientific Review Panel (ISRP), and the Council. The projects funded by BPA will be reviewed through the Council's Rolling Provincial Review Process once every three years.

The following is taken from NWPCC, 2001, and describes the rolling review process:

> "An adopted subbasin plan is intended to be a living document that increases analytical, predictive, and prescriptive ability to restore fish and wildlife. At each three-year cycle of planning, the updated information will guide revision of the biological objectives, strategies and implementation plan. The Council views the assessment development as an ongoing process of evaluation and refinement of the region's efforts through adaptive management, research and evaluation. It will need maintenance over time that will need to be coordinated with other agencies and stakeholders. In addition, as relationships are made at a larger scale such as a province or ESU, adaptive management practices may be warranted to reflect priorities at the larger scale."

The Lower Snake Subbasin Plan is a local response to this regional directive. Components of this plan will be integrated with those of the Yakima, Crab, Palouse, Deschutes, John Day, Lower Middle Columbia, Umatilla, Walla Walla, and Tucannon subbasins in the Columbia Plateau Province. The key components of this subbasin plan include the introduction, subbasin overview, aquatic species and habitat assessment, terrestrial species and habitat assessment, inventory of existing projects, integration of aquatic and terrestrial components, and the management plan. This plan is based upon the best available science, and its various components explicitly identify the data, hypotheses, and assumptions used during its development.

Following are the key components of the Lower Snake Subbasin Plan by chapter:

- Chapter 1: Introduction, planning context, approach, and participants.
- Chapter 2: Overview of current conditions in the subbasin.
- Chapter 3: Discussion of the Ecosystem Diagnosis and Treatment modeling method used for the aquatic assessment, and results of this effort.
- Chapter 4: Discussion of the methods used for the terrestrial assessment, and results of this effort.
- Chapter 5: Integration of aquatic and terrestrial components.
- Chapter 6: Identification of programmatic activities and recent habitat enhancement projects.
- Chapter 7: Discussion of subbasin priorities in terms of the vision, working hypotheses, biological objectives, and strategies. This includes identification of topics that required

special treatment outside of the standard assessment approach, and an implementation plan.

Through this planning process, the technical staff and the public worked together to identify working hypotheses regarding limiting factors for fish, wildlife, and habitat; define objectives that measure progress toward those goals; and develop strategies to meet those objectives. See Section 1.2 for a list of Planning Participants.

1.1 Planning Context

1.1.1 Role of the Snake River Mainstem in the Lower Snake Subbasin Plan

The Lower Mainstem Snake Subbasin includes 137 miles of mainstem Snake River habitat as well as numerous smaller tributaries. The majority of the Snake River mainstem section of the subbasin is composed of four reservoirs backed up by dams (Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams) that are operated for various purposes, including hydropower production and navigation. The lower six miles of the mainstem Snake River are part of the reservoir backed up by McNary Dam on the mainstem Columbia.

This subbasin plan focuses on the tributaries that are a portion of this subbasin. A vision, assessment, working hypotheses, biological objectives, and strategies have been developed for these tributaries. These plan elements have not been developed by the subbasin planners for the mainstem section of the subbasin. This section of the subbasin plan addresses the mainstem section of the subbasin and explains why the Lower Snake Mainstem Subbasin planners have not developed a vision, assessment, working hypotheses, biological objectives, and strategies for this plan.

The Northwest Power and Conservation Council has adopted the following vision for the mainstem areas of the Columbia River Basin, which includes the lower mainstem Snake River section contained in this subbasin:

> "Hydrosystem operations, fish passage efforts, habitat improvement investments and other actions in the mainstem should be directed toward protecting, enhancing, restoring and connecting natural river processes and habitats, especially spawning, rearing, resting and migration habitats for salmon, steelhead, sturgeon and important resident fish populations. This will allow for abundant, productive and diverse fish and wildlife populations. The vision includes providing conditions within the hydrosystem for adult and juvenile fish that: 1) most closely approximate natural physical and biological conditions; 2) support the expression of life history diversity; 3) allow for adequate levels of mainstem survival to support fish population recovery in the subbasins; and 4) ensure that water management operations are optimized to meet the needs of anadromous and resident fish species, including those in upstream storage reservoirs, with the least cost so that actions taken maximize benefits to all species while ensuring an adequate, efficient, economical and reliable power supply. Any system changes needed to achieve these goals must be implemented in such a way and over a sufficient time period to allow the region to make whatever power system adaptations are needed, if any, to maintain an

adequate, efficient, economical and reliable power supply." (Mainstem Amendments to the Columbia River Basin Fish and Wildlife Program, 2003, Northwest Power and Conservation Council, Council Document 2003-11, page 9)

This vision addresses an approach that will be implemented through considerations and decisions at the regional level, not the subbasin level. Elements of the Council's mainstem vision, and related biological objectives and strategies, will address fish and wildlife habitat issues such as mainstem flows, reservoir levels, connections to flood plain, juvenile and adult fish passage facilities at dams and spill at dams. These elements take into consideration the needs of fish for rearing, spawning and migration in the mainstem section of this subbasin as well as mainstem sections upstream and downstream of the Lower Snake Mainstem subbasin. These decisions will also take into consideration the needs to balance the cost supplying power with these other factors. Subbasin planners expect to be part of deliberations in these decision-making processes, but do not make these critical decisions that will affect rebuilding of all salmonid and other (i.e., sturgeon) fish populations in the Columbia River Basin.

The following section is taken from the Nez Perce Tribe's comments on the Draft Mainstem Amendments regarding the use of the Northwest Power Planning Council's Mainstem Amendments to the Columbia River Basin Fish and Wildlife Program as a guiding principle when dealing with mainstem biological objectives and strategies.

Inclusion into Plan

The Nez Perce Tribe has a vital interest in the Northwest Power Planning Council's Mainstem Amendments to the Columbia River Basin Fish and Wildlife Program. The final amendments adopted into the Program are intended to provide guidance and direction that will affect the future existence and persistence of culturally significant fisheries resources, including Chinook salmon, coho salmon, steelhead, Pacific lamprey, white sturgeon and bull trout. The Columbia and Snake River mainstems provide critically important habitats for anadromous fish spawning, incubation, freshwater rearing, juvenile migration and adult migration.

In its Final 2000 Federal Columbia River Power System (FCRPS) Biological Opinion, the National Marine Fisheries Service (NMFS) concluded that the proposed operation and configuration of the FCRPS and Bureau of Reclamation projects are likely to jeopardize the continued existence of listed Snake River spring/ summer Chinook salmon, Snake River fall Chinook salmon, Snake River sockeye salmon, and Snake River steelhead, and adversely modify their designated critical habitat. NMFS determined that, even with survival improvements in fish passage at and between dams, significant mortality associated with FCRPS operations will continue to occur.

Twelve species of the Columbia Basin anadromous salmonids are listed pursuant to the Endangered Species Act. These listings, and the plight of other severely reduced species such as Pacific lamprey, demonstrate that no species can survive the failure to provide for the full range of their life history needs. To be of value as a relevant source document to protect, mitigate and enhance fishery resources of the Columbia River Basin affected by the development and operation of the basin's hydroelectric facilities, the document must focus on providing for the full range of these life history needs. As indicated above, aggressive action is needed to improve survival through the mainstem FCRPS projects. Even with aggressive and progressive action, however, losses will still be severe and will jeopardize the continued existence of listed species, if additional offsite measures are not undertaken to attempt to compensate for those losses.

The Nez Perce Tribes general perception of the Mainstem Amendments is that energy supply and cost considerations tend to unduly dampen aggressive mainstem actions needed to serve life history needs of severely reduced fish populations and to avoid jeopardy. We believe this is a mistake and will result in continued mortalities through the hydrosystem at levels irrecompensible through offsite mitigation measures.

Further detail regarding Snake River Mainstem conditions can be found in the Lower Snake Subbasin Summary (Bartels et al. 2001).

1.1.2 Relationship to Applicable Federal and State Regulations

The Lower Snake Mainstem Subbasin Plan is one piece of a larger effort to achieve de-listing and/or recovery of species currently listed under the Endangered Species Act (ESA). As a mechanism to obtain funding for habitat enhancement projects, the Lower Snake Mainstem Subbasin Plan will play a key role in this process. The National Oceanographic and Atmospheric Administration-Fisheries (NOAA-Fisheries) and the U.S. Fish and Wildlife Service (USFWS) intend to use adopted subbasin plans as one component leading toward recovery of ESA-listed species. This includes integration with NOAA-Fisheries Technical Recovery Team (TRT) goals. In addition, the Council, BPA, NOAA-Fisheries and USFWS will use adopted subbasin plans to help meet requirements under the 2000 Federal Columbia River System Biological Opinion (BiOp) at the subbasin and/or province level.

Within the Lower Snake Subbasin tributaries the primary aquatic species listed as threatened under the ESA is steelhead. Threatened status means that the listed group is likely to become endangered (in danger of extinction) within the foreseeable future throughout all or a significant portion of its range. The Snake River Basin steelhead ESU, which includes summer steelhead in the Lower Snake Subbasin, was listed as threatened under the federal Endangered Species Act (ESA) by NOAA Fisheries in August, 1997 (62 FR 43937).

The 1972 Clean Water Act (CWA) requires states to establish and administer standards for specific pollutants in water bodies. The CWA requires states to identify those water bodies that do not meet state standards, i.e., the 303(d) list. Although the State of Washington is currently revising their water quality regulatory system, Total Maximum Daily Loads (TMDLs) will still be required for each water body and water quality parameter that caused it to be placed on the 303(d) list. In Washington, TMDLs are developed on a five-year rotating watershed schedule in which watersheds are divided into Water Quality Management Areas (WQMAs). Specific strategies outlined in the management plan (Chapter 7) will provide direction for water quality enhancement (primarily, turbidity and temperature).

1.1.3 Integration with Related Planning Efforts

The Lower Snake Subbasin Summary was completed in 2001 (Bartels *et al.* 2001). This summary was comprehensive with regard to the existing conditions, programs, projects, and management activities. Information contained in the subbasin summary was used in development of this plan to the greatest extent possible. During plan development, three key departures from the subbasin summary occurred: 1) development of a more solid scientific basis within the assessment; 2) development of the management plan section where hypotheses, objectives and strategies are developed and identified for a 10 to 15 year planning horizon (Chapter 7 of this subbasin plan); and 3) attempted integration and agreement by diverse stakeholders on the management plan.

Table 1-1 identifies other assessments and plans that subbasin technical staff and planners used to develop the current plan. Empirical data and local knowledge of the subbasin also played a key role in development of this plan. These assessment and plans are referenced in this subbasin plan, as appropriate.

Table 1-1 Primary Pre-Existing Assessments and Plans used for Subbasin Plan Development

Assessment/Plan	Sponsor
Limiting Factors Analysis	Washington Conservation Commission
Lower Snake Subbasin Summary	Northwest Power and Conservation Council
Bull Trout Recovery Plan (draft)	United States Fish and Wildlife Service
Spirit of Salmon; Wy-Dan-Ush-Mi-Wa_Kish-Wit	Columbia River Inter-tribal Fish Commission

In addition to integration with federal obligations under the Northwest Power Act, ESA, CWA, and tribal trust and treaty-based responsibilities, subbasin plans need to look more broadly toward other federal, state, and local activities. Inclusion of such elements will enable coordination of activities to eliminate duplication, enhance cost-effectiveness, and allow pursuit of funding in addition to that provided by the BPA.

One such planning activity is the Water Resource Inventory Area (WRIA) watershed planning process. In 1998, the Washington legislature passed HB 2514, codified into RCW 90.82, to set a framework for addressing water quantity and quality issues, including establishing instream flows and addressing salmon habitat needs. This process in WRIA 35, which includes the Lower Snake subbasin, is currently in the assessment phase. It is expected to incorporate the management plans of the Asotin, Lower Snake, and Tucannon subbasins as its approach for assessing and managing fish habitat.

The Snake River Salmon Recovery Plan is another local planning effort that will incorporate the information provided by several subbasin plans, including the Lower Snake. Snake River Salmon Recovery is a regional effort to identify a strategy for salmon recovery that is science-based and supported by the community and Tribes. Representatives from Asotin, Columbia, Garfield, Walla Walla, and Whitman counties, and the Nez Perce Tribe and the Confederated Tribes of the Umatilla Indian Reservation, are guiding the recovery planning process by serving on the Lower Snake River Salmon Recovery Board. The Board is committed to engaging all of the region's stakeholders in building a plan that puts effective and endorsed salmon recovery actions "on the ground." The Snake River Salmon Recovery Board will play an integral role in implementation and progress evaluation of habitat enhancement projects in the Lower Snake Subbasin Plan.

1.2 Planning Process and Participants

The planning process in the Lower Snake Subbasin involved numerous entities, including the Pomeroy Conservation District, Nez Perce Tribe, Washington Department of Fish and Wildlife, WRIA 35 Planning Unit, Snake River Salmon Recovery Board, and others. Figure 1-1 shows the general relationship between the various groups.

The lead entity for development of the Lower Snake Subbasin Plan was the Pomeroy Conservation District. The Nez Perce Tribe served as co-lead.

The Washington Department of Fish and Wildlife developed all technical assessment components, both aquatic and terrestrial. Their work was accomplished with the assistance of Mobrand Biometrics, Inc., who provided assessment data using the Ecosystem Diagnosis and Treatment model (see Chapter 3), compiled the inventory information (see Chapter 6), and completed the objectives analysis (see Chapter 7). Organizational support, policy development, facilitation, writing and document editing services were provided by the consultant team of Parametrix, Inc., and Economic and Engineering Services, Inc.

The key group involved in guiding the Lower Snake Subbasin Plan was the Asotin, Lower Snake, and Tucannon Subbasin Planning Team (SPT). The SPT was established in the fall of 2003, and has representation from the lead entity, co-lead, local resource managers, and others (see Table 1-2 for membership list). Meetings of the SPT were held on November 20, 2003, January 27, 2004, March 23, 2004, and April 28, 2004. Significant communication via teleconference and email occurred among SPT members between these meeting dates. The SPT served multiple roles, including information clearinghouse, approving documents prior to public review, and most importantly, as the forum in which significant policy-level issues were discussed and addressed. Given that all major groups involved in subbasin planning in the Lower Snake were involved on the SPT, it also served a key function coordinating the efforts of its members (see Figure 1-1). The SPT operated by consensus. Decision memos were used to track approval of plan components and key decisions throughout plan development.

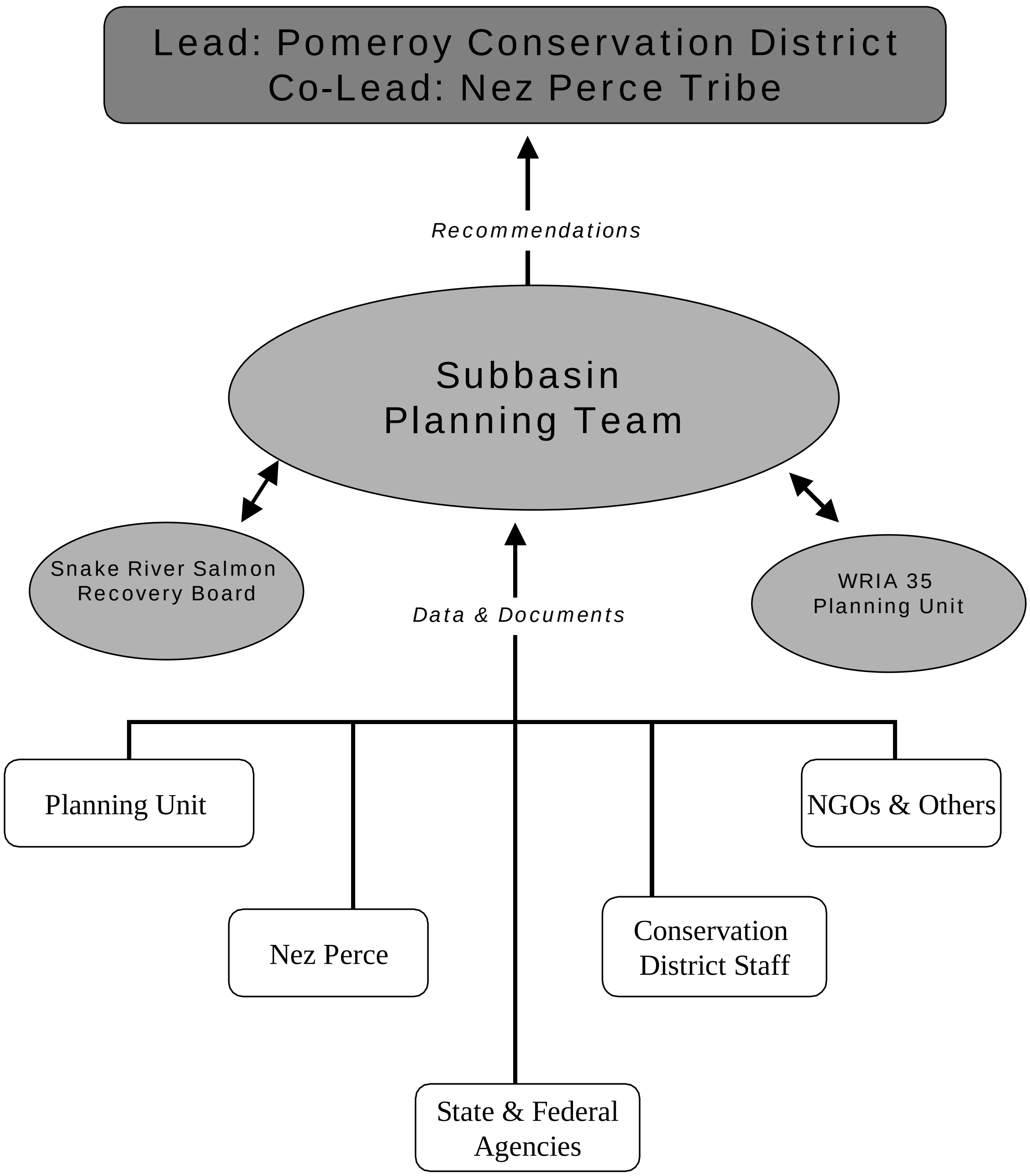

Figure 1-1 Lower Snake Subbasin Information Flow and Decision-Making Framework

Table 1-2 Asotin, Lower Snake, and Tucannon Subbasin Planning Team Membership

Member	Affiliation
Bradley Johnson	Asotin County Conservation District
Terry Bruegman	Columbia Conservation District
Duane Bartels	Pomeroy Conservation District
Emmit Taylor	Nez Perce Tribe
Paul Kraynak	Nez Perce Tribe
Angela Sondenaa	Nez Perce Tribe
Del Groat	United States Forest Service
Carl Scheeler	Confederated Tribes of the Umatilla Indian Reservation
Mark Wachtel	Washington Department of Fish and Wildlife
Jason Flory	United States Department of Fish and Wildlife
Paul Beaudoin	Landowner (Pomeroy Conservation District)
Chad Atkins	Washington Department of Ecology
Jed Volkman	Confederated Tribes of the Umatilla Indian Reservation
Keith Berglund	Garfield County Wheat Growers
Pat Fowler	Washington Department of Fish and Wildlife
Steve Martin	Snake River Salmon Recovery Board
Victoria Leuba	Washington Department of Ecology
Gary James	Confederated Tribes of the Umatilla Indian Reservation
Les Marois	Nez Perce Tribe

Informal technical work groups were also used throughout the process. These groups were composed primarily of Conservation District, Nez Perce Tribe, United States Forest Service, United States Department of Fish and Wildlife, Washington Department of Fish and Wildlife, Washington Department of Ecology, and consultant team staff. The primary purpose of the technical work group was to review and evaluate Washington Department of Fish and Wildlife work products before presentation to the public in order to identify inconsistencies and address technical issues.

The Lower Snake Mainstem Subbasin Plan will be a significant component of the WRIA 35 Watershed and Snake River Salmon Recovery planning efforts as they proceed. As such, these two groups were provided the opportunity to review plan components during development.

1.3 Public Involvement

1.3.1 Public Involvement During Plan Development

Public involvement was a key element of the subbasin planning process. Opportunities for public involvement were numerous, including the following:

- Subbasin Planning Scoping Public Meeting

- Subbasin Planning Assessment Public Meeting
- Management Plan Public Workshop #1
- Management Plan Public Workshop #2
- Information posted on the subbasin planning website (http://www.nwppc.org/fw/subbasinplanning/admin/upload/list.asp?id=48)
- Draft documents distributed to the WRIA 35 and Snake River Salmon Recovery Board mailing lists and interested parties, and discussed at their scheduled meetings

The assessment and two management plan workshops listed above provided a significant opportunity for interaction between the SPT, technical staff, and the public. Prior to each of these meetings, the technical work group met to review and revise information prepared by WDFW. At each public meeting, a subbasin planning overview and status update were provided, available information was presented, and the documents available were discussed and revised. Feedback received from the public was used to change the documents in real-time at the meetings. In addition, comment sheets and self-addressed stamped envelopes were distributed at each meeting for written comments, which were later incorporated into the plan. The public involvement plan for the Asotin, Lower Snake, Tucannon, and Walla Walla Subbasins can be found in Appendix A.

1.3.2 Outreach During Implementation

Over the long run, it is important to develop broad public understanding and commitment to fish and wildlife efforts in the Asotin Subbasin. This effort needs to involve individuals as well as agencies. Information and resources from state agencies, Nez Perce Tribe and subbasin scale efforts need to be provided to local groups, while local data from conservation districts and others need to be integrated into the subbasin scale effort. A sustained, long-term effort to provide information to communities and residents of the subbasin needs to be maintained. Implementation of this subbasin plan will rely upon the cooperation of private landowners. Public outreach regarding the purpose, objectives, and benefits of this plan can play a large role in supporting successful implementation. Further, public outreach and education can reap additional benefits as individuals voluntarily modify their actions for the benefit of aquatic and terrestrial species and their habitats. Public outreach and education activities should occur with the cooperation of a wide variety of local stakeholders, including the Pomeroy Conservation District, Nez Perce Tribe, state agencies, and others.

1.4 Plan Approval

On May 11, 2004, the Pomeroy Conservation District Board of Directors approved submittal of the Lower Snake Subbasin Plan, May 2004 Version, to the Northwest Power and Conservation Council.

1.5 Plan Updates

The Lower Snake Subbasin Plan was written with a 10 to 15 year planning horizon. All hypotheses, objectives, and strategies were established with this time frame in mind. Upon approval of the subbasin plan, it will be reviewed by the Council's Independent Science Review Panel (ISRP). The entities involved in development of this plan anticipate that they will be provided the resources and opportunity to address the ISRP's concerns through a subsequent plan finalization process at the subbasin level with local stakeholders. Upon adoption into the Council's Fish and Wildlife Program, the entities involved in development of this plan further anticipate that they will be provided the resources and opportunity to lead future updates of this subbasin plan.

2. Subbasin Overview

2.1 Subbasin Description

2.1.1 Location and Climate

The Lower Snake Subbasin is composed of portions Adams, Franklin, Walla Walla, Columbia, Whitman, Garfield and Asotin Counties in the southeastern corner of Washington (Figure 2-1). The following description of the location and climate of the subbasin was excerpted from the Draft Lower Snake Subbasin Summary completed by the Northwest Power Planning Council (NPPC 2001).

> "Several small tributaries with perennial water flow that likely contain fish populations are included in this subbasin. They generally drain an arid landscape and they have similar climate and land use. Some of these streams drain the north side of the Snake River in Whitman County (e.g., Alkali Flat Creek, Penawawa, Almota, Wawawai and Steptoe Canyon creeks). Others drain from the south, primarily in Garfield County (Alpowa, Deadman and Meadow creeks).
>
> "Alpowa Creek, located in southeastern Washington begins in the Blue Mountains at an elevation of approximately 4,000 feet above sea level and joins the Snake River at Lower Granite Lake about seven miles west of Clarkston, Washington. Major seasonal and ephemeral tributaries of Alpowa Creek include Page, Pow Wah Kee Gulch, Clayton Gulch, and Stember creeks.
>
> "The entire drainage area of the Alpowa Creek watershed is 82,944 acres (130 square miles). Most of this area is very arid landscape with several seasonal canyons that enter the mainstem Alpowa Creek.
>
> "Garfield County contains several watersheds (e.g., Pataha, Deadman, Meadow Creek, New York Gulch, Dry Gulch creeks) that drain into the Snake River... these creeks have been grouped and identified as the Deadman Creek watershed located in WRIA 35...
>
> "The total [Deadman Creek] watershed area is 214,560 acres of which 121,000 acres are cropland. The watersheds of Garfield County, excluding Pataha and Deadman creeks contain over 55 miles of perennial streams."

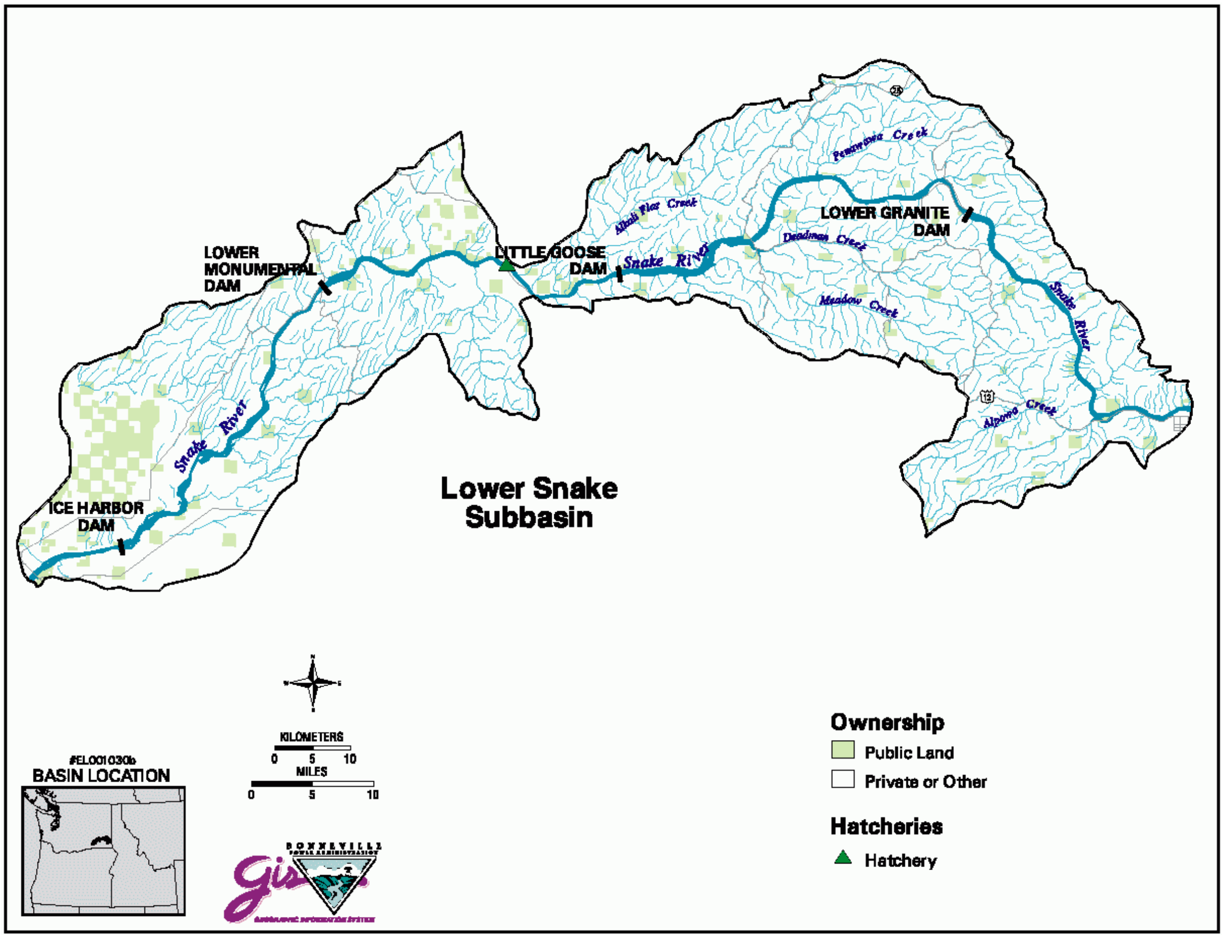

Figure 2-1 Lower Snake Subbasin
Source: NPPC 2001, Figure 1.

"The four dams on the Lower Snake River impound more than 96% (137 miles) of the Snake River in Washington from Asotin, Washington, to the confluence with the Columbia River at Pasco, Washington. Also impounded is the lower 3.7 miles of the Clearwater River in upper Lower Granite Reservoir. The remaining 6.0 miles of the Snake River below Ice Harbor Dam forms the uppermost reach of McNary Reservoir (Lake Wallula) on the Columbia River. The entire reach lies within a canyon cut through the Columbia plateau. The physical characteristics of each reservoir were summarized in Bennett *et al*. (1983), and all reservoirs generally share similar morphometry. Lower Granite is the longest reservoir, whereas Little Goose has the largest surface area. Mean depth ranges from 48-57 feet; Ice Harbor Reservoir is the shallowest. Three major tributaries enter this section. The Clearwater River joins the Snake River in upper Lower Granite, and the Palouse and Tucannon rivers join near the midpoint of Lower Monumental Reservoir.

"The Pacific Ocean, Cascade Mountains, and prevailing westerly winds largely influence the climate of this subbasin. The Cascades intercept the maritime air masses as they move eastward, creating a rain shadow effect that reaches as far as the Blue Mountains. These moisture patterns combined with differences produce warm and semiarid conditions along the reservoir system to cool and relatively wet at the tributary headwaters.

"Approximately 70-85% of the precipitation in the Alpowa Creek drainage falls from November through April. The watershed experiences precipitation mostly as rain. Although precipitation records for the Alpowa Creek area are absent, data exists for the nearby cities of Anatone and Pomeroy. In Anatone, precipitation varies from 0.71–2.12 inches in August and May, respectively, with the winter months and May showing the greatest variability in average monthly precipitation. The average monthly precipitation recorded at Pomeroy ranged from 0.59-2.16 inches in July and January, respectively, with the greatest variability in average precipitation occurring in the winter and spring. Amounts of precipitation in the Alpowa watershed varies from 14-18 inches depending on topography.

"Within the Deadman Creek watershed, average annual precipitation ranges from 11 inches on cropland in the western portion of the watershed to 25 inches near Mayview at the head of Casey Creek. Most of the precipitation occurs between September and June. Temperatures range from -22 ^{o}F to 109 ^{o}F. The frost-free growing season within the watershed averages 110-140 days."

2.1.2 Physical Environment

The following discussion of topography and soil composition in the Lower Snake Subbasin was excerpted from the Draft Lower Snake Subbasin Summary (NPPC 2001).

"Several mountain ranges, with intervening valleys and plains, lie within the Snake River Basin, a semiarid expanse formed by successive flows of basaltic lava."

The Snake River flows across a major physiographic region of the Pacific Northwest known as the Snake River Plateau and along the southern portion of the Columbia Plateau. The Snake River Plateau extends from southwestern Oregon across southern Idaho and includes parts of Nevada and Utah. The Columbia Plateau extends south from the upper curve of the Columbia River to the Blue Mountains, west to the Cascades, and east above the Snake River, just east of the Washington-Idaho state line. These two regions are composed mainly of lava flows covered with soil. In areas where the Snake River has cut canyons, the dark basalt rock is a primary surface feature. Many of the soils of the Snake River Plateau are light and highly erodible, with low rainfall limiting the ability of vegetative cover to reestablish once removed. This results in heavy sediment loads in the river, especially during the spring runoff season.

"The Miocene and Pliocene basalt flows that covered the region and diverted the Columbia River northward and westward to its present location are largely responsible for the topography of the Columbia Basin. Each basalt formation accumulated from individual flows ranging in thickness from 10-300 feet. Known as the Columbia River Basalt, the lava flows overlie the Precambrian Belt-Purcell Supergroup. The current topography of the region results from a combination of erosion and underlying structural deformation of the basalt.

"Throughout the subbasin, the mountain and plateau soils are dominated by wind-blown silt (loess) deposits. Volcanic ash from the eruption of Mt. Mazama can be found at higher elevations around mountain summits and north-facing canyon slopes. Plateau tops and shoulder slopes are characterized by silt loams moderately to well drained and highly erosive. Numerous soil series (e.g., Larkin, Tolo, Gwin, Walla Walla, Asotin, Chard, Athena, and Palouse) can be found in the Lower Snake River Subbasin."

2.1.3 Water Resources and Hydrology

The following discussion of hydrology and water quality in the Lower Snake Subbasin was excerpted from the Lower Snake Subbasin Summary (NPPC 2001). Note that Almota Creek was used as a reference reach for Alpowa Creek, and Deadman Creek was used as a reference reach for Penawawa throughout this subbasin plan due to existing data gaps on Alpowa and Penawawa.

Hydrology

"The Snake River Basin has a total drainage area of approximately 108,700 square miles upstream of its confluence with the Columbia River near Pasco, Washington. Approximately 5% of the Snake River's total drainage area is located downstream of its confluence with the Clearwater River at Lewiston, Idaho, and this region is relatively arid compared to the Snake River's upstream drainage areas. Therefore, only a relatively small amount of runoff occurs along the Lower Snake River downstream of the Clearwater River confluence… contributed primarily from the Tucannon and Palouse Rivers *(note-located in the Tucannon and Palouse Subbasins, respectively)*, which both empty into the Snake River between Lower Monumental and Little Goose dams…

"Alpowa Creek drains the northeastern slopes of the Blue Mountains while flowing eastward to the Snake River at River Mile (RM) 130.5. The elevation of the watershed ranges from 883 feet at the mouth to 4,485 feet near Iron Springs… The entire watershed has 193.4 miles (mostly seasonal drainages) of stream length and a drainage density (stream length/basin area) of 1.48 miles/square miles. The basin has a maximum length of 16 miles from east to west and a maximum width of 11.4 miles from north to south…

"…The main channel of Alpowa Creek is the only creek in the [Alpowa] watershed that maintains perennial flow. Stember Creek maintains year-round flow most years. Other areas in the watershed will maintain perennial flows for a length downstream of springs, but then flow subsurface… The potential for water storage in the soil is variable from high potential areas adjacent to the channel and on top of the ridges, to relatively low on the valley sides.

"The maximum streamflow in the Alpowa watershed generally occurs during the spring when the region sees high precipitation accompanying snowmelt. Minimum streamflow generally occurs in the summer months and early fall, when precipitation is low and irrigation withdrawals are highest. Alpowa Creek maintains perennial flow in part due to large springs located in the mid- and upper reaches of the creek. These springs are important in providing cool water in sufficient supply to maintain an anadromous fish population…"

"Groundwater plays an important role in the hydrology of the Alpowa watershed. Springs provide much of the summer baseflow and a cool water source necessary for steelhead and cold water resident fish. From aerial photos it is evident that large vegetation in the channel is often associated with mapped spring locations. From the brief field reconnaissance, it appears that many of the springs are where the channel has intercepted an interflow zone between basalt layers."

"Deadman Creek, which drains the northern portion of Garfield County flows westward to the Snake River, where it joins at RM 84.75. The elevation of the watershed ranges from 650 feet at the mouth to 2,500 feet near Kirby... The entire watershed has 68 miles of stream length and a drainage density (stream length/basin area) of .33 miles/square miles. The basin has a maximum length of 25 miles from east to west and a maximum width of 13 miles from north to south."

Water Quality

"Historic water summer temperatures in the Snake River basin far exceeded the optimal ranges [for salmonid stocks]. Adaptations included spring and summer chinook migrating into higher elevation tributaries to spawn so their young could rear where water temperatures were cooler. Snake River coho, sockeye, and steelhead adapted similar to the spring/summer chinook. Fall chinook spawned in the mainstem (usually near the mouth of major tributaries), about 95% of them upstream from the Lower Snake River. Their life history was likely adjusted in avoidance of hot summer water temperatures in the Lower Snake River by migrating before the heat of the summer when shoreline rearing areas heated up. Juvenile fall chinook from above Hells Canyon probably reached the Lower Snake River before peak hot temperatures in the summer. Juvenile fall chinook from Hells Canyon, the Lower Clearwater River, and the Lower Snake River probably moved through the Lower Snake River to rear in the slightly cooler waters of the lower Columbia River (now McNary, John Day, The Dalles, and Bonneville Reservoirs) if they had not experienced a sufficient growth period in the middle or upper Snake River."

"Water temperatures in the Lower Snake River are relatively cool in May and June during the peak flow and snowmelt period, with typical readings ranging from 10 to 14°C (50 to 57°F). By mid- to late July, however, temperatures usually warm up to 22°C to 24°C (71.6 to 75.2°F) and remain above 20°C (68°F) until late September. The highest temperatures generally occur from August to mid-September (BPA 1995). The late-summer maximum temperatures suggest that the most significant effect of hydropower dam construction may be that the period of maximum temperatures has shifted from mid-July through August to mid-August through September (EPA and NMFS 1971; BPA 1995). This is based upon a comparison with temperature data collected prior to dam construction (1955-1958) in the Lower Snake River, where maximum temperatures were frequently above 22°C (72°F) from mid-July to late August (FWPCA 1967). Similarly surface water temperature data (1 m depth) collected at SNR-107, prior to construction of the Lower Granite Dam, reached peak temperatures in excess of 22° C between mid-July and late-August…"

"Alpowa Creek drains an agriculturally dominated watershed. Sediment levels (both concentration and turbidity), stream temperature, and fecal coliform are three major water quality parameters of concern in this watershed. In 1981, Stream temperature during the summer months and high sediment loads especially during winter and spring high flows were recognized as water quality problems for fish in Alpowa Creek (Mendel and Taylor 1981). The WDOE surface water quality standards identify Alpowa Creek as a Class A stream. The classification of a water body in the state of Washington is based on its beneficial uses."

"One critical water quality problem in Alpowa Creek is elevated water temperature, especially during mid-summer (Soil Conservation Service (SCS) 1981; Mendel and Taylor 1981). Reduced base flow, summer irrigation withdrawals, and a lack of riparian vegetative cover along many stretches are likely contributors to high summer temperatures. The middle and lower reaches of Alpowa Creek support grazing and agriculture activities that have removed much of the woody riparian and streambank vegetation."

"Water temperature exceeded WDOE standards for a Class A stream (18°C) during September 1998 (Figure 2-2). Considering the temperature in September was 19°C (Center for Environmental Education 1999), it is probable that the average water temperature during July and August may also be higher than the WDOE standard."

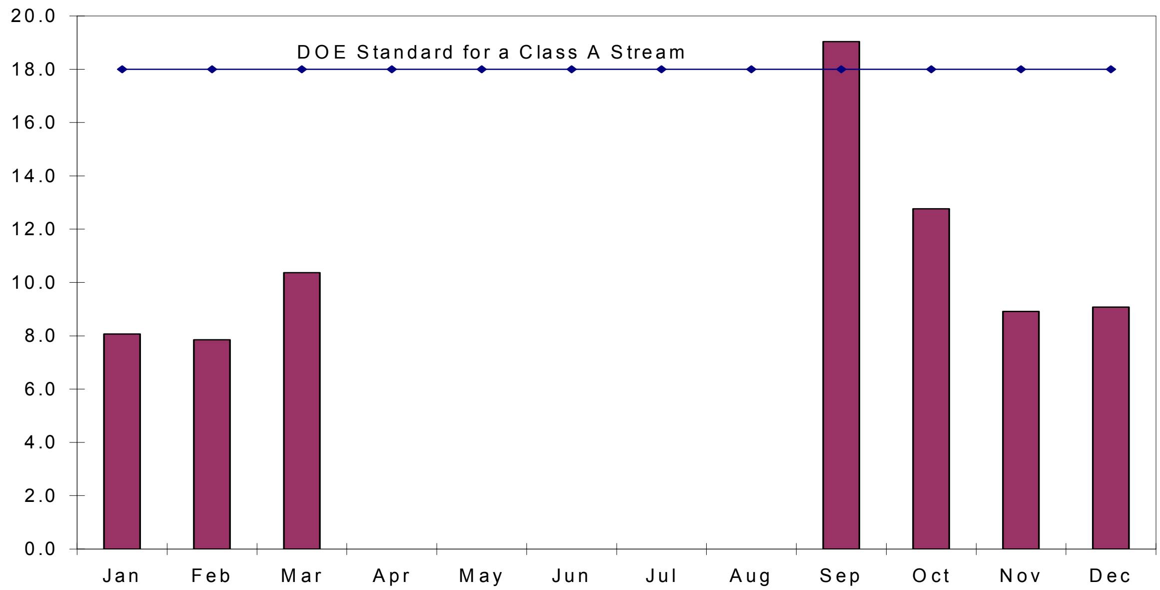

Figure 2-2 Average Monthly Stream Temperature of Alpowa Creek, September 1998—March 1999

Source: NPPC 2001, Figure 12

"The WDOE standard for fecal coliform in a Class A stream is that waters must not exceed a geometric mean of 100 cfu/100 ml. In addition, not more than 10% of all samples tested may exceed a geometric mean of 200 cfu/100 mL. In general, Alpowa Creek exceeds the WDOE standard of 100 cfu/ 100 mL every month tested with the exception of February (Figure 2-3).

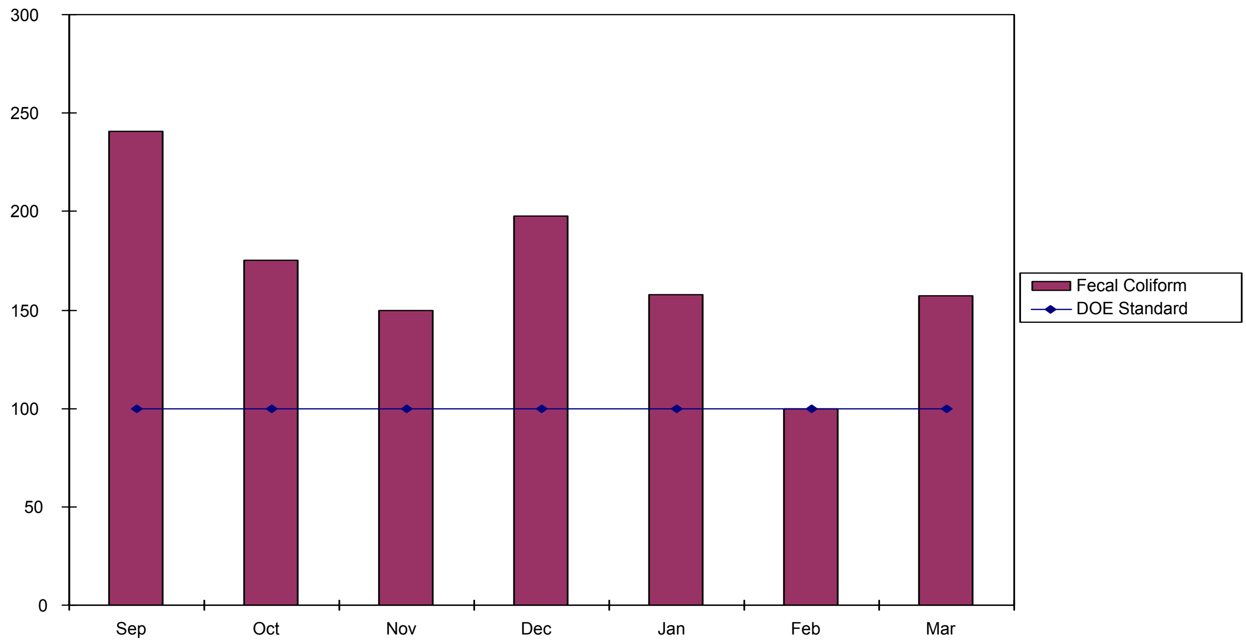

Figure 2-3 Geometric Mean of Monthly Fecal Coliform in Alpowa Creek, September 1998-March 1999

Source: Center for Environmental Education 1999 as shown in NPPC 2001, Figure 14

"Sediment levels (both concentration and turbidity), stream temperature, and fecal coliform are three major water quality parameters of concern in this watershed. Stream temperature during summer months and high sediment loads during winter and spring high flows are water quality problems for fish in Deadman Creek."

"Water temperature exceeded WDOE standards for a Class A stream (18°C) from May - September 1999. While it is impossible to know, given this data, what percentage of the time stream temperatures exceeded a specific critical level (i.e., 18°C as considered by WDOE for Class A waters), these water temperatures are clearly unfavorable to native salmonids during critical life history periods. In many cases, maximum stream temperatures during mid-summer are more extreme and potentially lethal for some native fish species. Steelhead fry may emerge from the substrate in Deadman Creek probably between May and July, and juveniles are rearing through the summer months when temperatures are highest, posing a potential stress during these life history periods."

"… seasonal variation in TSS generally coincides with peaks in stream discharge. The higher TSS in December probably is due to a rain-on-snow event. Stream discharge increases in response to precipitation or snowmelt in the watershed. High winter precipitation and snowmelt during spring increase runoff, and therefore produce more sediment in the watershed. Precipitation is the major factor influencing sedimentation to Deadman. An overall average for the Deadman Watershed is 42.71 at the mouth. This is about ½ the upper limit for optimum health of salmonids."

"Fecal coliform in Deadman Creek exceeds the WDOE standard of 100 cfu/ 100 mL about 50% of the tests with the overall averages above the standard. The geometric mean fecal coliform level from Deadman Creek exceeds the WDOE standard of 100 cfu/100 mL. It is difficult to evaluate contamination from any one source. Waste from livestock in the area is considered to be the major source of coliform in Deadman Creek."

2.1.4 Fish and Wildlife Species

Fish

The Subbasin reservoirs are home to 18 native and 17 introduced fish species (NPPC 2001; Table 2-1). The white sturgeon is a state species of concern in Idaho, and bull trout is listed as a threatened species in the Snake River Basin (NPPC 2001).

Table 2-1 Composite Resident Fish Species List and Sources of Data for the Lower Snake River

Common Name*	Scientific Name	Bennett *et al.* (1983)	BRD-ODFW (1991)	SOR (1995)
White sturgeon	*Acipenser transmontanus*	X		X
Rainbow trout	*Oncorhynchus mykiss*	X		X
Kokanee	*Oncorhynchus nerka*	X	X	X
Mountain whitefish	*Prosopium williamsoni*	X		X
Brown trout	*Salmo trutta*	X		X
Bull trout	*Salvelinus confluentus*		X	X
Chiselmouth	*Acrocheilus alutaceus*	X		X
Common carp	*Cyprinus carpio*	X		X
Peamouth	*Mylocheilus caurinus*	X	X	X
Northern pikeminnow	*Ptychocheilus oregonensis*	X	X	X
Longnose dace	*Rhinichthys cataractae*		X	X
Speckled dace	*Rhinichthys osculus*	X	X	X
Redside shiner	*Richardsonius balteatus*	X		X
Bridgelip sucker	*Castosmos columbianus*	X		X
Largescale sucker	*Catostomus macrocheilus*	X	X	X
Yellow bullhead	*Ameiurus natalis*	X	X	X
Brown bullhead	*Ameiurus nebulosus*	X	X	X
Channel catfish	*Ictalurus punctatus*	X		X
Tadpole madtom	*Noturus hyrinus*	X	X	X
Flathead catfish	*Pylodictus olivaris*	X	X	X
Mosquitofish	*Gambusia affinis*			X

Common Name*	Scientific Name	Bennett *et al.* (1983)	BRD-ODFW (1991)	SOR (1995)
Three-spine stickleback	*Gasterosteus aculeatus*			
Sandroller	*Percopsis transmontana*			X
Pumpkinseed	*Lepomis gibbosus*	X	X**	X
Warmouth	*Lepomis gulosus*	X	X	X
Bluegill	*Lepomis macrochirus*	X	X	X
Smallmouth bass	*Micropterus dolomieui*	X		X
Largemouth bass	*Micropterus salmoides*	X	X	X
White crappie	*Pomoxis annularis*	X	X	X
Black crappie	*Pomoxis nigromaculatus*	X		X
Yellow perch	*Perca flavescens*	X	X	X
Walleye	*Stizostedion vitreum*		X	X
Prickly sculpin	*Cottus asper*	X	X	X
Mottled sculpin	*Cottus bairdi*	X		X
Paiute sculpin	*Cottus beldingi*	X		X
Banded killfish ***	Fundulus diaphanous	N.A.	N.A.	N.A.
American shad ****	Alosa sapidissima	N.A.	N.A.	N.A.

*Bold type indicates native species.
**Questionable record.
Note: Bennett *et al*. (1983) reflects sampling by multiple gear types in the four reservoirs. BRD-Oregon Department of Fish & Wildlife (ODFW) (1991) reflects sampling by electrofisher and includes sampling in the unimpounded Snake River above Asotin, Washington. SOR (1995) is a compilation of data from various sources, including the Snake River below Ice Harbor Dam.
*** Added per personal communication between Dave Bennett and Glen Mendel, WDFW, due to recent discovery above Lower Granite Dam. Not in the original source document.
**** American shad are also presented in the portion of the Snake River mainstem that flows through the Lower Snake Subbasin (see http://www.fpc.org/CurrentDaily/7day-ytd_adults.htm for 2004 adult passage counts at the mainstem Columbia and Snake River dams)
Source: Army Corps of Engineers 1999 as shown in NPPC 2001, Table 32.

The following discussion of anadromous fish populations in the Lower Snake Subbasin was excerpted from the Draft Lower Snake Subbasin Summary (NPPC 2001).

> "Salmon populations in the Snake River have been listed under provisions of the U.S. Endangered Species Act (ESA). The pertinent listed species are Snake River sockeye salmon (*Oncorhynchus nerka*, listed as endangered in 1991), Snake River spring/summer and fall chinook salmon (*O. tshawytscha*, both listed as threatened in 1992), and Snake River steelhead *(O. mykiss*, listed as threatened in 1998)…"

> "[Spring chinook salmon] was listed as threatened in 1992. Spring and summer Chinook migrate through the mainstem Snake River, but no spawning or rearing is known to occur there or in any of the minor tributaries in this subbasin, except the Tucannon River where an endemic stock persists."

> "Fall chinook salmon were listed as threatened under the Endangered Species Act in 1992. Fall chinook salmon are unique in that they spend the entire freshwater portion of their life cycle in main-stem habitats. Historically, the majority of Snake River fall chinook salmon apparently spawned in the mainstem near Marsing, Idaho (Haas 1965; Irving and Bjornn 1981)."

"Construction of the Hells Canyon complex (1958-1967) and the Lower Snake River Dams (1961-1975) eliminated or severely degraded 530 miles of spawning and rearing habitat for fall chinook in the Snake River (Mendel 1998). Historically, fall chinook salmon runs averaged 72,000 fish between 1938-1949, with highs of up to 120,000 (Irving and Bjornn 1981). By the 1950s these runs had decreased to an average of 29,000. Fall chinook continued to decline, and by the late 1960s and 1970s the average run was only 5,100 fish at Ice Harbor Dam. The average annual runs have remained at 4,700-5,500 fish in the 1980s and the 1990s…"

"Wild coho [salmon] are extinct in the Snake River basin since the early to mid 1980s. Hatchery coho are being reintroduced in the Clearwater River by the NPT. Also, there may be stray coho from the Umatilla, and possibly the Yakima reintroduction efforts in the Snake River. Some of these fish are recovered at Lyons Ferry Hatchery or in the Tucannon River since about 1997."

"Information on Snake River steelhead is limited because it is difficult to develop stock-specific estimates of abundance and survival. Additionally, it is nearly impossible to obtain accurate redd counts for Snake River steelhead because of their spawning locations and timing…"

Note: Debate exists regarding whether redd counts are reliable predictors of the number of fish (Faurot & Kucera 2002; Faurot & Kucera 2003).

The average return of wild steelhead to the Snake River Basin declined from approximately 30,000 to 80,000 adults in the 1960s through mid-1970s, to 7,000 to 30,000 in recent years. Average returns during 1990 through 1991 and for the 1995 and 1996 return years was 11,465 fish. The general pattern has included a sharp decline in abundance in the early 1970s, a modest increasing trend from the mid-1970s through the early 1980s, and another decline during the 1990s. The sharp decline in steelhead numbers during the early 1970s parallels the similar sharp decline in spring/summer Chinook salmon populations during the same time period. However, whereas the wild steelhead population in the Snake River doubled from 1975 (13,000) to 1985 (27,000), the spring/summer Chinook salmon did not show an increase. In addition, much of the initial steelhead decline in the 1970s may be attributed to the construction of Dworshak Dam in 1973. This dam cut off access to the North Fork of the Clearwater River, which was an important spawning and rearing area for B-run steelhead.

"Some natural production of steelhead occurs in minor tributaries such as Alpowa Creek, Alkali Flat Creek, Almota Creek, Steptoe Creek., Deadman and Meadow creeks, etc. Steelhead are also produced from the Tucannon River. Spawning and rearing by steelhead is limited in the mainstem because of the Snake River Dams and reservoirs. Most tributaries that maintain summer water flows and do not have barriers are suspected of being used by steelhead…"

"Steelhead trout are known to have used Deadman Creek, although spawning was probably limited to the upper reaches. Anecdotal information from local residents suggest that steelhead still spawn in this stream system. Habitat in the upper reaches of the South Deadman are ideal for spawning and rearing and angler reports suggest steelhead were caught at the Deadman Creek Bridge at the base of Wildhorse Hill."

Recent steelhead spawning has been confirmed in Deadman Creek (Mendel et al. 2004).

Wildlife

A diverse variety of wildlife species are found in the Lower Snake Subbasin. Population status varies by area and species; several species are listed as state threatened, candidate, or species of concern (NPPC 2001; Table 2-2). Big game, upland birds, diversity species, furbearers, and waterfowl are managed by state and federal agencies (NPPC 2001).

Table 2-2 Status of Priority Habitat Species (PHS) within the Lower Snake River sub-basin

Species	Status	Population
Ferruginous hawk	T	5 nesting pairs ?
Prairie Falcon	PHS	13 eyries*
Peregrine Falcon	E & PHS	none
Ringneck pheasant	G	declining
Whitetailed jackrabbit	SC	unknown
Washington ground squirrel	SC	unknown
Mule Deer	G	---
Burrowing owl	C	5 nesting pairs
Ringneck pheasant	G	declining
Sharptail Grouse	T	extirpated
Whitetailed jackrabbit	C	unknown
Blacktailed Jackrabbit	C	low
Mule Deer	G	lowlands
Whitetail deer	G	increasing
Northern grasshopper mouse		unknown
Sagebrush Vole		unknown
Washington ground squirrel	C	low
Upland sandpiper	E	unknown
Long-billed curlew		low
Loggerhead shrike	C SC	unknown
Sage sparrow	C	unknown
Sabebrush lizard	SC	unknown
Sage thrasher	C	unknown
Bald eagle	T	wintering
Striped whipsnake	C	unknown
Kangaroo rat		unknown

* 1988 survey
State Status: E = endangered, C = candidate, T = threatened, SC = species of concern,
G = game species. PHS = Priority Habitat Species
Source: WDFW data as shown in NPPC 2001, Table 41.

2.1.5 Vegetation

A total of 345 different species of plants have been documented within the Lower Snake Subbasin in a 1976 inventory completed by the Army Corps of Engineers (NPPC 2001).

The following discussion of current and historic vegetation specific to Alpowa and Deadman Creeks was excerpted from the Lower Snake Subbasin Summary (NPPC 2001).

> "One of the earliest recorded observations of vegetation around Alpowa Creek dates back to October 1854, when the stream was described as being from eight to ten yards wide and fifteen inches deep and bordered by willow, long-leaved cotton-wood, birch, sumac, cherry, white haw, honeysuckle and gooseberry. The left bank of the stream was described with "very good grass and an abundance of wood" (Brauner 1976). The native riparian vegetation of the area was characterized by shrubby thickets, patches of deciduous trees, and grass-dominated plant communities. Conifer trees, predominantly ponderosa pine and douglas fir, were historically more common than today. A broad scale analysis of the changes in wetland distribution by researchers at the University of Idaho indicates a 97% reduction in the Palouse Bioregion. Most of these wetlands were drained or filled to increase the land available for agricultural and ranching uses (Black *et al* 1997)."

> "The predominant upland vegetation types were bluebunch wheatgrass communities on the drier sites, and shrub steppe communities of rabbitbrush, sagebrush, or antelope bitterbrush on the more mesic sites (Asherin and Claar, 1976). Significant alterations in the quality and quantity of upland habitats have occurred since European settlement. Habitats on more gentle topography have been converted to commercial agriculture, with the remaining areas used as pasture for domestic livestock. Some remnant shrub steppe communities can be found within the Alpowa Creek drainage but these are increasingly threatened by wildfire, and continued livestock grazing. Encroachment of noxious weeds has also degraded the quality of native plant communities within the uplands. Hironaka (1954) described bluebunch wheatgrass and Sandberg's bluegrass communities that had been invaded by St. John's wort. Cheatgrass and St. John's wort were early invaders but now yellow starthistle and other knapweeds are beginning to establish within the drainage."

> "The riparian vegetation within [Deadman Creek] basin was historically more extensive and diverse than what is present today (Black *et al*. 1997). In most areas, a mixture of mature trees, shrubs, and herbaceous plants covered the entire floodplain. However, as the width of area covered by dense trees and shrubs declined, so did the diversity and abundance of species. The Washington Department of Fish & Wildlife (WDFW) has developed recommendations on the width of the riparian zone that will help maintain high quality fish and wildlife habitat (Riparian Habitat Area-RHA) (Knutson and Naef 1997). Although the recommended RHA for Deadman Creek and its major tributaries is 150 feet, present conditions seldom meet this, contributing to a reduction in large woody debris recruitment potential and the watershed's ability to support fish and wildlife."

2.1.6 Current and Historic Land Use

The following discussion of land use in the Lower Snake Subbasin was excerpted from the Draft Lower Snake Subbasin Summary (NPPC 2001).

> "Unlike many reaches of the Columbia-Snake River System, much of the Lower Snake River is not paralleled by highways (Corps 1999). Railroad embankments occupy areas that otherwise might have been suitable for riparian vegetation."
>
> "Agriculture in the Alpowa Creek watershed and surrounding region is dominated by non-irrigated farming in the uplands, irrigated farming in the lower valleys, and cattle ranching."
>
> "Grazing is prevalent throughout the Alpowa watershed. Cattle ranching occurred on 51,000 of the Alpowa basin's 83,000 total acres in 1981, while farmlands cover approximately 27,000 acres, or 33% of the drainage (Soil Conservation Service *et al*. 1984; USDA 1981). The average size of a farm in Garfield County is 1,750 acres, and 1,933 in Asotin County—three times more than the state averages and as of 1997 had an average net worth of $650,000 each (Washington Agricultural Statistics Service 1997a, 1997b). Grazing has occurred in the riparian areas to varying degrees, and much of the riparian vegetation has been heavily impacted (Mendel 1981; Mendel and Taylor 1981; U. S. Department of Agriculture 1981)."
>
> "The majority of the farmland in the Alpowa watershed is non-irrigated. Mean annual precipitation, length of growing season, and depth of soil largely determine crop production in the watershed. Winter wheat, spring grain, peas, and bluegrass seed are the major non-irrigated crops grown in the uplands of the watershed. Cropping systems most frequently used are winter wheat summer fallow; winter wheat spring grain-summer fallow; wheat-peas; annual winter wheat; annual spring barley; and annual winter barley. Farming occupies the ridge tops and small areas adjacent to the creek...."
>
> "Proportionally, the watershed contains few irrigated lands (Employment Security Department 1998a, 1998b). Hay, small grains, and pasture are irrigated crops grown in the bottomlands near Alpowa Creek. Where croplands are located adjacent to the channel, the impact from agriculture can be much greater. The earliest recorded observations of the Alpowa watershed described it as "little more than a brook in summer, but its waters serve to irrigate some 300 acres of orchard lands near where it joins the Snake" (Russell 1897). The Pomeroy Conservation District (PCD) has estimated about ten irrigation diversions for irrigating smaller acreage currently exist in the Alpowa watershed."
>
> "In general, little forestry activity occurs in the Alpowa watershed. Timber harvest occurs on portions of the forested upper watershed, but this area is relatively small. As of 1981, only 3,882 acres had been harvested and 504 roaded (Soil Conservation Service *et al*. 1984). However, interpretation of aerial photos from the early 1990s by the

Washington GAP Analysis project indicates that much of the forested land in the watershed continues to be disturbed by logging."

"Since timber production is not significant in terms of forest surface within the Alpowa watershed, statistics for timber harvest are only available for Garfield County. In 1997, 5% of the trees cut were Douglas fir, 1.2% ponderosa pine, 40.4% true firs, 38% miscellaneous conifers, and 15.4% hardwoods. The proportion of products from old growth trees shows that 81% of the 1993 products were from old growth trees. However, this percentage declined sharply to 33% in 1994 and 51.6% in 1995. The variability results from Forest Service policies, because all old growth products came from forestlands under their administration. Products from private owners came only from young growth trees, indicating a lack of quality in forest resources (Washington Department of Natural Resources 1998)."

The economy of the [Deadman Creek] watershed is based primarily on agricultural production, with non-irrigated cropland farming and livestock production as the dominant agricultural enterprises.

"The largest land use in the Deadman Creek watershed is crop agriculture. Approximately 97,465 acres or 45% of the drainage is farmed (Soil Conservation Service *et al*. 1984), with the vast majority of this land non-irrigated. Cropping systems most frequently used are winter wheat—summer fallow; winter wheat—spring grain—summer fallow; annual winter wheat; annual spring barley; and annual winter barley. Most of the irrigated cropland, located in bottomland areas along Deadman Creek and its tributaries are used for hay, small grains and some rotation pasture."

"Livestock grazing is the second largest land use in the [Deadman Creek] watershed. A broad-scale analysis conducted by researchers at the University of Idaho on the changes in grass, shrubs, and forest cover types of the Palouse Bioregion illustrates the magnitude of the disturbance. The Deadman Creek ecosystem falls within the southern half of this bioregion, considered to be one of the most endangered in the world."

"Cattle are now grazed on approximately 93,500 acres, or 44% of the Deadman Creek watershed (Soil Conservation Service *et al*. 1984). This land use occurs predominantly in areas too steep, stony, shallow, or frequently flooded for farming… improperly managed cattle grazing can be a serious disturbance to riparian areas and thus the cause of deterioration to aquatic ecosystems."

2.1.7 Political Jurisdictions and Land Ownership

Lands adjacent to the Lower Snake River are primarily privately owned; public lands adjacent to the reservoirs are managed by the Army Corps of Engineers, and a few isolated parcels are owned by the State (NPPC 2001).

The Lower Snake Subbasin is composed of portions Adams, Franklin, Walla Walla, Columbia, Whitman, Garfield and Asotin counties. The Lewiston-Clarkston area and the area near the mouth of the Snake represent significant industrial, commercial, and residential development in the Subbasin (NPPC 2001). Other small urban areas include the communities of Almota, Riparia, and Windust.

The Lower Snake Subbasin is within the treaty territory of the Nez Perce Tribe and is protected as a usual and accustomed area via the treaty of 1855 that states;

> The exclusive right of taking fish in all the streams where running through or bordering said reservation is further secured to said Indians; as also the right of taking fish at all usual and accustomed places in common with citizens of the Territory; and of erecting temporary buildings for curing, together with the privileges of hunting, gathering roots and berries, and pasturing their horses and cattle upon open and unclaimed land (12 Stats., 957-Article 3). Treaty of 1855.

The tribe maintains a co-management authority with the State of Washington and the United States Government over the tribes' treaty reserved resources. Currently, the Lower Snake Subbasin provides hunting, fishing and gathering opportunities for tribal members (refer to tribal harvest section).

2.2 Regional Context for Subbasin Plan

2.2.1 Relation to ESA Planning Units

The Lower Snake Subbasin is only one portion of the larger ESUs that are the geographic basis for ESA listings. Given that it is only one subbasin within an ESU, if populations within the Lower Snake Subbasin were enhanced to become healthy and productive, the species could remain threatened at the ESU scale. As such, although efforts accomplished within the Lower Snake Subbasin will contribute to recovery at the ESU level, efforts across multiple subbasins will need to be coordinated to achieve enhancement of fish populations and eventual de-listing.

Figure 2-4 shows the relationship of the Lower Snake Subbasin to the Snake River Basin Steelhead ESU. Figure 2-5 shows the relationship of the Lower Snake Subbasin to the Snake River Basin Fall Chinook ESU. Figure 2-6 shows the relationship of the Lower Snake Subbasin to the Snake River Basin Spring/Summer Chinook ESU. Figure 2-7 shows the relationship of the Lower Snake Subbasin to the Snake River Recovery Unit for bull trout. Of these, only steelhead was selected as an aquatic focal species in the Lower Snake Subbasin.

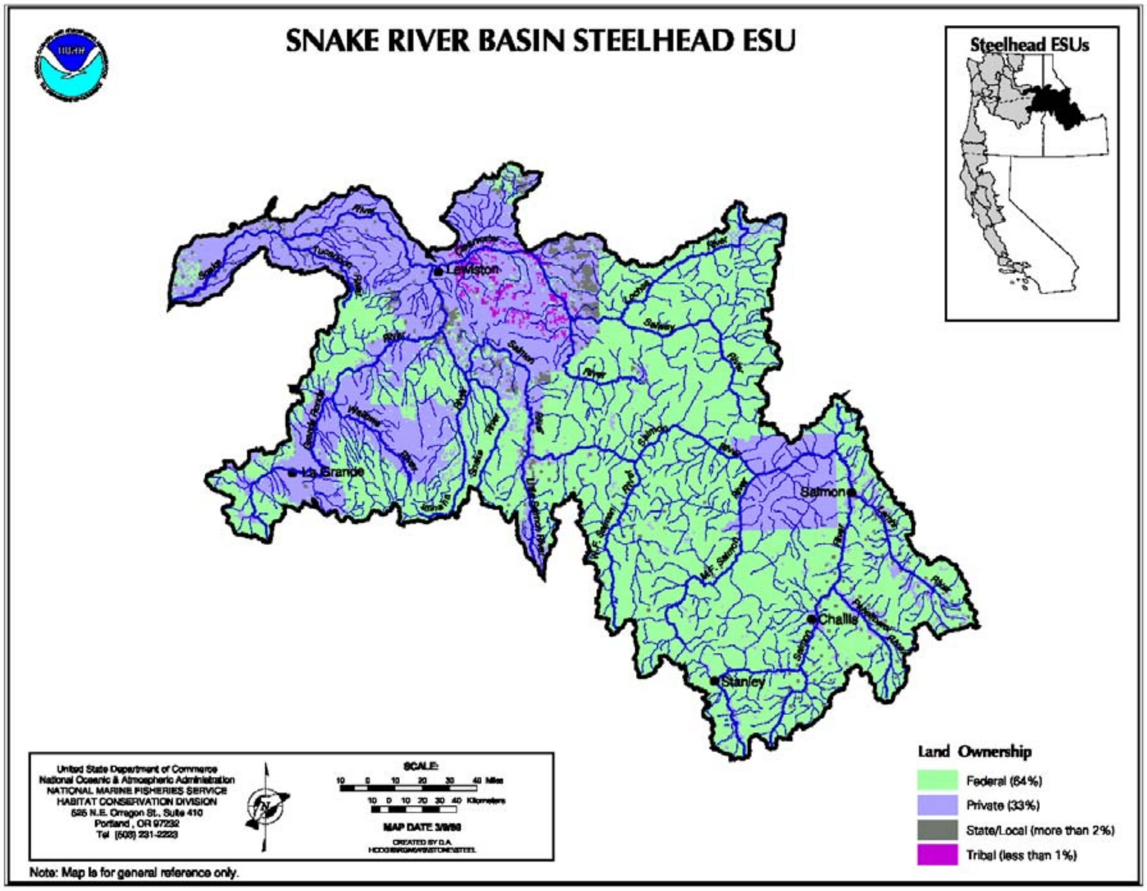

Figure 2-4 Relationship of Lower Snake Subbasin to the Snake River Basin Steelhead ESU

Source: NOAA-Fisheries 2004.

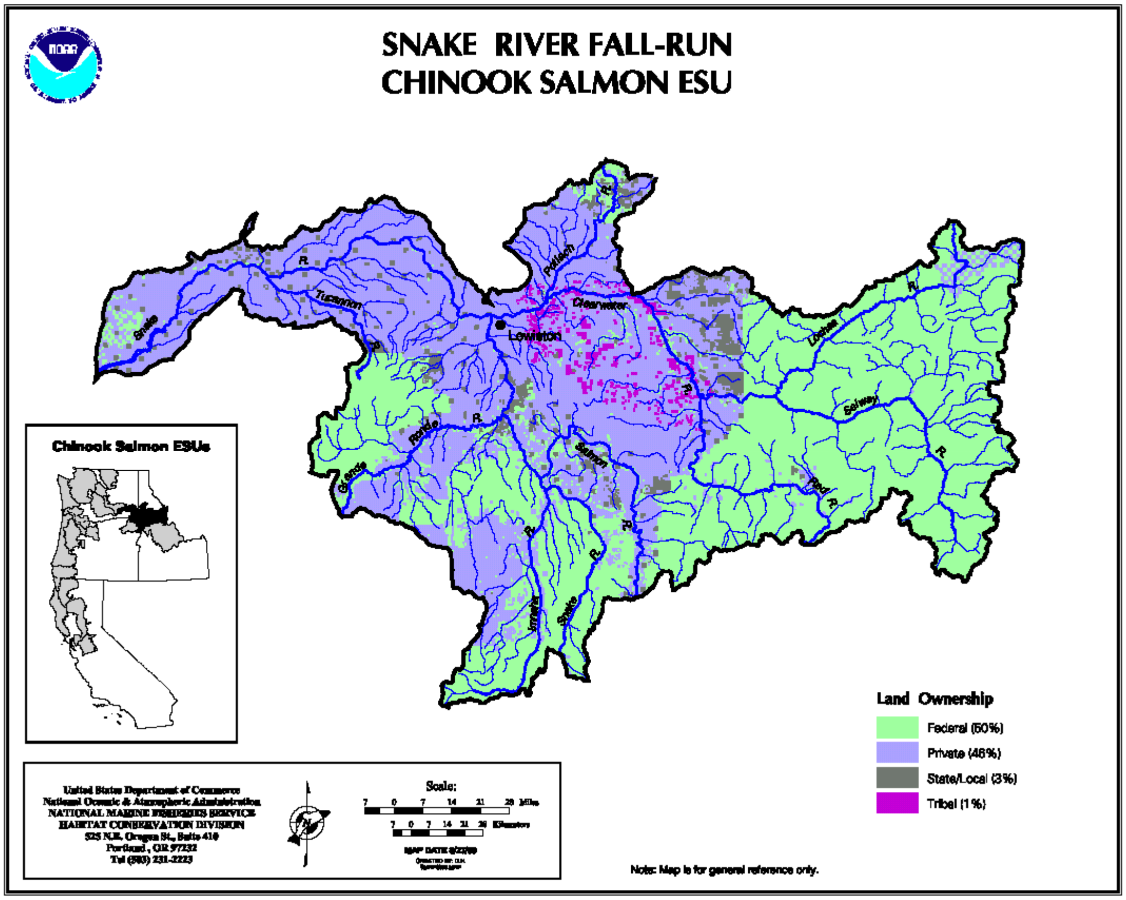

Figure 2-5 Relationship of Lower Snake Subbasin to the Snake River Basin Fall Chinook ESU

Source: NOAA-Fisheries 2004.

Note: Fall chinook were not selected as a focal species in the Lower Snake Subbasin (see Section 3.1).

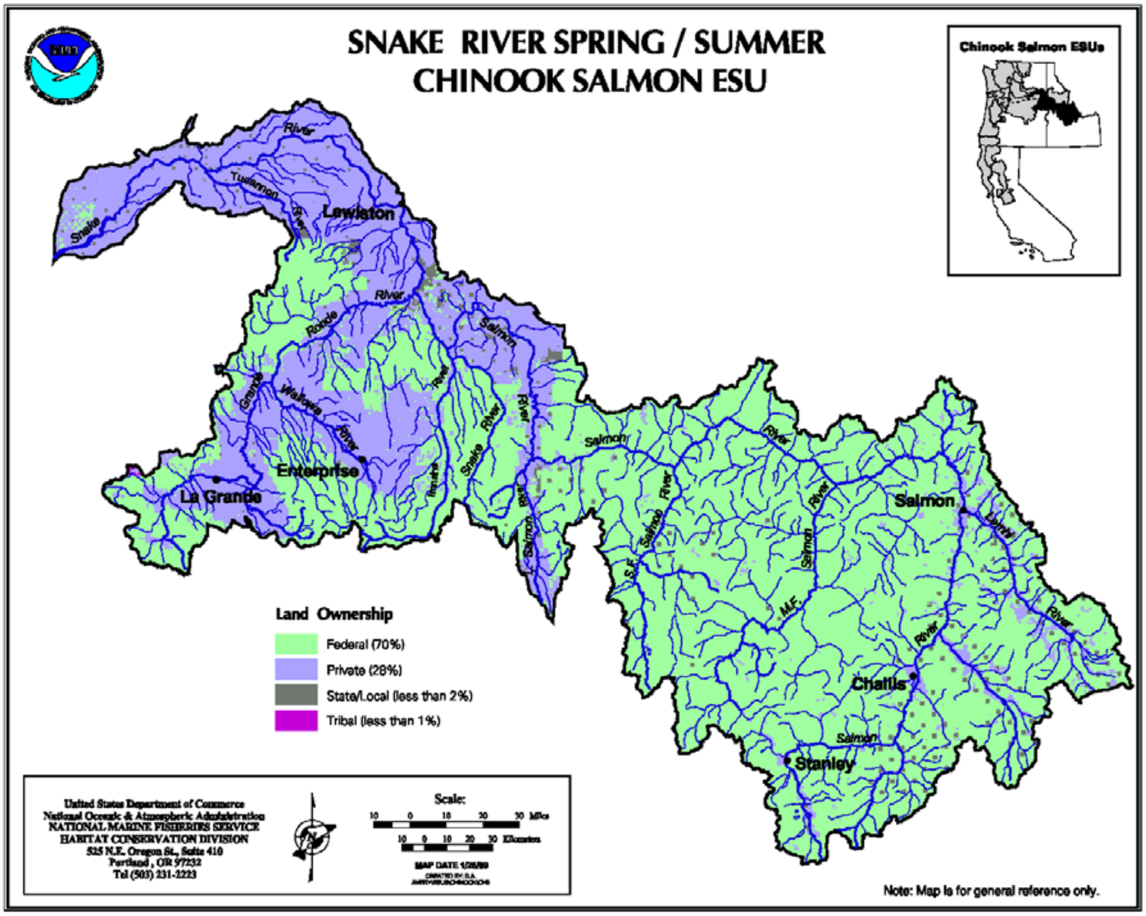

Figure 2-6 Relationship of Lower Snake Subbasin to the Snake River Basin Spring/Summer Chinook ESU

Source: NOAA-Fisheries 2004

Note: Spring/summer chinook are not a focal species in the Lower Snake Subbasin.

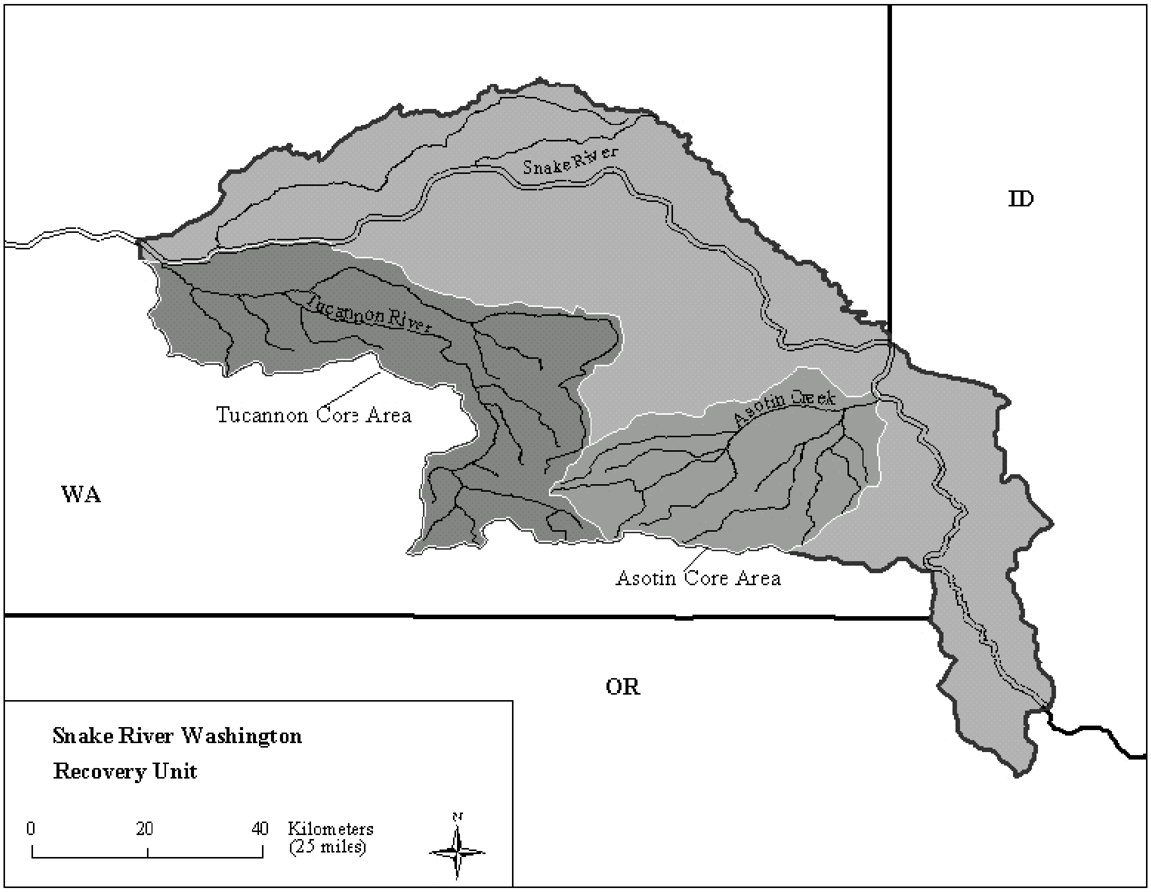

Figure 2-7 Relationship of Lower Snake Subbasin to the Snake River Bull Trout Recovery Unit

Source: Figure2, Chapter 24, USFWS 2002

Note: Bull trout were not selected as a focal species in the Lower Snake Subbasin.

2.2.2 Long-term Environmental Trends

Long-term environmental trends in climate have the ability to tremendously affect the baseline habitat conditions for salmonids. "Computer models generally agree that the climate in the Pacific Northwest will become, over the next half century, gradually warmer and wetter, with an increase of precipitation in winter and warmer, drier summers (USDA Forest Service 2004). These trends mostly agree with observed changes over the past century. Wetter winters would likely mean more flooding of certain rivers, and landslides on steep coastal bluffs (Mote et al. 1999) with higher levels of wood and grass fuels and increased wildland fire risk compared to previous disturbance regimes (USDA Forest Service 2004). The region's warm, dry summers may see slight increases in rainfall, according to the models, but the gains in rainfall will be more than offset by losses due to increased evaporation. Loss of moderate-elevation snowpack in response to warmer winter temperatures would have enormous and mostly negative impacts on the region's water resources, forests, and salmon (Mote et al. 1999). Among these impacts are a diminished ability to store water in reservoirs for summer use, and spawning and rearing difficulties for salmon…For the factors that climate models can simulate with some confidence, however, the prospects for many Pacific Northwest salmon stocks could worsen. The general picture of increased winter flooding and decreased summer and fall streamflows, along with elevated stream and estuary temperatures, would be especially problematic for in-stream and estuarine salmon habitat. For salmon runs that are already under stress from degraded freshwater and estuarine habitat, these changes may cause more severe problems than for more robust salmon runs that utilize healthy streams and estuaries." (TOAST 2004).

Locally, habitat within the Lower Snake Mainstem Subbasin tributaries continues to improve, particularly through implementation efforts from the model watershed plan. Further improvements that will be achieved through implementation of this and other habitat enhancement plans may serve to offset some of the anticipated climatic changes described above, especially if an adaptive management approach can be successfully implemented that allows these plans to evolve over time to meet changing ecological conditions.

3. Aquatic Assessment

3.1 Introduction

Summarized in this section is the aquatic assessment prepared by WDFW. Appendix B contains the complete WDFW assessment.

This section contains:

- Description of how focal species were selected and also identifies species of interest
- Description of the assessment methodology, including methodology limitations and qualifications, and instances in which the methodology was supplemented by previous assessment work and professional knowledge
- Assessment findings for the focal species
- Brief description of white sturgeon as a "species of interest."

3.2 Selection of Focal Species

One aquatic species, steelhead/rainbow trout (*Oncorhynchus mykiss*), was identified as a focal species for Lower Snake Subbasin Planning (see Figure 3-1)[1]. The subbasin planning parties (WDFW, Nez Perce Tribe, private citizens, and other interested agencies and entities) selected this species based on the following considerations:

- Selection of species with life histories representative of the Lower Snake Subbasin ecosystem;
- ESA status;
- Cultural importance of the species; and
- Level of information available/knowledge on species life history to conduct an effective assessment.

[1] Chinook salmon and bull trout were selected as focal species in other subbasins within the Ecoregion. Although they migrate through the mainstem Snake River, they are not known to inhabit the small streams that occur within the Lower Snake subbasin.

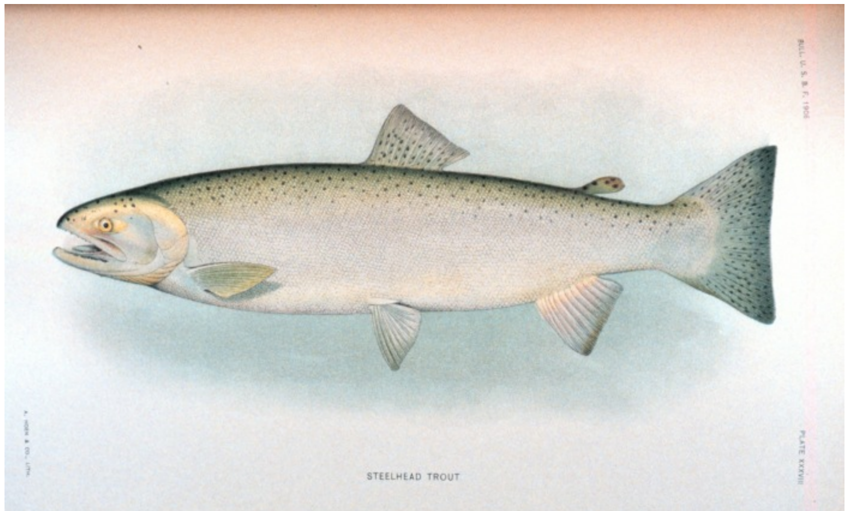

Figure 3-1 Steelhead trout (*Oncorhynchus mykiss*)
Source: NOAA Photo Library (http://www.photolib.noaa.gov/fish/fish3016.htm)

The life history of Lower Snake summer steelhead covers a broad range of the aquatic ecosystem. Spatially, its life history covers much of the subbasin. It also occupies the majority of the water column (including slack water, swift water and the hyporheic zone) during some portion of its lifecycle. Not only are steelhead present but also the ability of this species to thrive is dependent on being able to successfully occupy these areas. Temporally, they are present (or were assumed to be present in the past) at one lifestage or another throughout much of the watershed in all seasons. The ability of steelhead to be present at a particular time in a particular area is also key to their success. Given the wide range of both the spatial and temporal aspects of steelhead's life history, it can be assumed that having habitat conditions that are appropriate for them will also produce conditions that allow for the prosperity of other aquatic life in the Lower Snake subbasin.

The legal status of steelhead, listed as threatened under the ESA, is important to the people of the Lower Snake Subbasin. Currently the citizens, governments, state and federal agencies and tribes are engaged in planning for the steelhead recovery through different processes. The intention of subbasin planning to address listed species within the subbasin supports the inclusion of only steelhead within the subbasin as focal species. (Appendix B)

One other species, white sturgeon (*Acipenser transmontanus*) was identified as a "species of interest," and is discussed briefly at the end of this section.

3.3 Status of Focal Species in the Subbasin

Focal species information on historic and current distribution, population, harvest and hatchery (as applicable), is provided in Appendix B, along with available empirical data. Figure 3-2 identifies steelhead distribution and use type.

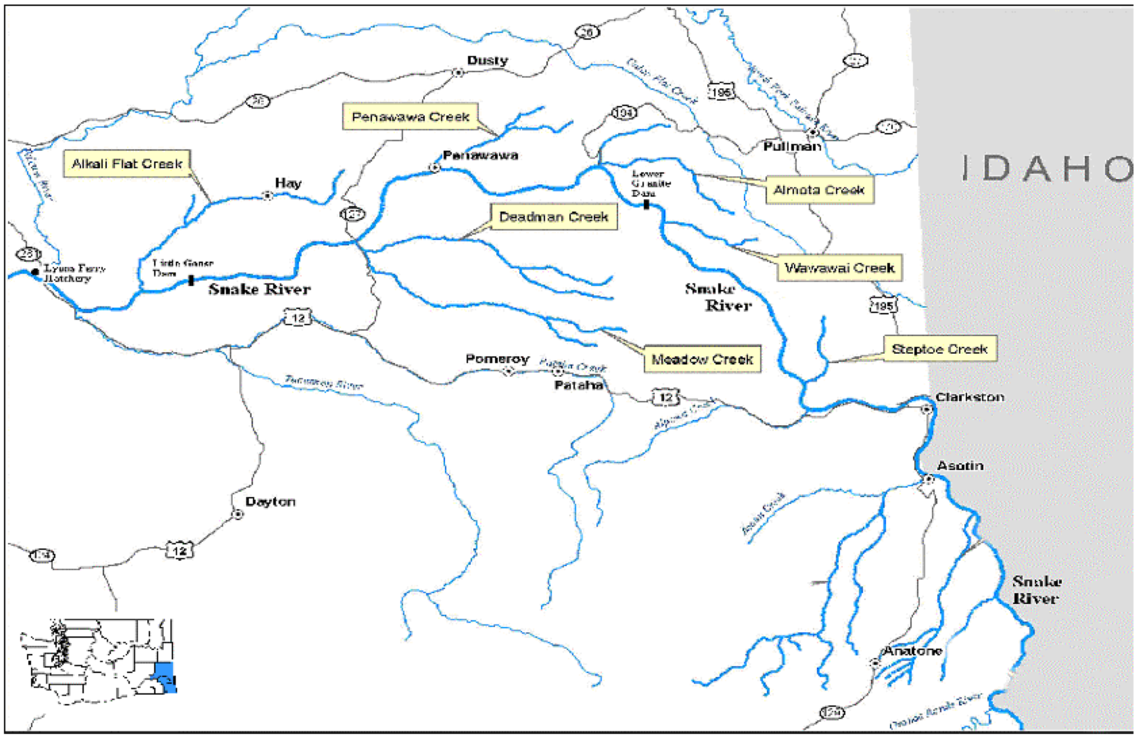

Figure 3-2 Known and Presumed Steelhead Bearing Streams, Lower Snake Subbasin
Source: Modified from Mendel et al. 2004 (figure taken from WDFW 2004).

3.4 Lower Snake Subbasin Habitat Aquatic Assessment Methods

3.4.1 Introduction

Summer steelhead populations in two Lower Snake tributaries (Almota and Deadman creeks) in the Lower Snake subbasin were assessed by the Washington Department of Fish and Wildlife using the Ecosystem Diagnosis and Treatment (EDT) method.   Although other species that may be present in the subbasin were not selected as focal species, most of the habitat improvements recommended for steelhead trout also would benefit other aquatic species.

3.4.2 Overview of EDT Methodology

EDT is an analytical model relating aquatic habitat features and biological (i.e., fish) health in an effort to support conservation and recovery planning (Lichatowich et al. 1995; Lestelle et al.

1996; Mobrand et al. 1997; Mobrand et al. 1998). Additional information on the EDT model can be found at www.edthome.org.

EDT is structured as an information pyramid in which each level builds on information from the lower level (Figure 3-3). Levels 1 and 2 characterize the condition of the ecosystem/environment. Level 3 analyzes the performance of a focal species (e.g., steelhead trout) based on the condition (quality) of its environment as detailed by the Level 2 ecological attributes. Level 3 can be thought of as a characterization of the environment in the eyes of the fish (i.e., how a fish would rate environmental conditions based on our understanding of their requirements) (Mobrand et al. 1997).

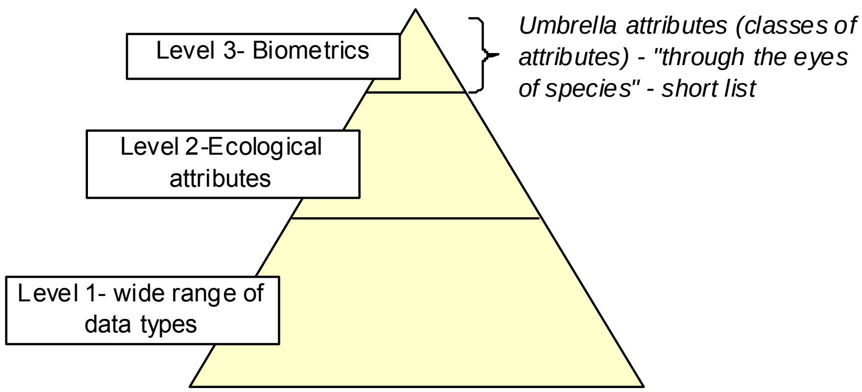

Figure 3-3 Data/Information Pyramid

Information derived from supporting levels (WDFW 2004).

The primary purpose of the EDT analysis is to compare historic conditions in the watershed to those that exist currently. Priority areas identified by EDT are those where historic conditions diverge the most from current conditions. WDFW began by gathering baseline information on aquatic habitat, human activities, and focal species life history to assess watershed conditions for the following three scenarios:

1. predevelopment (historic) conditions[2]
2. current conditions
3. properly functioning conditions (PFC)[3] .

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[2] In general, the subbasin's historic conditions would have included undisturbed streamside forests that provide shade to the streams, less in-stream sediment, increased stream flow during summer months, greater number of pools (critical habitat during warm summer months), cooler water temperatures.

The comparison of these scenarios formed the basis of the analysis, from which conclusions were drawn regarding the reduction in habitat quality in the Lower Snake subbasin and the associated reduction in focal species performance (WDFW 2004). The historic reference scenario also defined the natural limits to potential recovery within the basin (WDFW 2004).

WDFW tasked a technical workgroup to subdivide the subbasin into stream reaches based on similarity of habitat features, drainage connectivity, and land use patterns (WDFW 2004). For each of these stream reaches, the technical work group ranked 42 habitat parameters based on habitat quality using data/documentation when available and expert knowledge regarding fish biology, habitat processes, etc. when empirical data were not available (see Appendix B for data sources) (WDFW 2004). These habitat attributes were ranked for each of the three scenarios and input into the model.

WDFW then compiled life history information for steelhead trout (e.g., life history stages, timing of each stage, & location/habitat required for each stage within an individual stream reach) (WDFW 2004). This life history information was input into the EDT model and "crossed" with habitat information from each of the three scenarios (WDFW 2004). This Stream Reach Analysis produced a set of limiting habitat attributes by stream reach, by species, and by life history stage. This analysis identifies the key factors contributing to the loss in species performance within individual stream reaches (WDFW 2004). The result of this analysis is a priority ranking of stream reaches to be considered for restoration. For ease of comparison and implementation, WDFW (2004) grouped contiguous reaches with similar limiting factors into the geographic areas. More specific findings from EDT analysis, and a description of the resulting geographic areas are provided later in this section. Appendix C describes the ways in which out-of-subbasin effects were incorporated into EDT.

3.4.3 EDT Limitations

The EDT analysis used in this assessment has proved to be a valuable tool for conducting the steelhead assessment. As with all modeling tools, additional data collection and model calibration to further validate modeling conclusions would be desired. The time frame for developing the plan, combined with the shortage of data available for some key attributes suggests caution with the results.

While conducting this assessment and particularly while performing the attribute ratings for EDT, it became quite clear that in many cases we were lacking even the most basic habitat information. This made the assessment work quite difficult, particularly outside of the Forest Service lands where at least some basic surveys had been conducted. In order to properly assess the subbasin and provide better information for the management strategy process it is vital that additional habitat and life history surveys be conducted. There were some reaches for which we had no empirical data on habitat types (pools, riffles ,glides, etc.), embeddedness, LWD density,

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[3] Properly functioning conditions are a set of NOAA Fisheries standardized guidelines that are designed to facilitate and standardize determinations of the effect for Endangered Species Act (ESA) conferencing, consultations, and permits focusing on anadromous salmonids (Stelle 1996 as taken from ODFW 2004).

winter temperature or percent fines. The entire subbasin is lacking in bedscour, bankfull widths, flow and riparian function[4] data. Gradient measurements for individual reaches were also a concern. Gradients were measured using Terrain Navigator; the accuracy of these gradients is unknown and needs to be ground-truthed. Gradients for EDT input were derived using Terrain Navigator software. These gradients have not been ground truthed and some doubt remains as to whether any of the reaches actually exceed 3%. This could lead to habitat diversity appearing to be a higher magnitude problem than it actually is. It is the strong finding of this assessment that the above information begin to be acquired as soon as possible in order to better inform the land managers, public and private, during future planning efforts.

It is our determination that the current data set used for this EDT assessment should be re-examined and revised between each rolling provincial review, and/or before it is used for other planning efforts. Use in its present state for this Subbasin Plan was necessary, however, with more time and better data the model results can certainly be improved upon. Perhaps in the future the EDT model can also be used to develop a detailed bull trout habitat assessment.

With the limitations of EDT, information and findings from other assessment and planning processes were also used.

3.5 EDT Analysis

3.5.1 Introduction

A technical work group was formed for the Lower Snake subbasin for the purpose of rating the Level 2 habitat attributes for the freshwater stream reaches. The work group drew upon published and unpublished data and information for the basin to complete the task. Expert knowledge about habitat identification, habitat processes, hydrology, water quality, and fish biology was incorporated into the process where data was not available. Attribute rating for EDT was coordinated by WDFW using state, federal and tribal resources. The WDFW watershed steward served as coordinator for the attribute rating process. The sources used for rating the individual attributes are outlined in Table 4-4 of Appendix B. The patient (current) condition attribute ratings represent a variety of sources and levels of proof. Levels of proof (or confidence levels) assigned to ratings are directly from developed rating methods by MBI specifically for the EDT process. The attributes assigned to each reach are assigned a numerical value from 1 to 5 where: 1 is empirical observation; 2 is expansion of empirical observation; 3 is derived information; 4 is expert opinion; 5 is hypothetical. Table 4-5 of Appendix B includes template attributes.

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[4] The riparian corridor provides a variety of ecological functions that generally can be grouped into energy, nutrients, and habitat as they affect salmonid performance. Some aspects of these functions are expressed through specific environmental attributes within EDT, such as woody debris, flow characteristics, temperature characteristics, benthos, pollutant conditions, and habitat types (e.g., pool riffle units).

Three baseline reference scenarios were developed for the Lower Snake subbasin; predevelopment (historic or template as described above) conditions, current conditions, and properly functioning conditions (PFC). The comparison of these scenarios formed the basis for diagnostic conclusions about how the Lower Snake and associated summer steelhead performance have been altered by human development. The historic reference scenario also served to define the natural limits to potential recovery actions within the basin. Properly functioning conditions were a set of standardized guidelines that NOAA Fisheries provided that were designed to facilitate and standardize determinations of the effect for Endangered Species Act (ESA) conferencing, consultations, and permits focusing on anadromous salmonids (Stelle 1996). The objective of the diagnosis then became identifying the relative contributions of environmental factors to the losses in summer steelhead performance. To accomplish this, two types of analyses, each at a different scale of overall effect: 1) Individual stream reaches, and 2) Geographic area analysis.

The Stream Reach Analysis identified the factors that, if appropriately moderated or corrected, would produce the most significant improvements in overall fish population performance. It identified the factors that should be considered in planning habitat restoration projects.

The Geographic Area Analysis identified the relative importance of each area for either restoration or protection actions. In this case, the effect of either restoring or further altering environmental conditions on population performance was analyzed. These results will be discussed in the management plan (Chapter 7).

Tables 3-1 and 3-2 describe the stream reaches used for the Lower Snake subbasin assessment 2003 (WDFW 2004).

Table 3-1 Stream Reaches Defined in Almota Creek for the Ecosystem Diagnosis and Treatment Analysis Method

Reach code	Reach location/description	Start RM	End RM
Alm1	Almota Cr, mouth to Little Almota Cr	0	0.12
LAlm1	Little Almota Cr, mouth to impassible headcut	0	1.12
LAlm2	Impassible headcut	Obstruction	
LAlm3	Little Almota Cr, impassible headcut to cascade/culvert just above Little Almota Rd	1.27	1.27
Alm2	Almota Cr, Little Almota Cr to second Little Almota Cr (Hungate Grade)	0	0.88
2LAlm	Second Little Almota Cr, mouth to steelhead access limit at impassibly steep section just above LB draw in Sec 18	0	1.64
Alm3	Almota Cr, second Little Almota Cr to unnamed RB ephemeral stream which demarcates extremely confined reach	0.88	4.47
Alm4	Almota Cr, extremely confined reach ending at forks in Sec 11	4.47	5.46
NorthBranch	North Branch of upper Almota, mouth to impassibly steep and dewatered section	0	0.25
Alm5	Almota Cr, forks in Sec 11 to impassibly steep section	5.46	6.01

Table 3-2 Stream Reaches Defined in Deadman Creek for the Ecosystem Diagnosis and Treatment Analysis Method

Reach code	Reach location/description	Start RM	End RM
Dead1	Deadman embayment	0	1.45
Dead2	Deadman Cr, embayment entry to Willow Gulch Cr	1.45	2.28
Dead3	Deadman Cr, Willow Gulch Cr to Ping Gulch Cr	2.28	4.18
Ping1	Ping Gulch Cr, mouth to aproned bridge obstacle at the Leonard property	0	4.89
Dead4	Deadman Cr, Ping Gulch Cr to Lynn Gulch Cr	4.18	9.17
Lynn1	Lynn Gulch Cr, mouth to perched culvert near mouth	0	0.38
Lynn2	Lynn Gulch culvert	Obstruction	
Lynn3	Lynn Gulch Cr, culvert to historical access limit at confluence of East Lynn Gulch Cr	0.38	6.65
Dead5	Deadman Cr, Lynn Gulch Cr to confluence of NF & SF Deadman Cr	9.17	12.66
NFDead1	NF Deadman Cr, mouth to current access limit at intermittant zone	0	2.33
NFDead2	NF Deadman Cr, end of current access zone to historical access limit at forks of NF	2.33	7.28
SFDead	SF Deadman Cr, mouth to access limit at confluence of SF Deadman Gulch	0	10.2

3.5.2 Scaled and Unscaled Results

Results from this analysis are provided in two forms, scaled and unscaled. Unscaled results present the potential habitat benefits that could be achieved through protection and/or restoration of an entire geographic area. However, each geographic area is different in size, and habitat projects would be unlikely to occur throughout an entire geographic area. To provide a better understanding of the potential habitat benefits to be achieved through implementation of projects in specific portions of the geographic areas, scaled results were calculated that take into account the length of each geographic area by taking the original output from EDT (i.e. percent productivity change, etc.) and dividing it by the length of the stream in kilometers. This gives a value of the condition being measured per kilometer, which represents the most efficient areas to apply restoration or protection measures. Both results are presented, though the scaled version was given more weight in the conclusions portion of the assessment.

3.5.3 Lower Snake subbasin - Steelhead EDT Assessment

Summer steelhead in the Lower Snake subbasin were assessed in two basic ways:

1. By identifying areas that currently have high production and therefore should be protected (i.e., high "Protection Value")[5].

[5] Protection value describes stream reaches or geographic areas that currently are providing valuable habitat to support one or more life history stages and therefore should be protected from negative impacts.

2. By identifying areas with the greatest potential for restoring a life stage that is critical to increasing production (i.e., high "Restoration Potential")[6].

WDFW completed this assessment for two of the nine known or presumed steelhead bearing tributaries in the Lower Snake subbasin, Almota Creek and Deadman Creek. The assumption is that the habitat conditions present in these two streams are similar to those in the streams that were not analyzed. Therefore the limiting factors and life stages identified in Almota and Deadman creeks are assumed to be the same as those for the other steelhead bearing tributaries in the Lower Snake subbasin.

Tables 3-3 and 3-4 contain EDT model estimates for summer steelhead restoration/protection potential within Almota Creek and Deadman Creek, respectively.

Table 3-3 Ranked List of Geographic Areas Based Upon EDT Restoration/Protection Priority Potential in Almota Creek

Reach	EDT Protection/Restoration Priority Scaled Rank Total	Potential Performance Increase (% / km)	Potential Performance Decrease (% / km)
North Branch, mouth to access limit	2	574%	-35.7%
Almota, L. Almota to L. Almota 2	7	264%	-13.4%
Almota, L. Almota 2 to unnamed RB trib	9	108%	-35.1%
Almota, mouth to L. Almota	10	494%	0.0%
Almota, forks to access limit	11	189%	-9.1%
Almota, unnamed trib to forks	11	139%	-10.9%
L. Almota 2, mouth to access limit	11	104%	-18.3%
L. Almota, mouth to headcut	11	193%	-5.2%
L. Almota, headcut	19	9%	0.0%
L. Almota, headcut to culvert	19	0.0%	0.0%

Table 3-4 Ranked List of Geographic Areas Based Upon EDT Restoration/Protection Priority Potential in Deadman Creek

Reach	EDT Protection/Restoration Priority Scaled Rank Total	Potential Performance Increase (% / km)	Potential Performance Decrease (% / km)
SF Deadman, mouth to access limit	2	649%	-225%
Deadman, Ping to Lynn Gulch	5	413%	-6%
NF Deadman, intermittent zone to historical access limit	7	477%	-3%
Deadman, Lynn to forks	8	373%	-5%

[6] Restoration potential describes the capacity of a stream reach or geographic area to positively respond to restoration efforts designed to bring back a significant habitat attribute that currently is limiting the focal species population.

Reach	EDT Protection/Restoration Priority Scaled Rank Total	Potential Performance Increase (% / km)	Potential Performance Decrease (% / km)
NF Deadman, mouth to intermittent zone	11	294%	-4%
Ping, mouth to bridge obstruction	14	398%	-1%
Deadman, embayment to Willow	15	168%	-2%
Deadman, Willow to Ping	15	312%	-1%
Lynn, mouth to perched culvert	16	146%	-2%
Deadman embayment	18	132%	-2%
Lynn, mouth to culvert	21	2%	-1%
Lynn, culvert to access limit	24	269%	0%

Almota Creek - Steelhead Summary of limiting habitat attributes

Habitat diversity, sediment load, key habitat quantity, and flow were the most common limiting factors for summer steelhead throughout most of Almota Creek (WDFW 2004). Channel stability and food were secondary limiting factors (WDFW 2004).

Restoration efforts should focus on reducing the limiting factors identified for summer steelhead. Protection efforts should focus on protecting habitats (or stream reaches and geographic areas that contain these habitats) that provide one or more of these limiting attributes. Recommendations regarding locations of specific restoration and protection activities are outlined in Chapter 7. See the Management Plan and Appendix B for additional clarification regarding limiting habitat attributes and a detailed discussion of restoration and protection activities recommended in individual geographic areas.

Deadman Creek - Steelhead Summary of limiting habitat attributes

Habitat diversity, sediment load, key habitat quantity, and flow were the most common limiting factors for summer steelhead throughout most of Deadman Creek (WDFW 2004). Temperature, channel stability, predation, and food were secondary limiting factors (WDFW 2004).

Restoration efforts should focus on reducing the limiting factors identified for summer steelhead. Protection efforts should focus on protecting habitats (or stream reaches and geographic areas that contain these habitats) that provide one or more of these limiting attributes. Recommendations regarding locations of specific restoration and protection activities are outlined in Chapter 7. See the Management Plan and Appendix B for additional clarification regarding limiting habitat attributes and a detailed discussion of restoration and protection activities recommended in individual geographic areas.

Baseline Population Performance

The primary purpose of the EDT analysis is to provide a comparison of current, historical, and PFC habitat conditions. Results of this comparison help identify limiting habitat attributes and priority restoration and protection areas. Although not its primary purpose, the EDT model also estimates productivity, adult abundance, and capacity of focal species populations for each baseline habitat condition. These values are not concrete population estimates, but rather are used to calibrate the EDT model (i.e., compare model results to available empirical data) and for comparative purposes (e.g., current vs. historic vs. predicted fish returns after implementation of the management plan) to ensure habitat goals will translate to desired population numbers.

Almota Creek Summer Steelhead

WDFW summarizes their EDT analysis of the Almota Creek steelhead populations as follows:

> "The EDT model estimated the average spawning population size of the current Almota Creek summer steelhead to be 26 fish, with a carrying capacity of 74 fish and a productivity of just 1.6 adult returns per spawner (Table 3-5). The life history diversity value indicated only 17 % of the historic life history pathways could be successfully used under current conditions. The analysis also suggests that the Almota Creek watershed had a much greater production potential for summer steelhead than it now displays, as historical abundance was estimated at 806 spawners, with a productivity of 28.4 returning adults per spawner (Table 3-5). The EDT model predicted that with properly functioning habitat conditions Almota Creek could have an abundance of 110 fish, productivity of 6.2 returning adults per spawner, and a life history diversity of 53 % (Table 3-5)."

Table 3-5 EDT Summer Steelhead Spawner Population Performance Estimates for Almota Creek

Scenario	Diversity Index	Productivity	Capacity	Adult Abundance
Patient (Current)	17%	1.6	74	26
PFC (Properly Functioning Conditions)	53%	6.2	131	110
Template (Reference)	100%	28.4	832	803

Source: (WDFW 2004).

Deadman Creek Summer Steelhead

WDFW summarizes their EDT analysis of the Deadman Creek steelhead populations as follows:

> "Model results for Deadman Creek summer steelhead are based on life history assumptions summarized in Table 4-8. The EDT model estimated the average spawning population size of the current Deadman Creek summer steelhead to be 6 fish, with a carrying capacity of 165 fish and a productivity of just 1.0 adult returns per spawner (Table 3-6). The life history diversity value indicated only 1 % of the historic life history pathways could be successfully used under current conditions. The analysis also suggests that the Deadman Creek watershed had a much greater production potential for summer steelhead than it now displays, as historical abundance was estimated at 1,868 spawners, with a productivity of 17.1 returning adults per spawner (Table 3-6). The EDT model predicted that with properly functioning habitat conditions Deadman Creek could have an abundance of 356 fish, productivity of 5.2 returning adults per spawner, and a life history diversity of 83 % (Table 3-6)."

Table 3-6 EDT Summer Steelhead Spawner Population Performance Estimates for Deadman Creek

Scenario	Diversity Index	Productivity	Capacity	Adult Abundance
Patient (Current)	1%	1.0	165	6
PFC (Properly Functioning Conditions)	83%	5.2	440	356
Template (Reference)	100%	17.1	1,984	1,868

Source: (WDFW 2004).

3.5.4 Population characteristics consistent with VSP.

The NOAA Fisheries Viable Salmonid Population (VSP) document (McElhany 2000) identified four parameters that are key in determining the long-term viability of a population: abundance, population growth rate, population spatial structure and diversity. Specific targets for these parameters have not been developed by the TRT for summer steelhead; consequently, quantitative goals for the four parameters cannot be established at this time. Given the small size of the Almota Creek and Deadman Creek watersheds and their limited capacity (even under PFC), it is unlikely that they could ever meet the minimum requirements of an independent population.

3.5.5 Out-of-Subbasin Effects

Given that this subbasin plan focuses heavily upon anadromous species, out-of-subbasin environmental conditions can play a large role in determining the actual populations of such species. Out-of-subbasin effects were described effectively by TOAST (2004):

> "Subbasin planning, by definition, is focused on the major tributaries to the mainstem Columbia and Snake rivers. However, many focal species migrate, spending varying amounts of time and traveling sometimes extensively outside of the subbasins. Salmon populations typically spend most of their lives outside the subbasin. Unhindered, sturgeon will spend short periods in the ocean. Lamprey typically spend most of their life as juveniles in freshwater, but gain most of their growth in the ocean. Planning for such focal species requires accounting for conditions during the time these populations exist away from their natal subbasin. Out-of-subbasin effects (OOSE) encompasses all mortality factors from the time a population leaves a subbasin to the time it returns to the subbasin. These effects can vary greatly from year to year, especially for wide ranging species such as salmon."

Further detailed discussion of out of subbasin effects developed by the Nez Perce Tribe and reviewed by WDFW can be found in Appendix C. This document provides details regarding estimated smolt to adult survival rates in the mainstem Snake River. Primary out of subbasin effects include factors that can be natural in origin (ocean productivity, climate, and estuary conditions), human-caused (harvest), or a combination (mainstem flows / dam operations). Although the subbasin planning process is designed to focus on restoration and protection opportunities within the subbasin, the EDT analysis also summarizes the proportion of the total restoration and protection potential that exists within the subbasin versus the portion that would be realized exclusively from improvements made outside of the basin (i.e., restoration and protection activities downstream in the Snake and Columbia rivers). Appendix C provides further detail regarding how out-of-subbasin effects were integrated into the EDT analysis.

Although the subbasin planning process is designed to focus on restoration and protection opportunities within the subbasin, the EDT analysis also summarizes the proportion of the total restoration and protection potential that exists within the subbasin versus the portion that would be realized exclusively from improvements made outside of the basin (i.e., restoration and protection activities downstream in the Snake and Columbia rivers). Analysis of the maximum in-basin and out-of-basin changes in life history diversity, productivity, and abundance that could potentially be observed for steelhead and spring Chinook has been summarized in Table 3-7 below. The relative contribution of within-subbasin efforts versus out-of-subbasin efforts was determined by identifying areas critical to preserving current production (e.g. by identifying areas with high "Protection Value"), and by identifying areas with the greatest potential for restoring a significant measure of historical production (e.g. by identifying areas with high "Restoration Potential").

Table 3-7 Steelhead Restoration and Protection Potential

	Life history diversity		Productivity		Abundance	
	Within Subbasin	Out of Subbasin*	Within Subbasin	Out of Subbasin*	Within Subbasin	Out of Subbasin*
Almota						
Restoration Potential	34%	66%	86%	14%	48%	52%
Protection Potential	45%	55%	50%	50%	50%	50%
Deadman						
Restoration Potential	79%	21%	96%	4%	79%	21%
Protection Potential	33%	67%	28%	72%	39%	61%

* Out of subbasin refers to impacts and benefits from restoration and protection in the mainstem Snake and Columbia Rivers.
Source: Section 4.3.4.6 of Appendix B

This suggests that 14-66 % of the potential for improving performance of Almota summer steelhead is tied to actions in the mainstem Columbia and Snake Rivers, while 4-72% of the potential for improving performance of Deadman summer steelhead is tied to actions in the mainstem. Despite the significant variation in potential life history diversity, productivity, and abundance improvements in these two streams, mainstem habitat clearly has a large influence upon these populations. Discussion of the need for activities outside of the subbasin in addition to those actions proposed in this plan is provided in Section 7.3.

3.6 Integrated Assessment Analysis and Conditions

3.6.1 Introduction

The information presented in this section was taken from Appendix B (WDFW 2004), and includes the results from integrating the two separate steelhead assessments into one combined approach, setting the stage for the management plan (Chapter 7). Divergences from EDT are identified, along with a description of the priority restoration and protection areas, and a summary of the basis for these.

3.6.2 Assessment Analysis Summary

The combined restoration and protection rankings for Almota and Deadman Creek are presented in Table 3-8 below. In small streams such as these where you haved only a few reaches it is useful information to know where in the stream both restoration and protection can provide the greatest increase in species potential. Rankings were based on the total combined ranks for protection and restoration as presented above. In the Almota, North Branch was the number one ranked reach for restoration and protection as was South Fork Deadman in Deadman Creek.

Table 3-8 Combined Protection and restoration rankings for Deadman Creek and Almota Creek as determined by EDT analysis.

Area	Reach	EDT Protection/Restoration Priority Scaled Rank Total	Potential Performance Increase (% / km)	Potential Performance Decrease (% / km)
Almota				
	North Branch, mouth to access limit	2	574%	-35.7%
	Almota, L. Almota to L. Almota 2	7	264%	-13.4%
	Almota, L. Almota 2 to unnamed RB trib	9	108%	-35.1%
	Almota, mouth to L. Almota	10	494%	0.0%
	Almota, forks to access limit	11	189%	-9.1%
	Almota, unnamed trib to forks	11	139%	-10.9%
	L. Almota 2, mouth to access limit	11	104%	-18.3%
	L. Almota, mouth to headcut	11	193%	-5.2%
	L. Almota, headcut	19	9%	0.0%
	L. Almota, headcut to culvert	19	0.0%	0.0%
Deadman				
	SF Deadman, mouth to access limit	2	649%	-225%
	Deadman, Ping to Lynn Gulch	5	413%	-6%
	NF Deadman, intermittent zone to historical access limit	7	477%	-3%
	Deadman, Lynn to forks	8	373%	-5%
	NF Deadman, mouth to intermittent zone	11	294%	-4%
	Ping, mouth to bridge obstruction	14	398%	-1%
	Deadman, embayment to Willow	15	168%	-2%
	Deadman, Willow to Ping	15	312%	-1%
	Lynn, mouth to perched culvert	16	146%	-2%
	Deadman embayment	18	132%	-2%

Area	Reach	EDT Protection/Restoration Priority Scaled Rank Total	Potential Performance Increase (% / km)	Potential Performance Decrease (% / km)
	Lynn, mouth to culvert	21	2%	-1%
	Lynn, culvert to access limit	24	269%	0%

Rankings were ascertained by combining the rank places from the restoration and protection results.

3.6.3 Analysis Discussion

The subbasin assessment has many findings that are comparable to other recent assessments and planning efforts. Habitat Diversity, Key Habitat by Lifestage, Sediment and Riparian Function were the most common limiting attribute identified with the assessment; this compared favorably with earlier assessments (Table 3-9).

Table 3-9 Assessments performed in the Lower Snake Subbasin and the Key Limiting Factors Identified

Assessment	Key Limiting Factors Identified
Ecosystem Diagnosis and Treatment	Habitat Diversity (Includes: riparian Function, confinement, gradient, LWD density for most life stages); Sediment Load (Including embeddedness; and percent fines); Key Habitat (pools and pool tail-outs)
Limiting Factors Analysis	a) protect riparian vegetation b) re-establish riparian veg. c) practice proper riparian management d) continue to reduce fine sediment e) reduce summer stream temperatures f) inventory surface water diversions g) increase channel complexity h) enforce existing landuse regulations i) inventory habitat conditions and fish presences and abundance every 5 years.
Subbasin Summary	a) conduct baseline assessments and periodic monitoring of fish abundance and habitat conditions in tributaries. b) collect hydrologic data to thoroughly characterize the area. c) identify the location of channel and riparian vegetation alteration and the amount of water removed from the streams d) restore riparian habitat e) reduced sediment

3.7 Assessment Conclusions

The EDT analysis was conducted on only two of the nine known or presumed steelhead bearing tributaries in the Lower Snake subbasin. Results from these were to be applied to the other streams within the subbasin. The assumption is that the habitat conditions are similar across these streams. Given that, the limiting factors and life stages identified in Almota or Deadman Creeks can assumed to be the same in the other tributaries. Performing EDT analysis on these streams allowed us to identify priority reaches within these streams based on the EDT output while considering empirical data and past planning efforts. It did not, however, provide information with which to identify other areas in the subbasin that may be priority for restoration and protection. Based on the empirical data presented in Appendix B, Alpowa Creek and Penawawa Creek should also be priorities for restoration and protection in the subbasin. Besides Almota Creek these two streams have the highest densities of juvenile steelhead in the subbasin. While this assessment puts forward these two streams as priorities with Deadman and Almota, it does not identify reaches within these streams that should be the focus of restoration and protection. In order to focus efforts clearly in the subbasin this step needs to be accomplished. Given the lack of an EDT analysis the decision on a priority reaches for these streams would be best accomplished during the first management workshop with the assembled technical and citizen groups.

3.7.1 Restoration/Protection Priority Areas

In the Lower Snake Subbasin, all geographic areas that were priority protection areas were also priority restoration areas. As such, they are discussed under the name of "Restoration/Protection Priority Areas." The following streams and reaches have the highest restoration/protection value in the Lower Snake Subbasin according to the EDT analysis of steelhead and taking into account other factors, such as previous planning efforts and empirical data, as discussed in the next section (see Figure 3-4 for the locations of these geographic areas):

- Almota Creek
  - Alm1
  - Alm2
  - Alm3
  - Alm4
  - North Branch
- Deadman Creek
  - Dead4
  - Dead5
  - SFDeadman
- Alpowa Creek
  - Reach to be determined.
- Penawawa Creek
  - Reach to be determined

A continuous block of stream was identified on Almota Creek. It starts at the mouth and continues up the mainstem to the forks; and then up the North Branch. The priority area for Deadman is also contiguous starting at Ping Gulch and continuing to the forks and up South Fork Deadman to the steelhead access limit.

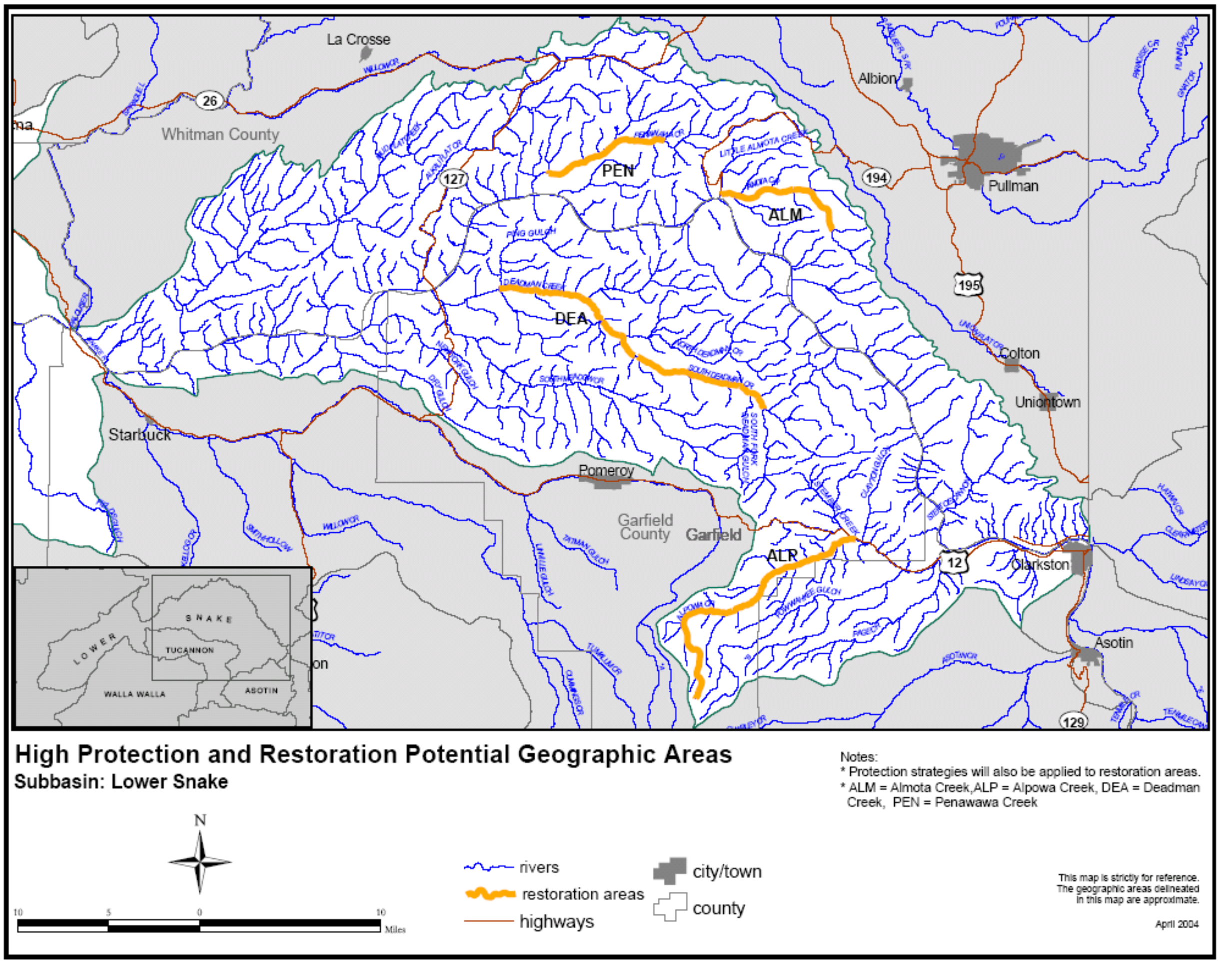

Figure 3-4 Priority Protection and Restoration Geographic Areas in the Lower Snake Subbasin

Key: ALP=Alpowa Creek, ALM=Almota Creek, DEA=Deadman Creek, PEN=Penawawa Creek.

3.7.2 Divergence from EDT – NF

The EDT model provided ranking of geographic areas based solely upon their potential to provide habitat for fish species from a biological perspective, comparing historic conditions to current conditions. However, the Subbasin Planning Team reevaluated these EDT results in light of two additional considerations.

- Prioritization of geographic areas was required. This necessitated comparison of trade-offs between the biological benefits provided by restoration and protection of the geographic areas.

- Socioeconomic factors may limit restoration opportunities in selected geographic areas. Given the lack of time and resources to develop a comprehensive socioeconomic analysis for the subbasin, limitations due to this factor were based upon best professional judgment of the Subbasin Planning Team and technical staff. Clearly there are value judgments involved in determining what is considered feasible and not feasible, and differences in such value judgments do exist within the subbasin. A comprehensive socioeconomic study within the subbasin should be developed with the cooperation of local stakeholders. This analysis would provide a solid foundation upon which socioeconomic conditions could be factored into consideration of project priorities. In the Lower Snake Subbasin, this factor had a greater impact upon the type of strategies proposed in the priority geographic areas rather than selection of the priority areas themselves.

The only divergence from EDT in the Lower Snake Subbasin was regarding Deadman Creek. North Fork Deadman from the intermittent flow zone to the end of steelhead access was not included in the final priority list. The empirical data did not support the inclusion of this reach at the cost of excluding the mainstem Deadman from Lynn Gulch to the forks. There is also added value from including the mainstem reach on Deadman; it maintains a continuous corridor along the stream as being priority restoration and protection.

Selection of priority streams, as identified by EDT and modified per the considerations above, does not preclude projects from being implemented non-priority areas. If opportunities present themselves in non-priority areas, project sponsors could use the initial EDT modeling results to support the need for such a project. The full EDT modeling results are provided in Appendix B. However, such a project would be a lower priority than projects proposed in a priority geographic area or a project that addresses imminent threats.

3.7.3 Impacted Life Stages

Within the priority restoration/protection areas above the following life stages are the most impacted according to the EDT analysis:

- Incubation
- Fry
- Subyearling Rearing
- Overwintering

The impacted life stages are strictly from the EDT analysis performed on Almota and Deadman Creeks. It is assumed that the same life stages are limited in Alpowa and Penawawa. These represent the top four by life stage rank for the areas as determined from the reach analysis. Life stage ranks are determined through EDT for each reach by considering all three EDT population performance measures (life history diversity, abundance and production). Almota1 was the only exception to the four listed life stages. Spawning was actually ranked higher when considering all three performance measures. Overwintering in this reach was determined to actually be more limiting due to a much larger performance impact on productivity (55 percent vs. 7 percent). It should be noted that in order to develop a well targeted subbasin plan we determined to make this distinction in life stage impacts. However, throughout the system the habitat factors that were identified as most limiting to these life stages actually impact all life stages of salmonids to one degree or another. The previous assessment and planning documents did not usually go into this fine of detail, in that limited life stages were not clearly defined within specific reaches.

3.7.4 Limiting Habitat Attributes

The following habitat attributes are considered to have the most impact as determined by EDT within the above Lower Snake reaches and key life stages listed above:

- Attributes common to all reaches in both Almota and Deadman
  - LWD
  - Sediment (Turbidity, Fines and Embeddedness)
  - Key Habitat (pools)
  - Flow
- Attributes present in one or more reaches in both Almota and Deadman
  - Confinement
  - Riparian Function
- Attribute present only in Deadman
  - Temperature

These habitat attributes were taken directly from the EDT analysis. They were then examined for accuracy given local knowledge and for consistency with previous assessment and planning documents. Please note the commonality of compromised habitat attributes in the above reaches. When the data was presented to the technical and citizen workgroups it was accepted that the attribute as distributed above correctly characterize not just the streams analyzed but the tributaries in general that are in the Lower Snake Subbasin. Large wood and pools are considered lacking throughout the basin and it is clearly accepted that sediment input to the stream is quite likely limiting steelhead production. Less widely accepted is the notion of limited flow compared to historical conditions. Water withdrawals from the streams are present in the Lower Snake but are not common. It is agreed that flow is likely somewhat reduced due to the lack of ground cover in the uplands and removal of riparian vegetation. The question is: How reduced is the flow from historical? That question is not readily answered. It was agreed, however, actions in the subbasin that benefit the other limiting attributes will also benefit flow. Given that flows are considered to be lower than historic, and water withdrawals are limited, the focus for flow enhancement is on improvements in upland infiltration, as described in Chapter 7.

3.7.5 Mainstem Snake River Geographic Areas

The mainstem portion of the Snake River from the mouth to the confluence with the Clearwater River is considered part of the Lower Snake Subbasin. The assessment team considered this area for further assessment work. It was decided that the there were not enough resources to do credible job on the tributaries and to also take on the task of re-summarizing the extensive empirical data that has been gathered on the mainstem. Also considered was the fact that the mainstem had already undergone the amendment process to the Fish and Wildlife Program. The mainstem Amendments to the Fish and Wildlife Program were adopted by the Northwest Power and Conservation Council (NPCC) in April of 2003 and posted to the federal register on August 6, 2003 (volume 68, number 151). Given that the mainstem amendment has a vision, set of biological objectives and strategies it is recommended by the assessment team that the management plan development group defer to the Mainstem Amendment. The general guidance given in the mainstem amendment should serve as the basis and support for projects proposals and funding based in the mainstem.

3.7.6 Revisiting the EDT Analysis

The EDT analysis used in this assessment has proved to be a valuable tool. While conducting this assessment we have tried to use this tool in a responsible manner. We believe that the most value from EDT is in the future. The time frame that we operated under and the shortage of data available for some key attributes (see below) encouraged us to use caution with the results. It is our determination that the current data set used for this EDT run should be re-examined and revised between each rolling provincial review. This should also occur before it is used for other planning efforts. We believe that its use in its present state for this Subbasin Plan was necessary, however, with more time and better data the model results can certainly be improved upon both in accuracy for Almota and Deadman, and to expand the number of tributaries that have sufficient data available to run EDT.

3.7.7 Habitat Data Gaps

While conducting this assessment and particularly while performing the attribute ratings for EDT, it became quite clear that in many cases we were lacking even the most basic habitat information. This made the assessment work quite difficult. In order to properly assess the subbasin and provide better information for the management strategy process it is vital that additional habitat and life history surveys be conducted. There were some reaches for which we had no empirical data on habitat types (pools, riffles, glides, etc.), embeddedness, LWD density, winter temperature or percent fines. The entire subbasin is lacking in, bedscour, bankfull widths, flow and riparian function data. Gradient measurements for individual reaches was also a concern. Gradients were measured using Terrain Navigator; the accuracy of these gradients is unknown and needs to be ground-truthed. Gradients for EDT input were derived using Terrain Navigator software. These gradients have not been ground truthed and some doubt remains as to whether any of the reaches actually exceed 3 percent. This could lead to habitat diversity appearing to be a higher magnitude problem than it actually is. It is the strong finding of this assessment that the above information begin to be acquired as soon as possible in order to better inform the land managers, public and private, during future planning efforts.

3.8 Aquatic Species of Interest

Species of Interest (SOI) was included within the plan to provide a venue to present species that may have ecological and/or cultural significance but for which there is not enough known about the species to include them in the focal species category for planning purposes. SOI were submitted to the subbasin planning team for approval to be included within the plan. SOI that are submitted have an unknown quantity of ecological significance; in order to determine whether or not these species should be considered as focal for the subbasin more must be learned about subbasin specific life histories and conditions that may be limiting there productivity. Each SOI has a corresponding section within the research, monitoring and evaluation section that includes either a research plan for the SOI or a place holder with the intention of inserting a plan in a later iteration of the subbasin plan. Species of Interest were not to be submitted without either a research plan or the intention of developing one.

Within the Lower Snake Subbasin, the Nez Perce Tribe suggested white sturgeon as a species of interest. The following write-up on white sturgeon was provided by the Nez Perce Tribe and has not been reviewed or approved by the Subbasin Planning Team or other local technical staff: Further detail can be found in Appendix D.

History: Historically abundant populations of white sturgeon occupied the Columbia Basin, and millions of pounds were harvested commercially during the turn of the century (Craig and Hacker 1940; Galbreath 1985). Today the only population in the Columbia Basin that migrates to the ocean is downstream from Bonneville Dam. Dams have effectively trapped and separated the historical single population of white sturgeon into a number of separate reservoir populations, and thus created a number of functionally isolated non-anadromous populations upstream from Bonneville Dam (North et al. 1993). Remaining populations are thus considered to be landlocked or resident in the reservoirs upstream from Bonneville. They do not migrate to the ocean. Rather, they complete their life cycle in the mainstem Columbia and Snake rivers. Prior to hydroelectric development white sturgeon were semi-anadromous throughout much of the Columbia and Snake river basins, with the exception of the geographically isolated Kootenai River population (Northcote 1973).

Life History: White sturgeon (*Acipenser transmontanus*) is a large, long-lived species, commonly reaching 70 years of age and weighing in excess of 1,000 pounds (Bajkov 1949; Scott and Crossman 1973; Beamesderfer et al. 1995).

White sturgeon spawn in areas of high water velocities (greater than 0.8 m/s) over areas of bedrock, rubble, and large boulders (Parsley et al. 1993). Historical spawning areas were probably located at the downstream end of falls, cascades, and rapids. Today these conditions are met in the tailrace areas immediately downstream from hydroelectric dams. Sturgeon begin spawning when water temperatures are 10 to 18°C, with optimal temperatures between 13 and 15°C. White sturgeon are broadcast spawners, and probably spawn in small groups consisting of a single female and several males. Newly laid eggs are extremely adhesive, and drift to the river bottom where they adhere to bottom substrates. Hatching generally occurs within 7 to 12 days

(Miller and Beckman 1993). Eggs can be killed if temperatures rise above 18°C. Newly hatched white sturgeons have an internal yolk sac. These yolk sac larvae disperse by swimming vertically into the current and drifting downstream. The larvae metamorphose within a 25 to 30 day period, after which they grow rapidly. Females require an average of 2 to 3 years before they spawn, with males maturing earlier.

Because of their size (up to 4 to 5 meters total length) and longevity (> 100 years) white sturgeon is well adapted to thrive in large riverine systems such as the Snake River. These life history aspects may now be a hindrance to survival as riverine habitat is dwindles. Other unique life history characteristics include late maturation for females (15 to 30 years) and infrequent spawning by individual fish (once every 10 years), (IDFG, 2003).

Data: The most recent available data is from the Hells Canyon reach, Lower Granite Dam up to the Hells Canyon Dam. The Hells Canyon reach of the Snake River supports one of the two most viable wild populations of white sturgeon in Idaho. (IDFG 2003). The current estimated population size for this reach is 4,171 (95 percent CI 3,585 – 5,682). The goal for this reach is a population that will support a sustainable annual harvest equivalent to 5kg/ha/yr (CBFWA 1997) (Everett 2003).

Need: This is the proposed placeholder for the White Sturgeon for the Lower Snake subbasin. It has been demonstrated that White Sturgeon were quite common in the Columbia and Snake River basins. Since the development of the hydroelectric system, these anadromous fish have been isolated to river sections between dams.

The Lower Snake subbasin has a portion of the Snake River (Hells Canyon to Lower Granite dams) white sturgeon population. The IDFG, White Sturgeon Management Plan calls for continued sport catch and release fishing.

The Nez Perce Tribe’s need is to within 7 years, halt the declining trends in salmon, sturgeon, and lamprey populations originating upstream of Bonneville Dam and to within 25 years, increase sturgeon and lamprey populations to naturally sustainable levels that also support tribal harvest opportunities.

Current efforts to initially meet this need are being addressed by the Tribe through the reconvening of the Biological Risk Assessment Team to generate a new biological risk assessment and subsequent adaptive management plan (Everett 2003). This would address the critical uncertainties of the White sturgeon population life histories in the Lower Snake River subbasin.

4. Subbasin Terrestrial Assessment

4.1 Introduction

The terrestrial assessment occurred at two spatial scales. First was the Southeast Washington Ecoregion scale, which incorporated the Asotin, Lower Snake, Palouse, Tucannon, and Walla Walla subbasins. Note that the ecoregion also includes portions of Idaho and Oregon. The ecoregion-scale assessment, completed by WDFW, is located in Appendix E. The subbasin-scale assessment, incorporating portions of the Ecoregion document and information unique to the subbasin, can be found in Appendix E.

This section includes descriptions of the following:

- data available that was used for the terrestrial assessment (Section 4.2),
- selection process used to identify priority terrestrial habitats (Section 4.3.1)
- four priority terrestrial habitats – Ponderosa Pine Forest, Eastside Grassland, Eastside Riparian Wetlands, Shrub-Steppe (Section 4.3.2)
- one cover type of interest – Agriculture (Section 4.3.3)
- status of terrestrial habitat (Section 4.3.4)
- focal terrestrial species (Section 4.4)

4.2 Data Used for Terrestrial Assessment

This assessment at both scales was completed through review of several key databases that summarize current and historic conditions for terrestrial wildlife and their habitats. These include the Ecosystem Conservation Assessment (ECA), Interactive Biodiversity Information System (IBIS), and GAP analyses.

The following description of the ECA database was taken directly from Appendix E (Ashley and Stovall 2004):

> "Ecoregion Conservation Assessments are conducted at the ecoregional scale and provide information for decisions and activities that:
>
> 1. establish regional priorities for conservation action
> 2. coordinate programs for species or habitats that cross state, county, or other political boundaries
> 3. judge the regional importance of any particular site in the ecoregion
> 4. measure progress in protecting the full biodiversity of the ecoregion.

> "ECA brings diverse data sources together into a single system. Terrestrial species and habitat information are brought together as an integrated planning resource to identify which areas contribute the most to the conservation of existing biodiversity."
>
> "ECA has no regulatory authority. It is simply a guide for conservation action across the Ecoregion that is intrinsically flexible that should not constrain decision makers in how they address local land use and conservation issues. Since many types of land use are compatible with biodiversity conservation, the large number and size of conservation areas creates numerous options for local conservation of biodiversity. Ultimately, the management or protection of the conservation priority areas will be based on the policies and values of local governments, organizations, and citizens."
>
> "Ecoregion/subbasin planners prioritized ECA data into three conservation priority classes. The primary distinction between ECA classes is the amount of risk potential associated with those habitats. Ecoregional Conservation Assessment classifications include:
>
> - Class 1: Key habitats mostly under private ownership (high risk potential)
> - Class 2: Key habitats primarily on public lands (low to medium risk depending on ownership)
> - Class 3: Unclassified/unspecified land elements (mainly agricultural lands)"
>
> "ECA data included in the subbasin assessment provided subbasin planners with a logical path to initially determine how many acres of each focal habitat to protect and where protection should occur. An integral part of this land protection process is to identify lands already under public ownership within ECA identified areas. Public ownership, key aquatic areas, vegetation zones, and rare plant communities are fine filters subbasin planners will use to support and/or guide protection and enhancement objective efforts within the subbasin. This "fine filter" concept is applicable to all protection and enhancement objectives."

The IBIS database provided habitat descriptions, historic habitat maps, and current habitat maps. GAP data was used to identify the protection status of IBIS-defined habitat types. The "*GAP status*" is the classification scheme or category that describes the relative degree of management or protection of specific geographic areas for the purpose of maintaining biodiversity. The goal is to assign each mapped land unit a category of management or protection status, ranging from 1 (highest protection for maintenance of biodiversity) to 4 (no or unknown amount of protection).

Status 1 (High Protection): An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a natural state within which disturbance events of natural type are allowed to proceed without interference or are mimicked through management. Wilderness areas garner this status. Approximately 0.6 percent of the ecoregion is within this category. Juniper Dunes is one area of high protection within the Lower Snake Subbasin.

Status 2 (Medium Protection): An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a primarily natural state, but which may receive use or management practices that degrade the quality of the existing natural state. An estimated 0.8 percent of the lands within the ecoregion are in this category.

The Bureau of Land Management Juniper Forest management area is classified as medium protection status within the Lower Snake Subbasin.

Status 3 (Low Protection): An area having permanent protection from conversion of natural land cover for the majority of the area, but subjective to uses of either a broad, low intensity type or localized intensity type. It also confers protection to federally listed endangered and threatened species throughout the area. Lands owned by WDFW within the ecoregion fall within medium and low protection status. Ten percent of the lands within the ecoregion are in this category. Washington Department of Natural Resources and United States Forest Service lands have low protection status.

Status 4 (No or Unknown Protection): Lack of irrevocable easement or mandate to prevent conversion of natural habitat types to anthropogenic habitat types and allow for intensive use throughout the tract, or existence of such activity is unknown. This category includes the majority (88 percent) of the land base within the Ecoregion. (Appendix E)

The relative protection status of land in the ecoregion can be found in Table 4-1.

Table 4-1 Protection Status of Lands in the Southeast Washington Subbasin Planning Ecoregion

Subbasin	Palouse (acres)	Lower Snake (acres)	Tucannon (acres)	Asotin (acres)	Walla Walla (acres)	Total (Ecoregion)
Status 1: High Protection	49	7,383	13,793	0	8,211	29,436
Status 2: Medium Protection	15,014	8,443	10,298	4,976	8,500	47,231
Status 3: Low Protection	159,032	61,194	77,157	80,690	124,645	502,718
Status 4: No Protection	1,951,648	982,905	224,938	160,334	993,342	4,313,167
Total(Subbasin)	**2,125,841**	**1,059,935**	**326,185**	**246,001**	**1,126,198**	**4,892,552**

Source: Table 6 of Appendix E.

4.3 Terrestrial Priority Habitats

4.3.1 Selection of Terrestrial Priority Habitats

The Lower Snake Subbasin consists of 11 wildlife habitat types[7]. These habitat types are briefly described in Table 4-2. Their historic and current abundance in the Lower Snake Subbasin are illustrated in Figures 4-1 and 4-2 respectively, and the percent change between the two time periods is detailed in Table 4-3.

[7] The western juniper/mountain mahogany woodland habitat type is no longer present in the subbasin (Ashley and Stovall 2004).

Table 4-2 Wildlife Habitat Types Within the Lower Snake Subbasin

Habitat Type	Brief Description
Montane Mixed Conifer Forest	Coniferous forest of mid-to upper montane sites with persistent snowpack; several species of conifer; understory typically shrub-dominated.
Eastside (Interior) Mixed Conifer Forest	Coniferous forests and woodlands; Douglas-fir commonly present, up to 8 other conifer species present; understory shrub and grass/forb layers typical; mid-montane.
Lodgepole Pine Forest and Woodlands	Lodgepole pine dominated woodlands and forests; understory various; mid- to high elevations.
Ponderosa Pine and Interior White Oak Forest and Woodland	Ponderosa pine dominated woodland or savannah, often with Douglas-fir; shrub, forb, or grass understory; lower elevation forest above steppe, shrubsteppe.
Upland Aspen Forest	Quaking aspen (Populus tremuloides) is the characteristic and dominant tree in this habitat.
Subalpine Parkland	Whitebark pine (P. albicaulis) is found primarily in the eastern Cascade mountains Okanogan Highlands, and Blue Mountains.
Alpine Grasslands and Shrubland	Grassland, dwarf-shrubland, or forb dominated, occasionally with patches of dwarfed trees.
Interior Canyon Shrublands	Chokecherry, oceanspray, and Rocky Mtn. maple with shrubs and grasses dominated the understory.
Eastside (Interior) Grasslands	Dominated by short to medium height native bunchgrass with forbs, cryptogam crust.
Shrubsteppe	Sagebrush and/or bitterbrush dominated; bunchgrass understory with forbs, cryptogam crust.
Agriculture, Pasture, and Mixed Environs	Cropland, orchards, vineyards, nurseries, pastures, and grasslands modified by heavy grazing; associated structures.
Urban and Mixed Environs	High, medium, and low (10-29 percent impervious ground) density development.
Lakes, Rivers, Ponds, and Reservoirs	Natural and human-made open water habitats.
Herbaceous Wetlands	Emergent herbaceous wetlands with grasses, sedges, bulrushes, or forbs; aquatic beds with pondweeds, pond lily, other aquatic plants species; sea level to upper montane.
Montane Coniferous Wetlands	Forest or woodland dominated by evergreen conifers; deciduous trees may be co-dominant; understory dominated by shrubs, forbs, or graminoids; mid- to upper montane.
Eastside (Interior) Riparian Wetlands	Shrublands, woodlands and forest, less commonly grasslands; often multilayered canopy with shrubs, graminoids, forbs below.

Source: Ashley and Stovall 2004

Table 4-3 Changes in Wildlife Habitat Types in the Lower Snake Subbasin – Circa 1850 (Historic) to 1999 (Current)

Subbasin	Status	Western Juniper and Mountain Mahogany Woodlands	Interior Mixed Conifer Forest	Ponderosa Pine	Interior Canyon Shrublands	Eastside (Interior) Grasslands	Shrubsteppe	Agriculture, Pasture, and Mixed Environs	Urban and Mixed Environs	Lakes, Rivers, Ponds, and Reservoirs	Herbaceous Wetlands	Eastside (Interior) Riparian Wetlands
Lower Snake	Historic	739	0	492	0	939,785	32,007	0	0	21,913	42,348	21,833
	Current	0	52	1,014	95	416,207	6,505	596,268	1,609	34,652	352	3,180
	Change (acres)	-739	+52	+521	+95	-523,578	-25,502	+596,315	+1,609	+12,739	-41,996	18,653
	Change (%)	-100	999	+106	999	-56	-80	999	999	+58	-99	-85

Note: Values of 999 indicate a positive change from historically 0 (habitat not present or mapped in historic data.

Historic Eastside (Interior) Riparian Wetlands estimates in IBIS (2003) were not considered accurate. As such, estimates of historic wetland acres were developed separately.

Source: Ashley and Stovall 2004

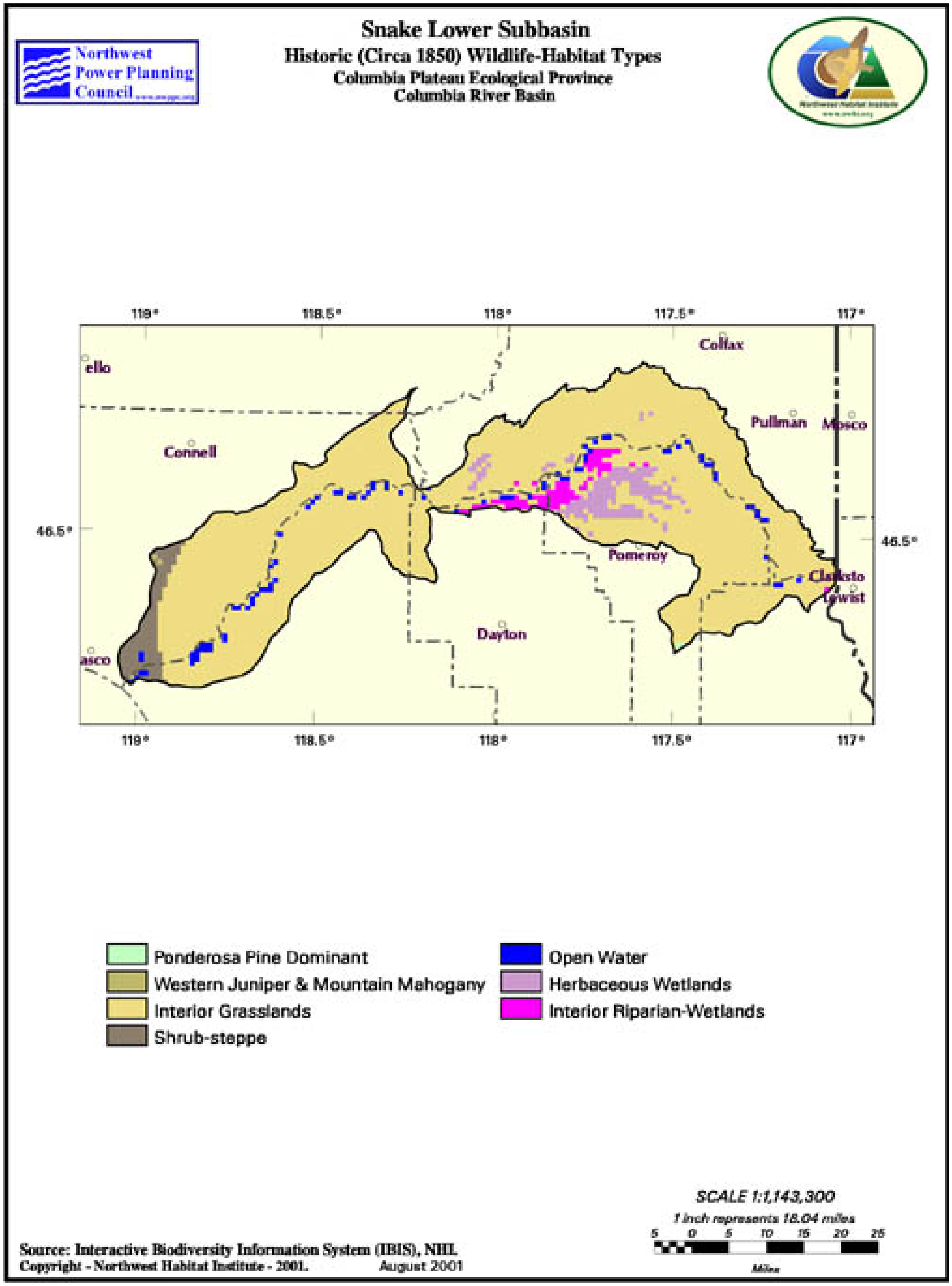

Figure 4-1 Historic Wildlife Habitat Types of the Lower Snake Subbasin

IBIS 2003, as cited in Ashley and Stovall 2004

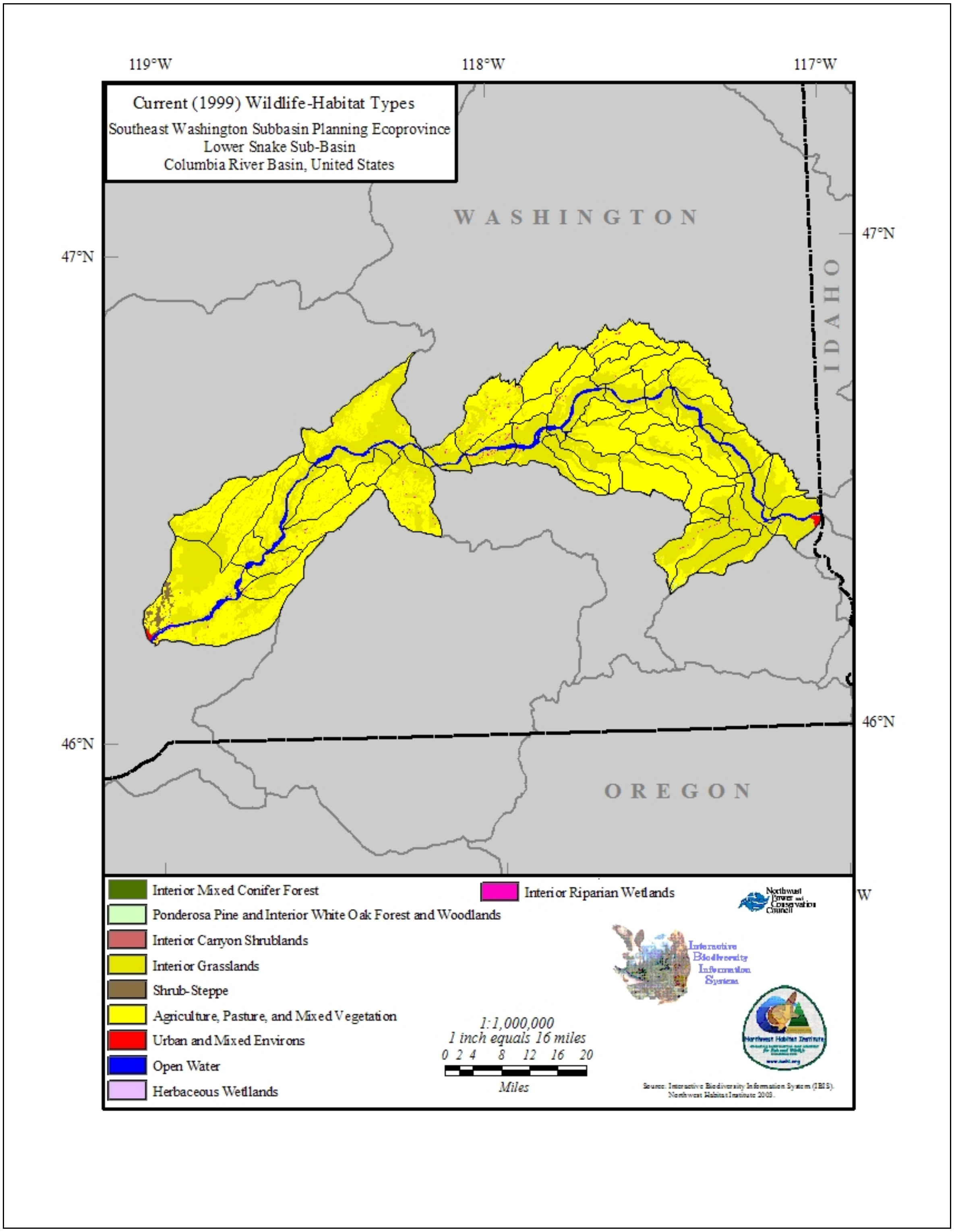

Figure 4-2 Current Wildlife Habitat Types of the Lower Snake Subbasin

IBIS 2003, as cited in Ashley and Stovall 2004

The following four key principles were used to guide selection of focal habitats (see Section 4.1.3 in Appendix E for more detail):

- Focal habitats were identified by WDFW at the Ecoregion level and reviewed/modified at the subbasin level.
- Focal habitats can be used to evaluate ecosystem health and establish management priorities at the Ecoregion level.
- To identify focal macro habitat types within the Ecoregion, Ecoregion planners used the assessment tools to develop a habitat selection matrix based on various criteria, including ecological, spatial, and cultural factors.

Of the 11 habitat types present within the subbasin, the following four were selected as focal habitats for a detailed analysis within this subbasin plan (note-the same habitats were selected as focal habitat types in all subbasins within the Southeast Washington Ecoregion):

- Ponderosa pine and interior white oak forest and woodland
- Eastside (interior) grasslands
- Eastside (interior) riparian wetlands
- Shrub-steppe

The number of extant acres occupied by each focal habitat type within the ecoregion is illustrated by subbasin in Table 4-4 (IBIS 2003, as cited in Ashley and Stovall 2004).

Table 4-4 Comparison of the Amount of Current Focal Habitat Types for Each Subbasin in the Ecoregion

	Focal Habitats			
Subbasin	Ponderosa Pine	Shrubsteppe	Interior Grassland	Riparian Wetlands
Asotin	14,997	0	134,789	1,687
Palouse	48,343	159,305	356,638	7,923
Lower Snake	1,014	6,505	416,207	3,181
Tucannon	9,918	0	114,263	4,512
Walla Walla	49,904	29,252	154,619	15,217

Note: Riparian/riverine acres for the Palouse and Walla Walla subbasins includes only Washington State acreages.
Source: Ashley and Stovall 2004.

Ponderosa pine, grassland, and shrub-steppe focal habitat types along with their associated land cover disturbances are detailed graphically in Figure 4-3. Current and historic riparian wetland habitat information is a significant data gap; consequently, riparian wetland habitat is not included in the habitat distribution maps for the Lower Snake Subbasin.

A brief description of each focal habitat type is presented in following sections. Detailed descriptions of the focal habitat types are presented in section 4.7.1 in Appendix E (Ashley and Stovall 2004). Subbasin-specific focal habitat type anomalies and differences are described in detail in the following sections.

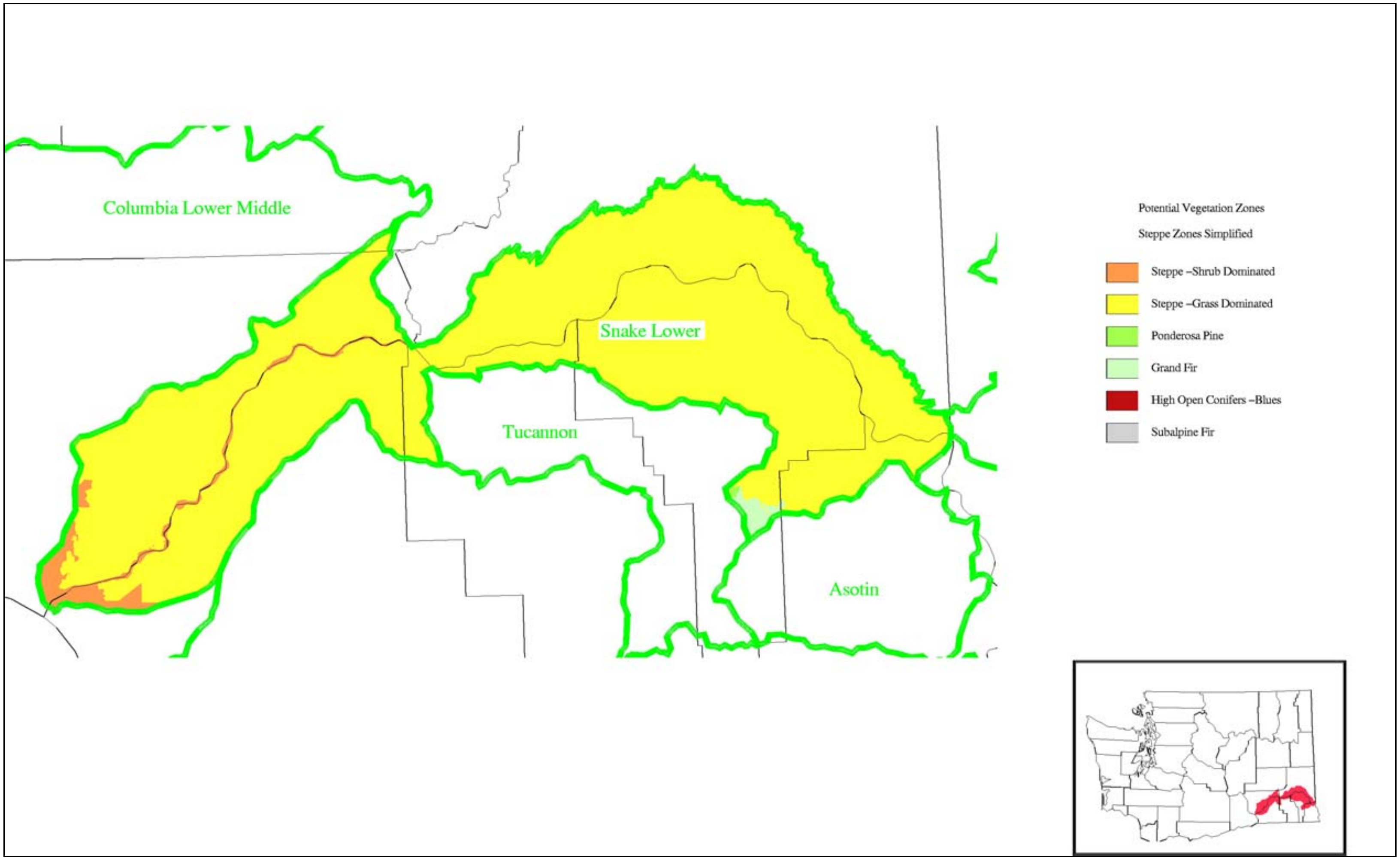

Figure 4-3 Ponderosa Pine, Grassland, and Shrubsteppe Habitat Types and Associated Land Cover Disturbances

Cassidy 1997; as cited in Ashley and Stovall 2004

4.3.2 Description of Terrestrial Priority Habitats

Ponderosa Pine (*Pinus ponderosa*)

This habitat type occurs in much of eastern Washington and Oregon, including the eastern slopes of the Cascades and the Blue Mountains (Johnson and O'Neil 2001). It typically occurs on the driest sites supporting conifers in the Pacific Northwest, and elevation ranges from just above sea level to over 6,000 feet in dry, warm areas (Johnson and O'Neil 2001). Typically a woodland or savanna with tree canopy coverage of 10 to 60 percent, ponderosa pines (*Pinus ponderosa*) and Douglas fir (*Pseudotsuga menziesii*) dominate the conifer community (Johnson and O'Neil 2001).

Within the subbasin, ponderosa pine habitat currently covers a wide range of seral conditions (Ashley and Stovall 2004). Forest management and fire suppression in the subbasin have resulted in the replacement of old-growth ponderosa pine forests with younger mixed forests (greater proportion of Douglas fir [*Pseudotsuga menziesii*] than ponderosa pine) (Habeck 1990, as cited in Ashley and Stovall 2004). Silviculture practices (particularly clear-cut logging) and subsequent reforestation have converted these older, diverse, ponderosa-dominated stands into younger stands that are less diverse and less complex structurally (Wright and Bailey 1982, as cited in Ashley and Stovall 2004).

Much of the ponderosa pine habitat has a younger tree cohort composed of more shade-tolerant species that form a more closed, multi-layered canopy (Ashley and Stovall 2004). For example, this habitat previously included natural fire-maintained stands in which grand fir (*Abies grandis*) often became the dominant canopy species (Ashley and Stovall 2004). Currently, most management regimes prescribe the harvest of large ponderosa pine and Douglas fir (Ashley and Stovall 2004). This decreases average tree size and increases stand density, thereby preventing the establishment of grand fir in the canopy (Ashley and Stovall 2004). In some portions of the subbasin, new woodlands have been created by patchy tree establishment at forest-steppe ecotones (Ashley and Stovall 2004).

Other impacts to this habitat type within the subbasin include

1. Introduced annuals (especially cheatgrass) and invading shrubs under heavy grazing pressure (Agee 1993, as cited in Ashley and Stovall 2004) – these exotics have replaced the native herbaceous species in the habitat's understory.

2. Four exotic knapweed species (*Centaurea* spp.) are spreading rapidly through the ponderosa pine habitat type and are threatening to replace cheatgrass as the dominant invader after grazing (Roche and Roche 1988, as cited in Ashley and Stovall 2004).

3. Dense cheatgrass stands eventually alter the fire regime by reducing the frequency of low-intensity fires. This leads to catastrophic fires that kill, and lead to the replacement of, the existing stand (Ashley and Stovall 2004).

4. Bark beetles (primarily of the genuses *Dendroctonus* and *Ips*) kill large numbers of ponderosa pines annually and are the major mortality factor in stands of commercial saw timber (Schmid 1988 in Howard 2001, as cited in Ashley and Stovall 2004).

100 percent of ponderosa pine habitats in the Lower Snake subbasin fall in the "low" to "no protection" categories. Consequently, this habitat type "will likely suffer further degradation, disturbance, and/or loss" in the ecoregion (Ashley and Stovall 2004). Although it may continue to expand its coverage in the Lower Snake Subbasin, new acreage will be young seral stages that provide little ecological value. Table 4-5 details the protection status of remaining ponderosa pine habitat within the Lower Snake Subbasin (Ashley and Stovall 2004).

Table 4-5 Ponderosa Pine Habitat GAP Protection Status/Acres in the Lower Snake Subbasin

GAP Protection Status	Acres
High Protection	0
Medium Protection	0
Low Protection	59
No Protection	956

Source: Ashley and Stovall 2004.

The number of acres protected by CRP (compared by county) are listed in Table 4-6 (FSA 2004, as cited in Ashley and Stovall 2004). The number of acres protected through the CREP program (also by county) are presented in Table 4-7 (FSA 2003, as cited in Ashley and Stovall 2004). Land in these two programs was considered to have short-term high protection status.

Table 4-6 CRP Protected Acres by County Within the Southeast Washington Subbasin Planning Ecoregion

County	Introduced Grasses (CP1)	Native Grasses (CP2)	Tree Plantings (CP3)	Wildlife Habitat (CP4)	Established Grass (CP10)	Established Trees (CP11)	Contour Grass (CP15)	Total Acres
Asotin	7,812	9,591	35	7,450	3,367	19	0	28,274
Columbia	5,991	20,162	581	5,929	10,839	355	28	43,885
Garfield	4,545	13,328	0	19,911	7,428	0	2,414	47,626
Walla Walla	4,501	3,989	777	1,219	3,276	385	N/A	14,147
Whitman	44,955	95,555	129	0	11,735	166	0	152,540

Source: FSA 2003.

Table 4-7 Number of Acres Protected Through the CREP/Continuous CRP Program by County

County	CP-22 Acres
Asotin	1,339
Columbia [1]	2,087
Garfield [2]	2,535
Umatilla	52
Walla Walla	1,922
Whitman [3]	1,052

Source: FSA CP-22 2003.

[1] Columbia County CP-22 acreage was modified from FSA values and of the 2,087 acres listed above for Columbia County, 1,519 are CREP (pers. comm. T. Bruegman, May 2004).

[2] Of the 2,535 acres listed above for Garfield County, 1,005 are CREP (pers. comm. D. Bartels, May 2004).

[3] Whitman County has no CREP acres (pers. comm. D. Bartels, May 2004).

Eastside (Interior) Grassland

Developing in hot, dry climates in the Pacific Northwest, this habitat type is found primarily at mid- to low elevations (Johnson and O'Neil 2001). In general, it is an open and irregular arrangement of short to medium-tall grass clumps (<1 meter) (Johnson and O'Neil 2001). Dominant native perennial grasses, on undisturbed sites, include Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass (*Pseudoroegneria spicata*), and Sandberg bluegrass (*Poa secunda*) (Johnson and O'Neil 2001). A large number of forbs are also present; balsamroot (*Balsamorhiza sagittata*), cinquefoil (*Potentilla recta*), and old man's whiskers (*Geum triflorum*) are among the most common (Daubenmire 1970; Franklin and Dyrness 1973; both as cited in Ashley and Stovall 2004). The eastside (interior) grassland habitat type is detailed in Appendix E (Ashley and Stovall 2004). Within the Lower Snake River Subbasin, grassland habitat is composed of the Palouse, Canyon Grassland, and Wheatgrass/Fescue vegetation zones (Ashley and Stovall 2004).

Significant portions of grassland habitat have been severely altered by the introduction of, and subsequent competition from, non-native weeds, including cheatgrass (*Bromus tectorum*), knapweed (*Centaurea* spp.), and yellow starthistle (*Centaurea solstitialis*) (Ashley and Stovall 2004). Over-grazing results in the replacement of native vegetation with invasive species, especially cheatgrass and yellow starthistle (Mack 1986; Roche and Roche 1988; both as cited in Ashley and Stovall 2004). Currently, "native perennial bunchgrass/shrub communities are found only on a few 'eyebrows' on steep slopes surrounded by wheat fields, or in non-farmed canyon slopes and bottoms within agricultural areas" (Ashley and Stovall 2004).

The protection status of remaining eastside (interior) grassland habitat in the Lower Snake Subbasin is presented in Table 4-8. The vast majority of the subbasin's grassland habitat is either not protected or is afforded only low-protection status; a very small percentage is included in the high-protection category (Ashley and Stovall 2004). Furthermore, the vast majority of grassland habitat throughout the ecoregion is not protected and is at risk for further degradation and/or conversion to other land uses (Ashley and Stovall 2004).

Table 4-8 Eastside (Interior) Grassland Habitat GAP Protection Status/Acres in the Lower Snake Subbasin

GAP Protection Status	Acres
High Protection	7,379
Medium Protection	7,910
Low Protection	34,148
No Protection	366,767

Source: Ashley and Stovall 2004.

Grassland habitats established through implementation of the Conservation Reserve Program receive short-term/high protection (Ashley and Stovall 2004). The number of acres protected by CRP (compared by county) are listed in Table 4-4 (FSA 2004, as cited in Ashley and Stovall 2004). The number of acres protected through the CREP program (also by county) are presented in Table 4-5 (FSA 2003, as cited in Ashley and Stovall 2004).

Eastside (Interior) Riparian Wetlands

Eastside (interior) riparian wetlands[8] occur along the interface between aquatic and terrestrial ecosystems, most often as linear strips that closely follow perennial or intermittent streams and rivers (Johnson and O'Neil 2001). Wetland hydrology or soils, periodic riverine flooding, or perennial flowing freshwater characterizes them (Johnson and O'Neil 2001). They are composed of a mosaic of shrublands, woodlands, and forest communities and have a tree layer that can be dominated by deciduous, coniferous, or mixed canopies (Johnson and O'Neil 2001). The undergrowth consists of low shrubs or dense patches of grasses, sedges, or forbs (Johnson and O'Neil 2001). The eastside (interior) grassland habitat type is detailed in Appendix E.

Ashley and Stovall (2004) summarize the current and historical condition of eastside riparian wetlands in eastern Washington as follows:

> "Historically, riparian wetland habitat was characterized by a mosaic of plant communities occurring at irregular intervals along streams and dominated singularly, or in some combination by grass-forbs, shrub thickets, and mature forests with tall deciduous trees. Beaver activity and natural flooding are two ecological processes that affected the quality and distribution of riparian wetlands."

> "Today, agricultural conversion, livestock grazing, altered stream channel morphology, and water withdrawal have played significant roles in changing the character and function of streams and associated riparian areas. Grazing has suppressed woody vegetation while introduction of Kentucky bluegrass, reed canarygrass, and other weed species has significantly altered native plant communities in most riparian areas."

[8] In Ashley and Stovall's (2004) analysis, the eastside (interior) riparian wetlands habitat type refers only to riverine and adjacent wetland habitats. Although nonetheless significant, other wetland habitat types that occur within the subbasins were not included as focal habitat types due to their limited extent.

> "Degraded riparian/riverine habitat affects both fish and wildlife species. Lack of thermal, loafing, and hiding cover, altered plant communities, and loss of forage/feeding opportunities limits wildlife use of riparian areas and, for riparian/riverine dependent species, limits populations. Loss of habitat function leads to sediment deposition, low water flows, and marginal water temperatures that are habitat-limiting factors for fish in subbasin tributaries."

Ashley and Stovall (2004) summarize the current condition of riparian wetlands in the Lower Snake Subbasin as follows:

> "Mendal (WDFW, personal communication, 2001) reported that most streams within the Lower Snake River Subbasin originate from springs and that habitat conditions in these small streams are affected by roads, livestock grazing, farming and other land use activities. Riparian vegetation is often absent or degraded along portions or the entire length of streams."

> "Where livestock grazing is the primary land use, riparian vegetation is minimal and stream habitat generally lacks complexity/structure (Mendel 1999). The Soil Conservation Service (1981) (NRCS), in a study on Alpowa Creek, asserted that heavily grazed riparian/riverine herbaceous habitat quality and extent was poor on 83% of the streambanks, shrubby vegetation quality was poor on 67% of the stream corridor and missing on the remaining 33%. Tree condition ranged from poor to fair quality. The trees were described as "relicts" and of little reproductive value…"

> "In addition to livestock grazing, mechanical and chemical means are used to remove/alter stream bank vegetation (Soil Conservation Service 1981). Stream channeling has also occurred in some areas. Riparian buffers are generally narrow with limited woody vegetation and heavily eroded streambanks throughout the Lower Snake River Subbasin."

Exceptions to the general condition described above do exist however. Stream segment eight on Alpowa Creek (where trees currently are in "good" condition despite evidence of heavy grazing in the past) could serve as a model for riparian restoration/recovery (Soil Conservation Service 1981, as cited in Ashley and Stovall 2004).

The protection status of remaining eastside (interior) riparian wetland habitat in the Lower Snake Subbasin is presented in Table 4-9. Nearly 100 percent of the subbasin's riparian/wetland habitat is either not protected or is afforded only low-protection status; none is included in the high-protection category (Ashley and Stovall 2004). Furthermore, the vast majority of riparian habitat throughout the ecoregion is not protected and is at risk for further degradation and/or conversion to other land uses (Ashley and Stovall 2004).

Table 4-9 Eastside (Interior) Riparian Wetlands GAP Protection Status/Acres in the Lower Snake Subbasin

GAP Protection Status	Acres
High Protection	0
Medium Protection	2
Low Protection	151
No Protection	3,025

Source: Ashley and Stovall 2004.

Riparian habitats are provided additional short-term high protection by USDA's CREP program (Ashley and Stovall 2004). The number of acres enrolled in the CREP program by county is listed in Table 4-5 (Ashley and Stovall 2004).

Shrub-steppe

Shrub-steppe habitats are common on the Columbia Plateau and extend onto the dry surrounding mountains (Johnson and O'Neil 2001). Widely scattered shrubs are mixed with perennial grasses (Johnson and O'Neil 2001). Elevation range is 300-9,000 feet, mostly between 2,000 and 6,000 feet (Johnson and O'Neil 2001). Shrub-steppe occurs on deep soils, stony flats, and lake beds with ash or pumice soils (Johnson and O'Neil 2001). Livestock grazing is the primary land use although, much shrub-steppe has been converted to irrigation or dry-land agriculture (Johnson and O'Neil 2001). The shrub-steppe habitat type is fully described in Appendix E.

Shrub-steppe habitat in the Lower Snake Subbasin is comprised entirely of the Central Arid Steppe vegetation zone (Ashley and Stovall 2004). Within the ecoregion, the Central Arid Steppe vegetation zone occurs only in the Walla Walla and Lower Snake River subbasins (Ashley and Stovall 2004).

Ashley and Stovall (2004) describe the shrub-steppe vegetation community as follows:

> "Big sagebrush, bluebunch wheatgrass, and Sandberg bluegrass dominate shrubsteppe climax vegetation (Daubenmire 1970). Other grass species occur in much smaller amounts including needle-and-thread, Thurbers needlegrass, Cusick's bluegrass, and/or bottlebrush squirreltail grass. Forbs play a minor role. A cryptogamic crust of lichens and mosses grows between the dominant bunchgrasses and shrubs. Without disturbance, particularly trampling by livestock, the cryptogamic crust often completely covers the space between vascular plants."

> "In areas with a history of heavy grazing and fire suppression, true shrublands are common and may even be the predominant cover on non-agricultural land. Most of the native grasses and forbs are poorly adapted to heavy grazing and trampling by livestock. Grazing eventually leads to replacement of the bunchgrasses with cheatgrass, Nuttall's fescue, eight flowered fescue, and Indian wheat (Harris and Chaney 1984). Several highly invasive knapweeds have become increasingly widespread. Yellow-star thistle is particularly widespread, especially along and near major watercourses (Roche and roche 1988). A 1981 assessment of range

conditions rated most shrubsteppe rangelands to be in poor to fair range condition, but ecological condition is usually worse than range condition (Harris and Chaney 1984)."

Within the ecoregion, the vast majority of shrub-steppe habitat is designated as low or no protection and is therefore at risk for "further degradation and/or conversion to other uses" (Ashley and Stovall 2004). The protection status of shrub-steppe habitat in the Lower Snake Subbasin is summarized in Table 4-10.

Table 4-10 Shrubsteppe GAP Protection Status/Acres in the Lower Snake Subbasin

GAP Protection Status	Acres
High Protection	0
Medium Protection	198
Low Protection	930
No Protection	5,381

Source: Ashley and Stovall 2004.

Shrub-steppe habitats may be re-established directly or passively through the CRP (Ashley and Stovall 2004). As with grasslands, CRP provides short-term/high protection to shrub-steppe habitats (Ashley and Stovall 2004). Additionally, CRP grasslands may potentially provide additional shrub-steppe habitat if allowed to reach climax community conditions (Ashley and Stovall 2004). Table 5 presents CRP acreage by county.

4.3.3 Agriculture (Cover Type of Interest)

Agriculture operations in the Lower Snake Subbasin include dryland/irrigated crops, fruit orchards, and irrigated and non-irrigated pasture (alfalfa and hay) (Ashley and Stovall 2004). Annual grains such as wheat, oats, barley, and rye are the primary cultivated crops (Ashley and Stovall 2004). They are typically produced on upland, rolling terrain without irrigation on non-forested areas of the subbasin (Ashley and Stovall 2004). Pastures adjacent to streams and riparian areas may be irrigated (Ashley and Stovall 2004). Hay pastures typically are composed of several species, while grass seed fields are composed of only one species (Ashley and Stovall 2004).

Agricultural lands concentrated in deep-soiled upland areas and valley bottoms have significantly affected grasslands, shrublands, and riparian zones in those areas (Ashley and Stovall 2004). Conversion of native habitats to agriculture altered, destroyed, and fragmented much of the grassland and riparian/floodplain habitat within the subbasin (Ashley and Stovall 2004). Increased sediment loads, the introduction of herbicides and pesticides into streams, and the invasion of exotic plants also are a result of agricultural operations (Ashley and Stovall 2004).

The conversion of agricultural land has had some beneficial wildlife impacts, especially for introduced game species. Ashley and Stovall (2004) discuss the pros and cons of agriculture conversion of native and introduced game species.

> "Although the conversion of native habitats to agriculture severely affected native wildlife species such as the sharp-tailed grouse, agriculture did provide new habitat niches quickly filled by introduced wildlife species including the ring-necked pheasant, chukar, and gray partridge. Introduced parasitic wildlife species such as European starlings also thrived as more land was converted to agriculture."

> "Native ungulate and waterfowl populations took advantage of new food sources provided by croplands and either expanded their range or increased in number (J. Benson, WDFW, personal communication, 1999). Indigenous wildlife species and populations that adapted to and/or thrived on "edge" habitats increased with the introduction of agriculture except in areas where "clean farming" practices and crop monocultures dominated the landscape."

> "In addition to crops, agricultural lands provide and support hunting and wildlife viewing opportunities, which promotes local economic growth. Conversely, crop depredation by elk and deer is an issue in some areas of the subbasin with a number of landowners desiring reductions in ungulate herds…."

IBIS (2003) reports that nearly all of the agriculture habitat type in the Lower Snake Subbasin and across the ecoregion is not protected. However, low and medium protection is provided to lands enrolled in conservation easements or protected under other development restrictions (e.g., county planning ordinances and university-controlled experimental stations) (Ashley and Stovall 2004). The GAP protection status of agricultural habitat in the Lower Snake Subbasin is illustrated in Table 4-11.

Table 4-11 GAP Protection Status/Acres of Agriculture and Mixed Environments in the Lower Snake Subbasin

GAP Protection Status	Acres
High Protection	4
Medium Protection	186
Low Protection	25,678
No Protection	570,391

Source: Ashley and Stovall 2004.

The Lower Snake Subbasin represents the ecoregion's median for land dedicated to agriculture (Figure 4-4) (Ashley and Stovall 2004). Agricultural production generally occurs wherever it is not precluded by unsuitable soils or topography or by public land ownership (Ashley and Stovall 2004).

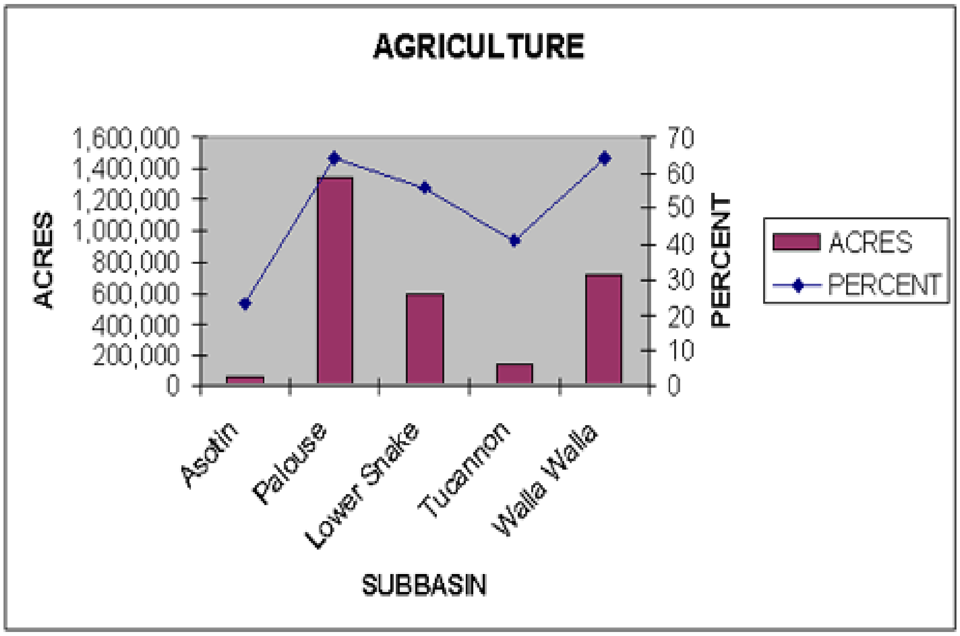

Figure 4-4 Agricultural Land Use Within the Ecoregion
IBIS 2003, as cited in Ashley and Stovall 2004.

4.3.4 Terrestrial Habitat and Protection Status Summary

Table 4-12 summarizes changes in the extent of focal habitats within the Lower Snake Subbasin (Ashley and Stovall 2004). Only one of four Lower Snake Subbasin focal habitats (ponderosa pine) has increased since 1850. Shrub-steppe, grassland, and riparian wetland habitats have decreased since 1850. The vast majority of decreases in each of these focal habitats is primarily due to conversion to agricultural uses (agricultural land has increased by 596,268 acres since 1850).

Table 4-12 Changes in Focal Wildlife Habitat Type Acreage in the Lower Snake Subbasin from Circa 1850 (Historic) to 1999 (Current)

Focal Habitat Type	Historic Acres	Current Acres	Acre Change	Percent Change
Ponderosa Pine	495	1,014	+521	+100
Shrubsteppe	32,007	6,505	-25,502	-80
Eastside (Interior) Grassland	939,785	416,207	-523,578	-56
Eastside (Interior) Riparian Wetlands	21,833	3,180	-18,653	-85
Agriculture	0	596,268	+596,268	+100

Source: Ashley and Stovall 2004

Ashley and Stovall (2004) summarize these habitat losses as follows:

> “All focal habitats within the subbasin have decreased significantly since circa 1850 except for the Ponderosa Pine Habitat Type, which has doubled in extent. The amount of

> ponderosa pine habitat has increased more than 100% in both the Lower Snake and Walla Walla subbasins. Agricultural conversion accounts for nearly 100% of the total change (loss) in Eastside (Interior) Grassland and Shrubsteppe habitat types (IBIS 2003). Riparian/riverine wetland habitat data are incomplete and limited in value… Subbasin wildlife managers, however, believe that significant physical and functional losses have occurred to these important riparian habitats from hydroelectric facility construction and inundation, agricultural development, and livestock grazing."

The Dunes Wilderness Area, which comprises approximately 0.7 percent (7,383 acres) of the Lower Snake Subbasin, is the only GAP priority status 1 area within the subbasin (Figure 4-5) (Ashley and Stovall 2004). An additional 0.8 percent (8,443 acres) of the subbasin is composed of public lands managed by BLM and USCOE that are under GAP priority status 2 protection. Roughly 6 percent (61,194 acres) and 93 percent (982,905 acres) of the subbasin are provided GAP priority status 3 and 4 protection, respectively (Ashley and Stovall 2004). Lands owned by the Washington Department of Natural Resources are included in the status 3 category (Ashley and Stovall 2004). Definitions of various levels of GAP protection status can be found in the introduction of this section.

Subbasin ECA priorities and focal habitat types are shown in Figure 4-6. The Lower Snake subbasin consists almost exclusively of lands unprotected by ECA; however, a relatively small portion of the subbasin, primarily composed of public land, is afforded a higher level of protection (Ashley and Stovall 2004). ECA is described in detail at the beginning of Section 4.

The protection status of an area is significant, because a higher level of protection is assumed to give planners and resource managers greater opportunities for long-term habitat enhancement (i.e., they are assured that habitat enhancement efforts will be protected in the future). Subbasin planners can use a combination of ECA, StreamNet, GAP, and IBIS data to identify areas in which to focus protection strategies and conservation efforts (Ashley and Stovall 2004). Ashley and Stovall (2004) identify "protection of critical habitats on private lands, located adjacent to existing public lands, within ECA designated areas" as a high conservation priority within the subbasin and ecoregion.

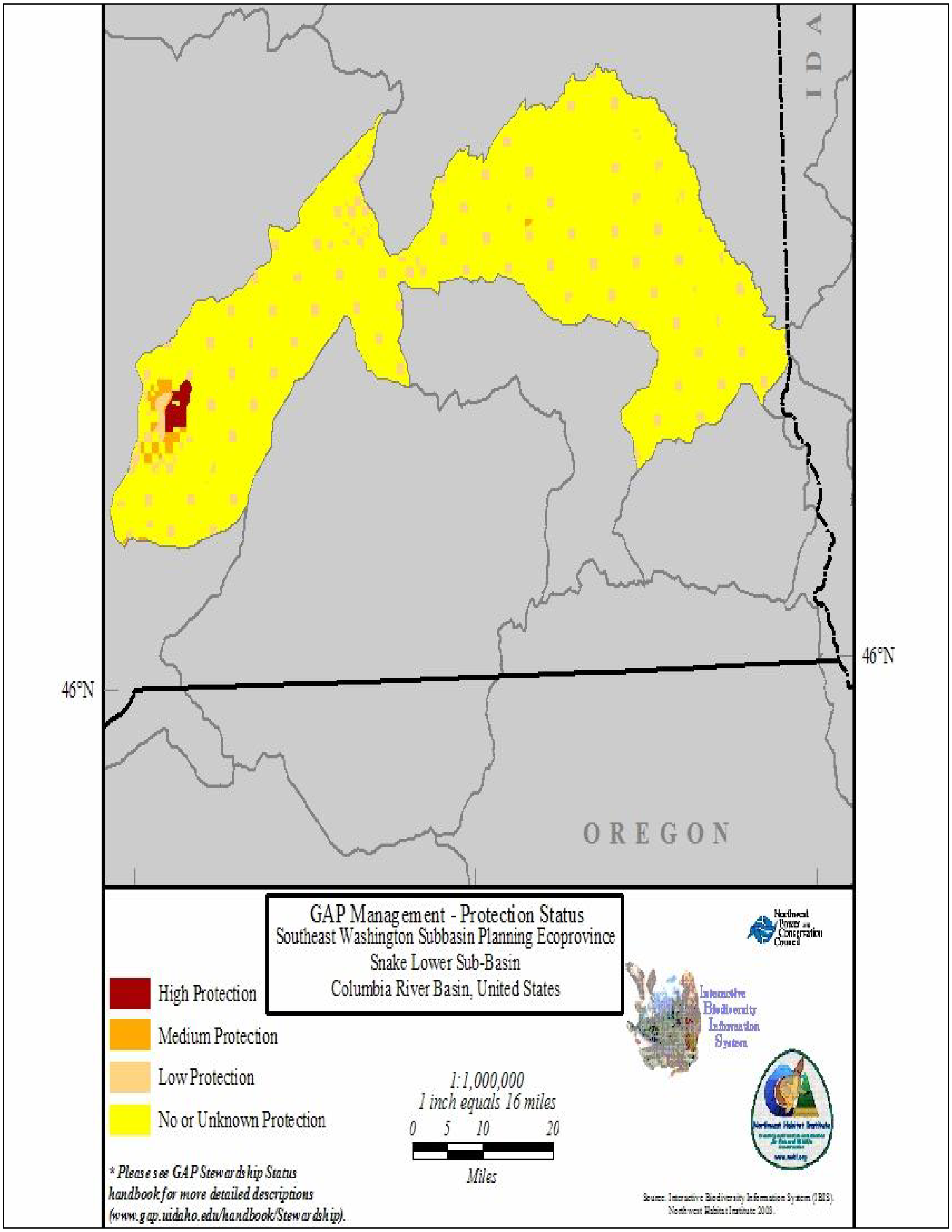

Figure 4-5 GAP Protection Status in the Lower Snake Subbasin

Ashley and Stovall 2004

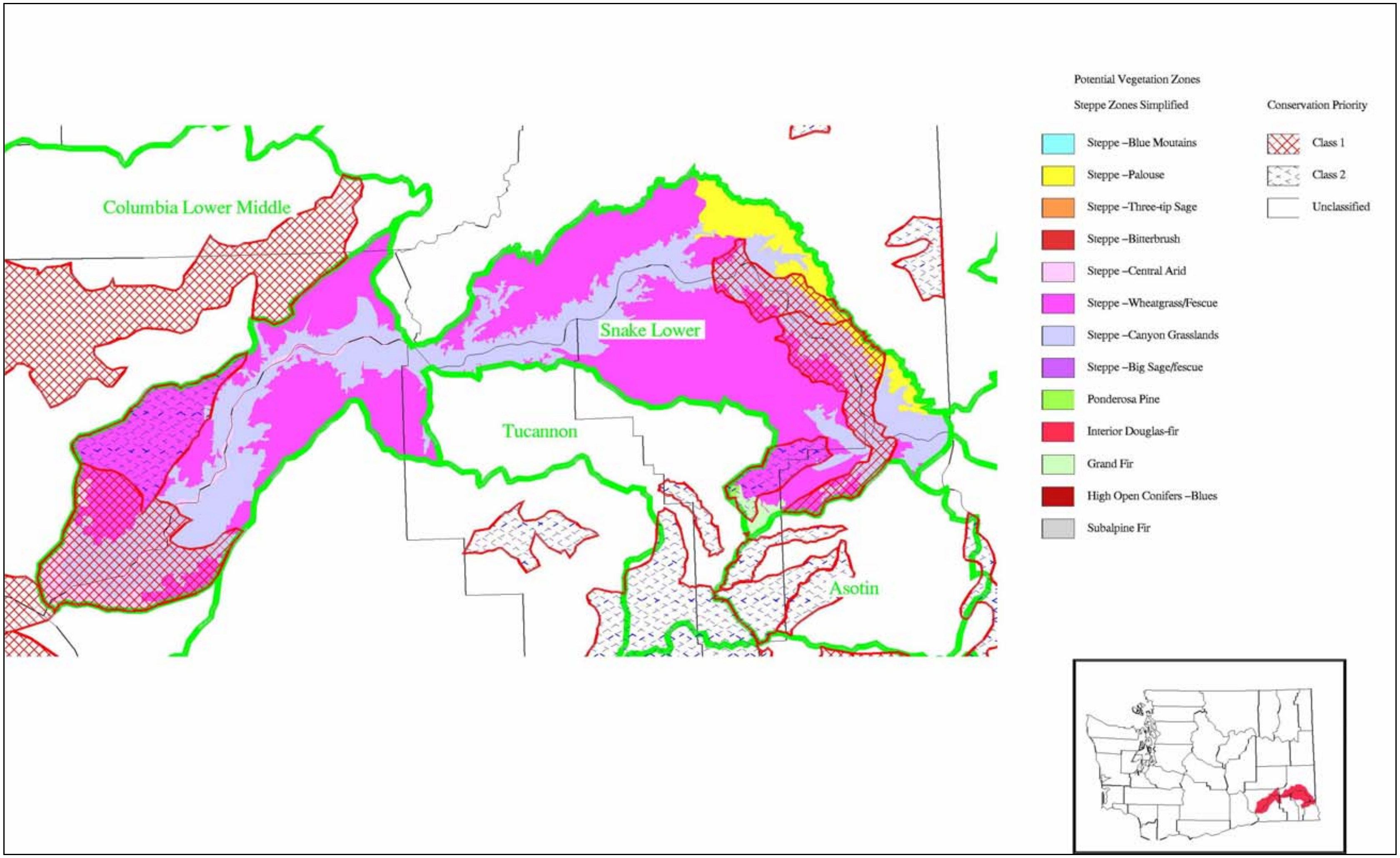

Figure 4-6 ECA and Focal Habitat Types in the Lower Snake Subbasin

ECA 2003, as cited in Ashley and Stovall 2004

4.4 Focal Species

4.4.1 Introduction

This section reviews the process for selecting focal species, which species were chosen, and general information regarding their life history, status, and environmental relationships.

4.4.2 Focal Wildlife Species Assemblage Selection and Rationale

Subbasin planners selected focal wildlife species using a combination of several factors including:

- primary association with focal habitats for breeding;
- specialist species that are obligate or highly associated with key habitat elements/conditions important in functioning ecosystems;
- declining population trends or reduction in their historic breeding range (may include extirpated species);
- special management concern or conservation status such as threatened, endangered, species of concern and management indicator species; and
- professional knowledge on species of local interest.

A total of nine bird species and three mammalian species were chosen as focal or indicator species to represent four priority habitats in the Lower Snake Subbasin (see Table 4-13). Focal species selection rationale and important habitat attributes are described in further detail in Table 31 of Appendix E.

4.4.3 Focal Terrestrial Species Descriptions

There are an estimated 332 wildlife species that occur in the Lower Snake Subbasin (Table 25 in Appendix E). Of these species, 132 are closely associated with wetland habitat, and 75 consume salmonids during some portion of their life cycle (Ashley and Stovall 2004). Thirteen species in the Lower Snake Subbasin are non-native (Ashley and Stovall 2004). Eight wildlife species that occur in the subbasin are federally listed and 41 species are listed in Washington as threatened, endangered, or candidate species (Ashley and Stovall 2004).

Table 4-13 Focal Species Selection Matrix for the Lower Snake Subbasin

Common Name	Focal Habitat[1]	Status[2]		Native Species	PHS	Partners in Flight	Game Species
		Federal	State				
White-headed woodpecker	Ponderosa pine	n/a	C	Yes	Yes	Yes	No
Flammulated owl	Ponderosa pine	n/a	C	Yes	Yes	Yes	No
Rocky Mountain elk	Ponderosa pine	n/a	n/a	Yes	Yes	No	Yes
Sage sparrow	Shrub-steppe	n/a	C	Yes	Yes	Yes	No
Sage thrasher	Shrub-steppe	n/a	C	Yes	Yes	Yes	No
Brewer's sparrow	Shrub-steppe	n/a	n/a	Yes	No	Yes	No
Mule deer	Shrub-steppe and Eastside (Interior) Grassland	n/a	n/a	Yes	Yes	No	Yes
Yellow warbler	Eastside (Interior) Riparian Wetland	n/a	n/a	Yes	No	Yes	No
American beaver	Eastside (Interior) Riparian Wetland	n/a	n/a	Yes	No	No	Yes
Great blue heron	Eastside (Interior) Riparian Wetland	n/a	n/a	Yes	Yes	No	No
Grasshopper sparrow	Eastside (Interior) Grassland	n/a	n/a	Yes	No	Yes	No
Sharp-tailed grouse	Eastside (Interior) Grassland	SC	T	Yes	Yes	Yes	No

[1] SS = Shrubsteppe; RW = Riparian Wetlands; PP = Ponderosa pine.
[2] C = Candidate; SC = Species of Concern; T = Threatened; E = Endangered.
Source: Table 30, Appendix E (modified).

Information regarding management of specific species, where applicable, can be found in Chapter 6. Figures 4-7 to 4-14 provide distribution maps for selected terrestrial focal species. Detailed information regarding the life history, status, environment/species relationships, distribution, and key ecological functions of terrestrial focal species can be found in Chapter 5 of Appendix E.

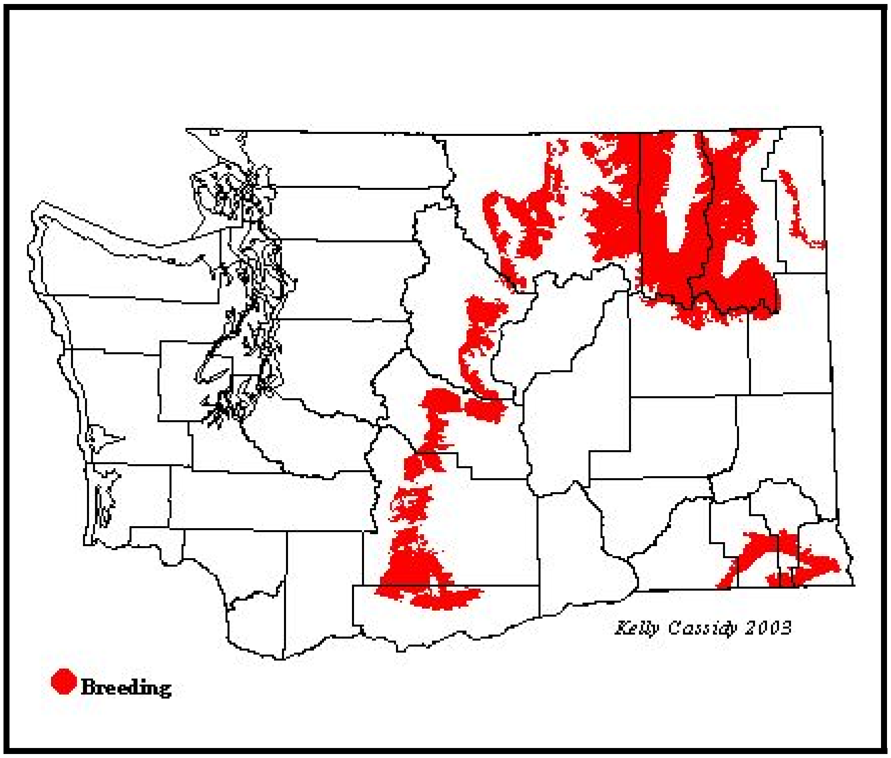

Figure 4-7 Flammulated Owl Distribution, Washington
Source: Kaufman 1996; as cited in Appendix E

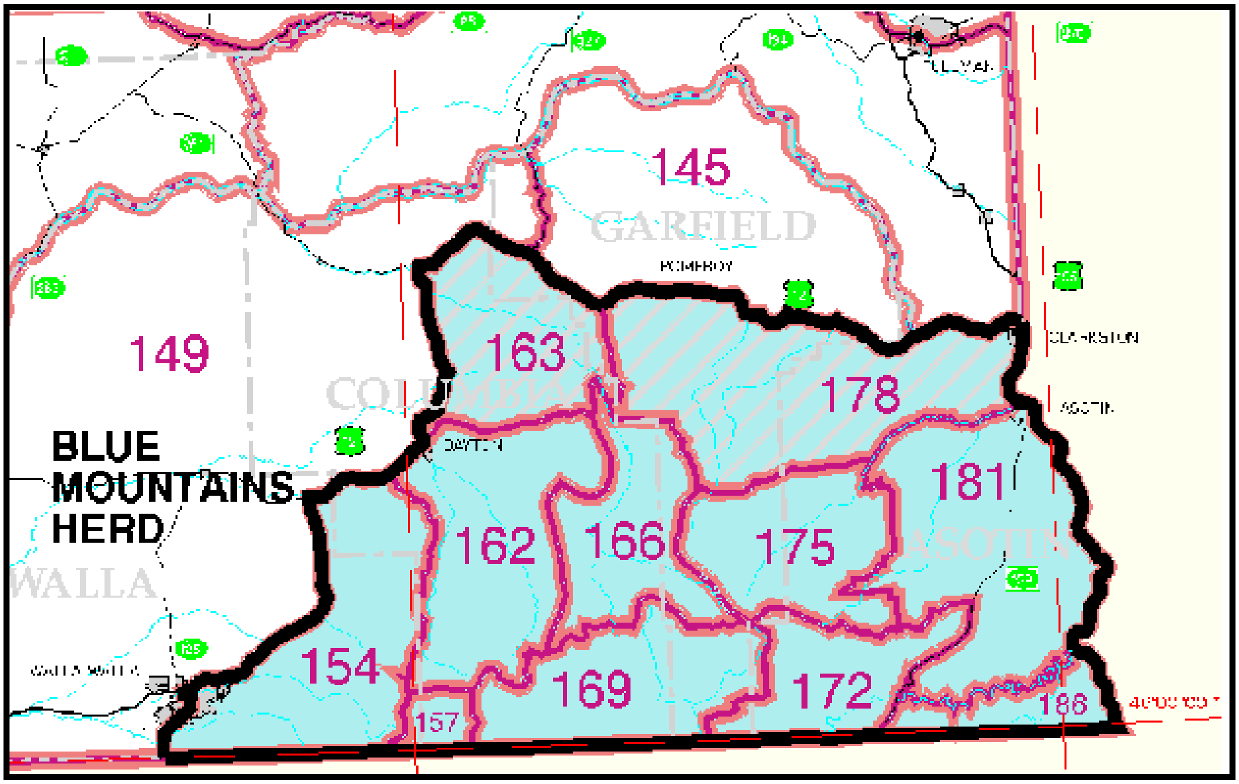

Figure 4-8 Elk Game Management Units in the Southeast Washington Subbasin Planning Ecoregion, Washington

(Fowler 2001, as cited in Ashley and Stovall 2004).

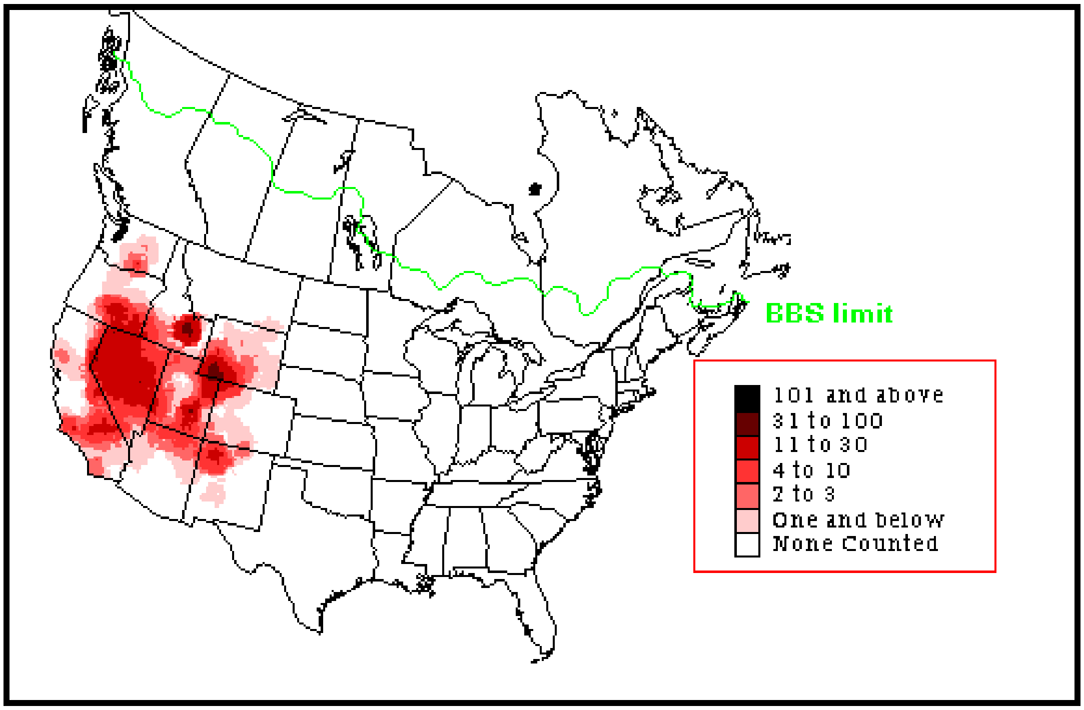

Figure 4-9 Sage Sparrow Breeding Season Abundance

Sauer et al. 2003, as cited in Ashley and Stovall 2004

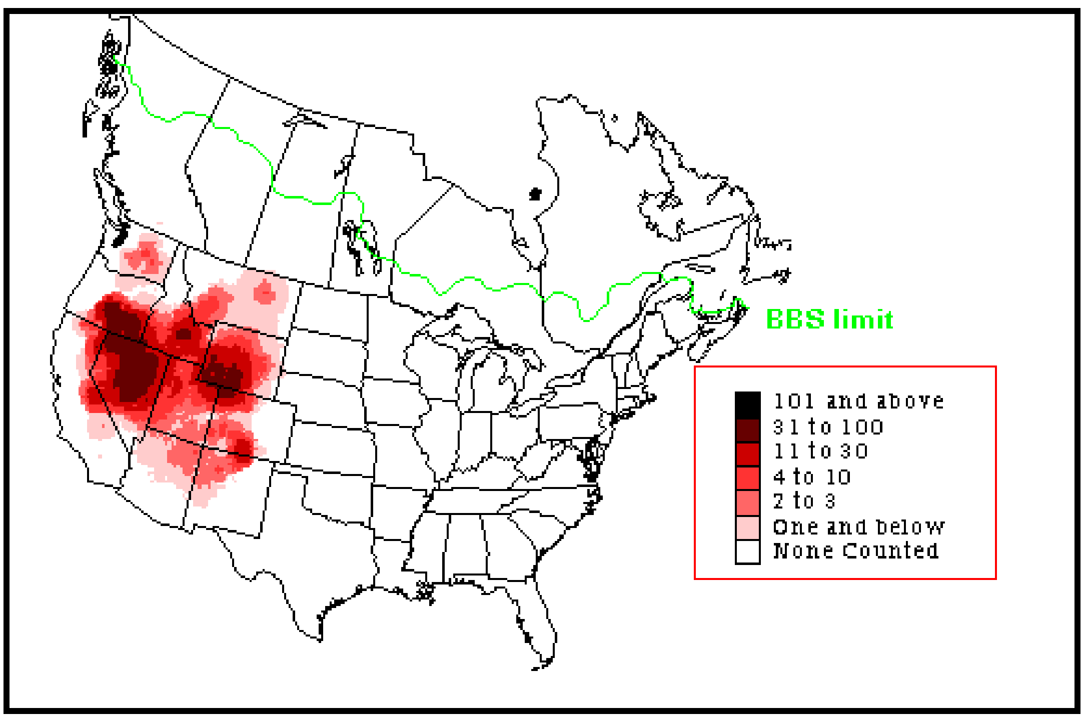

Figure 4-10 Sage Thrasher Breeding Season Abundance

Sauer et al. 2003, as cited in Ashley and Stovall 2004

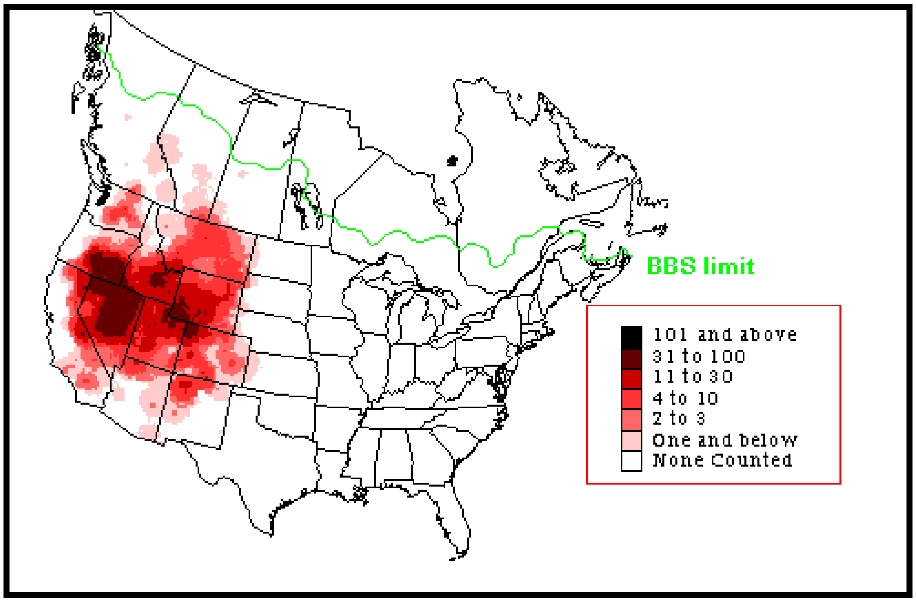

Figure 4-11 Sage Sparrow Breeding Season Abundance

Sauer et al. 2003, as cited in Ashley and Stovall 2004

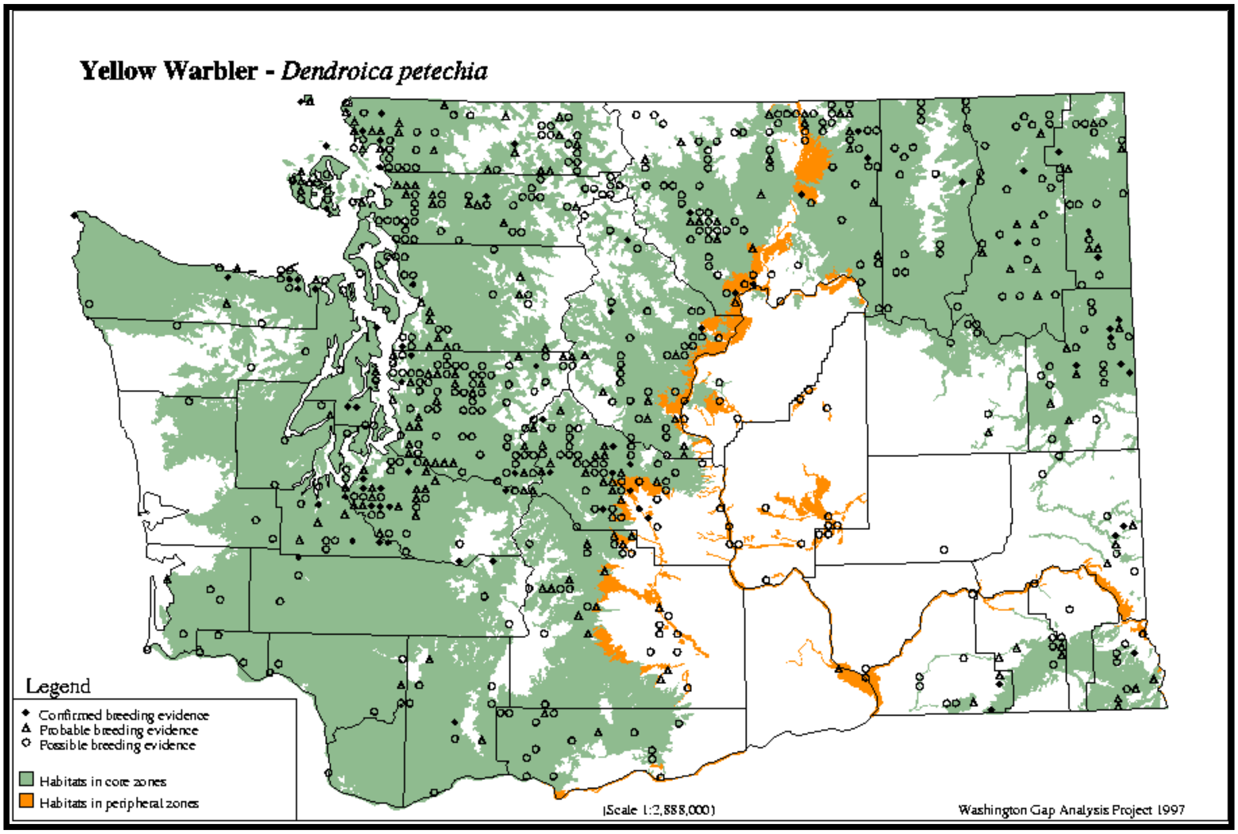

Figure 4-12 Yellow Warbler Distribution

(Washington GAP Analysis Project 1997, as cited in Ashley and Stovall 2004).

Figure 4-13 Geographic Distribution of American Beaver

Source: Linzey and Brecht 2002, as cited in Ashley and Stovall 2004.

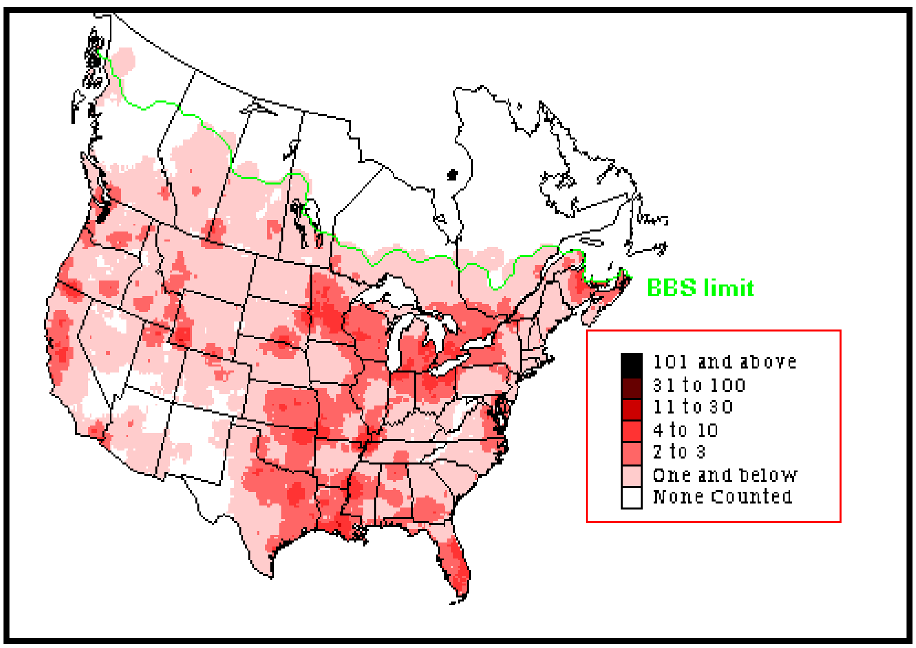

Figure 4-14 Great Blue Heron Summer Distribution

Source: Sauer et al. 2003, as cited in Ashley and Stovall 2004

5. Integration of Aquatic and Terrestrial Components

This section of the subbasin plan addresses integration of the aquatic and terrestrial parts of the plan. These parts of the plan were developed independent of each other. The assessments for each were conducted using different methodologies and approaches. The working hypotheses, biological objectives, and strategies address the findings of the respective assessments. No attempt was made to integrate the aquatic and terrestrial aspects in other sections of this plan.

Recognizing the above, this section attempts to integrate these two aspects of the plan. The integration that is possible within the constraints of schedule and resources is very preliminary. A methodology to more fully integrate the aquatic and terrestrial aspects of the subbasin plan is under development at this time. When available later this year, it is expected that a full integration of aquatic and terrestrial aspects could be done and would be a desirable addition to this plan.

The following information is addressed in this section. First, a suggested methodology for integration that is based on the best available science is discussed. Next, a description of the process that is underway to refine this methodology, and how it could be used to provide an integration of fish and wildlife for this plan, is addressed. Finally, a preliminary integration of the aquatic and terrestrial aspects of the subbasin plan is provided.

5.1 Suggested Methodology

Work has been performed in this subbasin plan to identify appropriate aquatic and terrestrial biological objectives and strategies. A clear demonstration of how these aquatic and terrestrial aspects can be and are integrated will ensure that actions taken to improve the habitat for one biological objective does not prove counter-productive to another desired biological objective. Importantly, it will also demonstrate where implementation of a strategy or strategies will positively address two or more biological objectives whether aquatic and/or terrestrial. This will provide a better basis for selecting priorities and for most effectively implementing the subbasin plan.

In order to address integration, it is valuable to consider the relationships between land management actions and habitat impacts. The species influence diagram presented below is excerpted from *Wildlife Habitat Relationships in Oregon and Washington* (Figure5-1). The diagram displays the relationships between land management actions and the anticipated influence upon habitats, species, and wildlife functions.

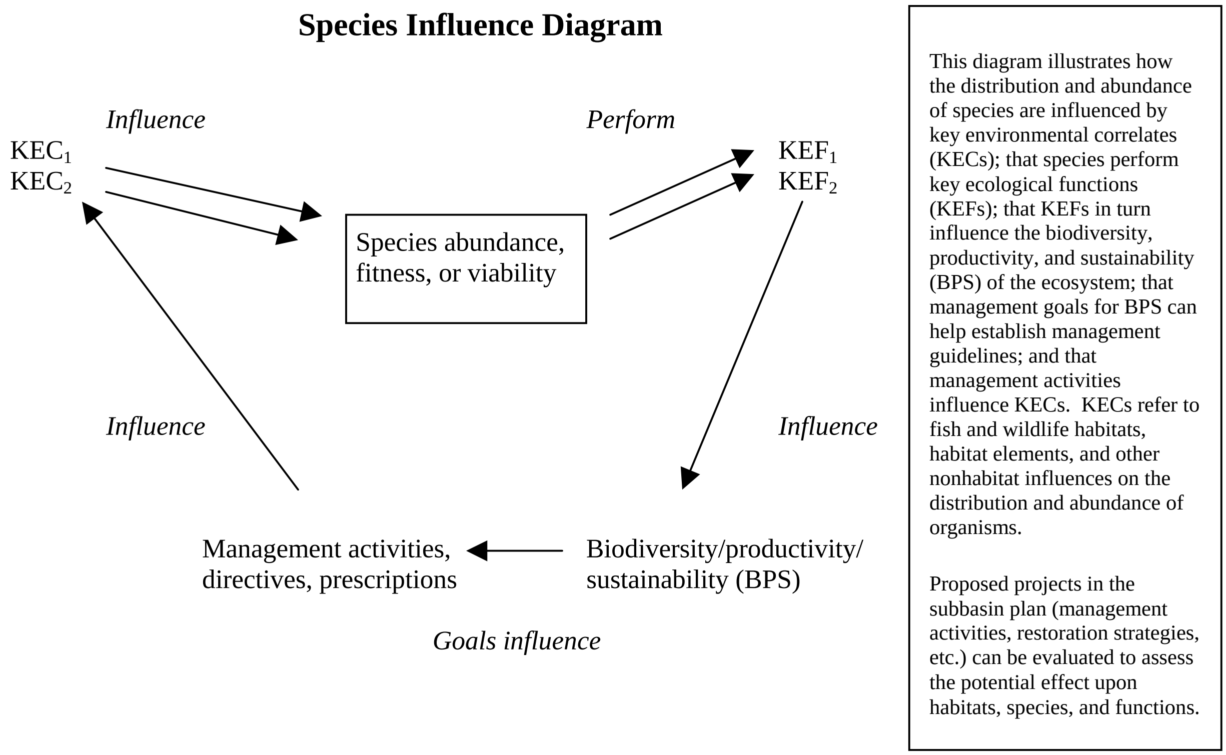

Figure 5-1 Species Influence Diagram
Source: Johnson and O'Neil, 2001.

The framework depicted above is relevant to the subbasin planning process in terms of its potential utility for integrating the aquatic and terrestrial components of the plan. Rather than viewing baseline conditions, impacts, and improvements to one system (aquatic vs. terrestrial), the status of the entire system becomes the subject of study.

As an example, the effects of land management activities upon upland and riparian habitats can be evaluated by linking specific activities to those Key Environmental Correlates (KECs), or habitat features, that are likely to be affected by the action. Based on the anticipated impacts to the habitat, one can infer how fish and wildlife species may be affected. In turn, it then becomes possible to evaluate how the functions performed by those species may be influenced – and thus gain additional insight into the effect of the proposed action on the biodiversity and sustainability of the system as a whole. For example, if planting of vegetation is proposed to occur within a riparian area, it becomes possible to quantify (based on footprint of "alteration" and the use of GIS) the anticipated effect to KECs. Once the effect to KECs is understood, it becomes possible to assess the effects to species that may result from the positive or negative alteration of existing habitats. Based on the changes to the diversity, abundance and fitness of species that may use the site, it becomes possible to understand how Key Ecological Functions (KEFs), or the functions performed by wildlife (e.g. seed dispersal), may change as a result of the proposed activities.

This assessment technique bridges the gap between terrestrial and aquatic systems. In the previous example, if vegetative planting actions are proposed to occur in a riparian area, the footprint of effect can be assessed to determine if changes to KECs (e.g. the growth of woody vegetation to a certain size) may influence the ability of the system to provide KECs that are of importance to aquatic species (e.g. large woody debris). This provides an opportunity to evaluate the relationship between management activities and habitat, from the abiotic and/or habitat forming processes perspective.

5.2 Future Efforts

Currently, efforts are underway to refine the relationships depicted in Figure 5-1 to reflect the contribution of abiotic functions (e.g. habitat forming processes) to the system. An Oregon Department of Transportation group known as the Comprehensive Mitigation/Conservation Strategy team (CMCS)[9] is working through development of this aspect, as it relates to the above diagram and the concept of ecosystem services. The relationships currently being explored between management activities, abiotic processes, and habitats are depicted in Figure 5-2. Further refinement of the specific relationships between management activities and abiotic processes will occur in association with the CMCS throughout the 2004 calendar year.

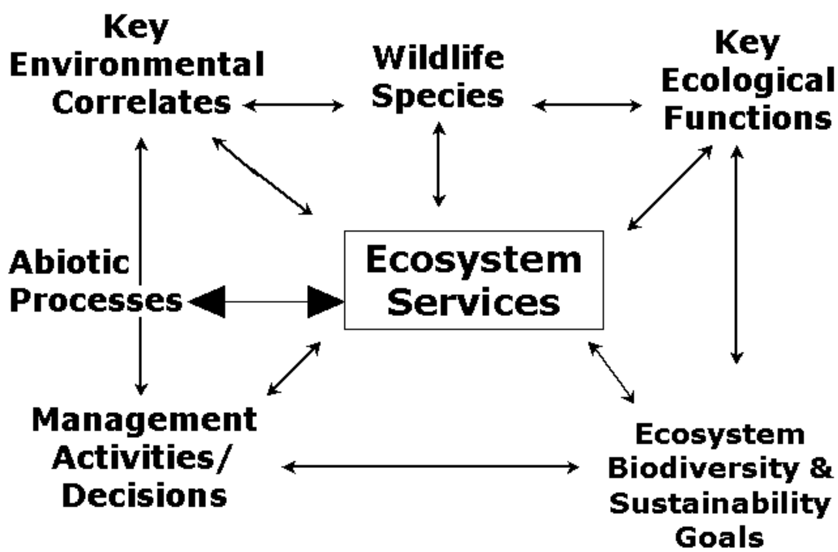

Figure 5-2 Integration of Abiotic Processes (Habitat Forming Processes)
Source: T.A. O'Neil and B. Marcot (2004).

[9] CMCS team members include representatives from ODOT, US Environmental Protection Agency, US Fish and Wildlife Service, US Army Corps of Engineers, NOAA Fisheries, Oregon Department of State Lands, Oregon Department of Fish and Wildlife, Oregon Department of Environmental Quality, Federal Highways Administration, Oregon Watershed Enhancement Board, and the Oregon Governor's Office. The CMCS is staffed by a team comprised of the Northwest Habitat Institute (Tom O'Neil), USDA Forest Service (Bruce Marcot), and Parametrix (Michelle Wilson).

An additional opportunity for integration of the aquatic and terrestrial components of the plan is provided when one examines the relationships between individual species of fish and wildlife. The Northwest Habitat Institute has identified those wildlife species in the region that have a relationship to salmon (pers. com. T.A. O'Neil, 2004). These relationships are based primarily on predator-prey interactions between the wildlife and salmon. A total of sixty-five wildlife species were preliminarily identified as having some relationship to salmonids. Of those species, six have a strong and consistent relationship with salmon; twenty-four have a recurrent relationship with salmon, and seventeen species have an indirect relationship to salmon (Johnson and O'Neil, 2001).

Of the nine focal wildlife species identified in this subbasin plan, the great blue heron is the only one that is identified as having a relationship to salmonids using the above analysis. This analysis will need to be tailored to extend to east-side watersheds, and to model salmon relationships to wildlife, to be useful for this subbasin plan. Regardless, this approach provides an example of how to develop information that can be used to identify benefits accrued to terrestrial habitat-related species through enhancement of aquatic habitat and related species.

The application of this technique can occur on a broad regional scale. It can also be utilized as part of an intense site-specific review, where one considers the impacts of various land management strategies as they apply to the specific site, as well as the entire ecoprovince in which they occur. Future revisions of the subbasin plan could more fully address the integration of the aquatic and terrestrial components by:

- Step 1. Regional Perspective
    - Assessing changes in fish and wildlife habitat (Partially complete)
    - Assessing changes in fish and wildlife species over time (Partially complete)
    - Assessing changes in fish and wildlife functions over time; identification of functional specialists or critical functional link species that need to be addressed (This information would need to be derived from changes in habitat types and changes in species)
- Step 2. Project or Program Tool
    - Assess specific study areas (potential areas of impact/benefit) utilizing field method designed to document KECs (captures habitat elements related to species needs) (Parametrix and NHI, 2004)
    - Identify relationships between specific management/activity proposals and KECs; identify whether proposed activities have a positive, negative, or neutral effect upon the habitats and habitat features of interest
    - Assess the effect of proposed impacts/improvements upon the species of interest
    - Assess the influence of changes to species (resulting from changes to habitat), upon the functions performed by those species; identify whether the changes in function support system goals for biodiversity/sustainability; identify whether the needs of critical functional link species or functional specialists are addressed

- Assess how the proposed program or project activities relate to the broad-scale regional assessment performed in Step 1; determine how the anticipated project/program effects relate to what is happening on a regional basis; determine if the proposed activities support the objectives of the sub-basin plan

While this analysis is currently outside the scope of this document, the approach may provide a potential future step for combining terrestrial and aquatic components of the plan. The true benefit comes in terms of monitoring and adaptive management, as the framework provides a feedback loop for continuous learning and improvement, based on measurable and reproducible results. Incorporation of the compatible EDT information, which can be included as a component of this integrated approach, would provide valuable depth and robustness to the management component of the framework.

5.3 Preliminary Integration

This section describes a very preliminary integration approach for the subbasin plan by identifying preliminary integrated working hypotheses. It is expected that these preliminary integrated working hypotheses will be used to add justification for proposed projects that address aquatic and terrestrial biological objectives identified in Section 7 of this subbasin plan. Simple stated, we anticipate that these hypotheses will be referenced, as appropriate, in project proposals.

The preliminary integrated working hypotheses that follow have been identified by screening the aquatic and terrestrial biological objectives and strategies. This screening looked for areas where benefits potentially will accrue to fish and wildlife species associated with habitats other than those being addressed by the specific aquatic or terrestrial habitat type biological objective and associated strategy. For example, management objective and strategies in terrestrial focal habitat types may also play a direct role in affecting aquatic priority habitats:

- Shading provided by ponderosa pine may keep streams cool
- Ponderosa pine near streams and rivers may ultimately provide large woody debris
- Fully functioning grassland and shrub-steppe habitat may benefit aquatic habitat by decreasing erosion and sedimentation.

In addition, indirect effects from terrestrial management objectives and strategies include the addition of KEFs that may also impact aquatic habitats and aquatic species. For example, as ponderosa pines grow in diameter from saplings (under one inch in diameter) to large trees (20 to 29 inches in diameter) the number of bird species associated with the habitat types increase from one species to 52. Moreover, the species compositions change during this process. Large trees are more likely to support piscivorous birds than smaller trees. The larger trees provide more suitable habitat for great blue herons, osprey, bald eagles, common mergansers, and hooded mergansers. Depending on the bird species, their presence may be detrimental to the focal fish species by directly preying on these fish or by competing for the same food sources. Conversely, the piscivorous birds may be beneficial to the focal fish species by consuming competitor and predatory species.

It is much more likely that terrestrial habitat improvements will have a direct effect on salmonid focal species and habitat than it is that aquatic habitat improvements will have a direct effect in terrestrial habitats and species. Except for increased riparian vegetation identified in the aquatic habitat objectives and strategies, these objectives and strategies tend to be focused on in-water structural conditions that do not directly impact many terrestrial habitat and species. However, many indirect, secondary impacts to terrestrial species may occur as a result of better aquatic habitat. For example, increased numbers of salmonids translates to increased numbers of terrestrial predators and scavengers, such as the great blue heron, bald eagle, and black bear. In addition, more properly functioning substrate and nutrient loads may increase aquatic insect populations, resulting in more food for terrestrial insectivores such as the yellow warbler. Effects on other wildlife species including most of the focal terrestrial wildlife species would be from tertiary relationships. For example, increased nutrient cycling may increase prey items for flammulated owls and great blue herons and browse for mule deer and elk. The effects of these structural improvements will likely decrease to a greater extent as the distance from enhanced streams increases.

Preliminary integrated working hypotheses are presented below that integrate terrestrial and aquatic biological objectives and strategies.

Preliminary Integrated Working Hypotheses

Hypotheses based on Aquatic Biological Objectives that Influence Terrestrial Habitat and Related Wildlife:

- Biological objectives and associated strategies that address “riparian function” for aquatic species will provide benefits for terrestrial species in the “riparian/riverine wetlands” terrestrial habitat type.
- Biological objectives and associated strategies that result in increased returns of adult salmonids will positively influence wildlife species because of the increased food resources for scavengers and predators such as bald eagles, osprey, and black bear.
- Biological objectives and associated strategies that result in increased returns of adult salmonids will positively influence wildlife species because increased nutrient cycling benefits aquatic macroinvertebrates that are preyed on by wildlife species.
- Biological objectives and associated strategies that reduce turbidity, percent fines, and embeddedness will benefit wildlife species by increasing survivorship of their prey species (fish and invertebrates). Decreased turbidity will also increase the visibility of prey species to terrestrial predators.
- Biological objectives and associated strategies that increase riparian vegetation quality will benefit wildlife by providing habitat for nesting, foraging, and cover.
- Biological objectives and associated strategies that result in setback of roads from streams to help improve water quality and stream stability will benefit riparian-associated species by decreasing disturbance from passing vehicles.

Hypotheses based on Terrestrial Biological Objectives that Influence Aquatic Habitat and Related Fish Species:

- Biological objectives and associated strategies that result in taller, larger trees that will increase shading of streams will create better habitat for salmonids.
- Biological objectives and associated strategies that increase the number of medium trees or larger (15+ inches in diameter) will increase the amount of large woody debris in streams, which positively influence salmonids.
- Biological objectives and associated strategies that decrease spraying for detrimental insects will result in increased survival of beneficial adult insects that complete their larval stage in streams, e.g., mayflies and caddisflies, and of aquatic macroinvertebrates in general. Increased survivorship of adult and larval insects will positively influence insectivorous fish species.
- Biological objectives and associated strategies that address overgrazing and destruction of cryptogrammic crusts will decrease erosion and resulting sediment loading in streams, which will benefit salmonids.
- Biological objectives and associated strategies that enhance upland habitat through programs such as CRP or techniques such as construction of sediment basins and upland terraces will benefit aquatic species by decreasing sedimentation, turbidity, and embeddedness.

6. Inventory of Existing Programs and Projects

6.1 Programmatic Activities

This chapter outlines both recently completed and ongoing projects within the Lower Snake subbasin and identifies the main programs that are in effect. The intent is to provide a picture of what has been happening within the subbasin that will be useful in guiding decisions about project implementation in the future. The information presented here is a summary of the aquatic and terrestrial permits, management plans, and projects that are described in the Washington Department of Fish and Wildlife (WDFW) and Lower Snake Inventory Assessment (see Appendix F).

There are a variety of ongoing programmatic activities in the state of Washington that have the potential to improve both aquatic and terrestrial habitat and address limiting factors in the Lower Snake subbasin. These programmatic activities are summarized in Table 6-1 below. This is not meant to be a comprehensive list of all existing activities. More details may be found in the WDFW Lower Snake Inventory Draft (Appendix F) and the Lower Snake Creek Subbasin Summary (NPPC 2001).

Table 6-1 Programmatic Activities within the Lower Snake Subbasin

Administering Agency	Regulation/Program	Intent
The Northwest Power and Conservation Council (NWPCC)	1980 Northwest Electric Power Planning and Conservation Act	Protect, mitigate and enhance fish and wildlife of the Columbia River Basin that have been impacted by hydropower dams
USFWS/NOAA	Endangered Species Act (ESA)	Protect endangered or threatened species from actions that may result in harm or death to the species
US Army Corps of Engineers	USACE 404 Permits and Section 10 Permits	Protect aquatic life and water resources; requires a permit when locating a structure, excavating, or discharging dredged or fill material in waters of the United States or transporting dredged material for the purpose of dumping it into ocean waters
Washington Department of Ecology (WDOE)	Total Maximum Daily Load (TMDL) Program	Bring 303(d) listed streams into compliance with state water quality standards
WDFW	Hydraulic Code and Hydraulic Code Rules	Protect fish life and habitat areas; regulate hydraulic projects that affect the flow or channel bed of any waters of the state
Washington Department of Transportation (WADOT)	Road maintenance/ transportation - RCW 77.55.060	Mitigate for fish passage barriers by regulating dam construction or construction of other features which obstruct fish passage
Cities and counties, with technical assistance from Department of Community, Trade, & Economic Development	Growth Management Act (GMA) – RCW 30.70A	Plan for and control growth in natural resource and critical areas for fish and wildlife
Cities and counties, with technical assistance from Dept of Ecology	Shoreline Management Act (SMA) – RCW 90.58	Protect and regulate shoreline environmental resources and uses

Administering Agency	Regulation/Program	Intent
Department of Ecology and local planning units (involves collaboration with local government, tribes, and public citizens)	Watershed Planning Act – RCW 90.82	Integrated protection and management of watersheds through voluntary, collaborative plans; primary focus is on instream flows and water quantity with optional components of water quality and habitat
Nez Perce Tribe	The Wy-Kan-Ush-Mi Wa-Kish Wit: Spirit of the Salmon	To restore anadromous fish populations in the Columbia Basin above the Bonneville Dam. This long-term restoration plan consists of both institutional and technical recommendations to address factors contributing to the decline of aquatic species, including support of cultural values.

Source: Derived in part from Appendix F.

Table 6-2 presents a variety of USDA programs that deal primarily with protection, restoration, and enhancement of fish and wildlife habitat. For more detailed descriptions concerning the operation of these programs, refer to Appendix F.

Table 6-2 USDA Programs Targeting Habitat Enhancement

Program	Purpose	Additional information
Conservation Reserve Program (CRP)	Remove highly erodible land from agricultural production and planting cover crops to increase wildlife habitat	Voluntary program for private landowners involving a 10-year contract and installation and annual payments
Continuous Conservation Reserve Program (CCRP)	Restore riparian habitat and improve water quality	Voluntary program for private landowners involving a 10-15 year contract and installation and annual payments
Conservation Reserve Enhancement Program (CREP)	Protect and restore agricultural land and riparian habitat by removing land from production	Voluntary program for private landowners involving a 10-15 year contract, rent, incentive and maintenance payments, and cost-sharing for installation
Wildlife Habitat Incentive Program (WHIP)	Restore and enhance fish and wildlife habitat on private lands	Voluntary program for private landowners; includes both financial and technical assistance from NRCS
Wetland Reserve Program (WRP)	Restore, create, protect, and enhance wetlands	Voluntary program for private landowners, who may participate in restoration cost-sharing or establish conservation easements on their land
Environmental Quality Incentives Program (EQIP)	Address soil, water, and related natural resource concerns on private lands in an environmentally beneficial and cost-effective manner	Voluntary program targeting farmers and ranchers; technical and financial assistance provided by NRCS, esp. for implementing land management practices such as nutrient management, pest management, and grazing land management
The Public Law 566 Small Watershed Program (PL 566)	Improve watershed conditions	Local organizations can seek funding from NRCS and other federal, state, and local funds

Note: All programs in the above table are implemented through the cooperative efforts of the USDA-Natural Resources Conservation Service (NRCS), Farm Service Agency (FSA) and local Conservation Districts.
Source: Appendix F.

In addition to the programmatic activities described above, a wide range of federal, state, tribes and local agencies and other organizations are involved in protecting and restoring habitat within the Lower Snake subbasin. Table 6-3 summarizes a subset of these organizations that are responsible for managing or implementing programs and projects with the greatest effect on protecting and improving habitat. More detailed discussion of the various responsibilities of these entities can be found in Appendix F and the Lower Snake Subbasin Summary (NPPC 2001).

It is important to note that the Pomeroy Conservation District plays a key role in the subbasin, providing significant support in the planning, design, and implementation of the majority of programs and projects to enhance fish and wildlife habitat throughout the majority of the subbasin. In addition, it is also the primary conduit for funding to local landowners participating in habitat improvement activities. The Whitman and Palouse Conservation Districts play a similar role in smaller portions of the subbasin.

Table 6-3 Agencies and Organizations Involved in Habitat Enhancement in the Lower Snake Subbasin

Agency	Purpose	Activities
Federal		
US Forest Service; Pomeroy Ranger District (PMD)	Achieve quality land management under the sustainable multiple-use management concept to meet the diverse needs of people	Implementation of a range of management plans and strategies designed to better manage forestlands and improve fish and wildlife habitat. Examples include: Umatilla National Forest Plan, Land and Resource Management Plan, and the Upper Charley Subwatershed Ecosystem Restoration Projects Environmental Impact Statement
Tribal		
Nez Perce Tribe (NPT)	Manage, protect, and enhance treaty fish and wildlife resources for future generations	Restoration and mitigation activities
State		
WDFW	Protect and restore fish and wildlife habitat	Support of a range of habitat improvement programs: Habitat Development Program, Upland Restoration Program, and Priority Habitats and Species Program. Manages the W.T. Wooten Wildlife Area and provides resources for property acquisition.
WDOE	Protect, preserve, and enhance Washington's environment and promote the wise management of air, land, and water for the benefit of current and future generations	Establishment of regulatory standards for water quality; water quality monitoring; management of water resources, instream flow rule development, shoreline, floodplain, wetlands, and watersheds
Washington State Conservation Commission (WCC)	Protect, conserve and enhance the natural resources of the state; encourage conservation stewardship	Support for conservation districts, funding for natural resource projects, grants to support environmental improvements
Washington Department of Natural Resources (WDNR)	Manage state land; monitor and enforce logging regulations on private lands	Land acquisition

Agency	Purpose	Activities
Local		
Pomeroy, Palouse, and Whitman Conservation Districts	Assist in watershed planning and implementation; assists private landowners with adoption of best management practices (BMPs) to improve natural resources	Noxious weed control, erosion control, USDA program implementation, and other activities.
Columbia County Weed Board	Control noxious weed infestations which threaten wildlife habitat through biological, chemical, and mechanical/hand control strategies	Cost share programs, restoration demonstration projects
County Government	Enhance fish and wildlife habitat	Local regulations include: shorelines master program, county zoning ordinance, flood damage prevention ordinance, critical areas ordinance
Agricultural Community	Protect and enhance private lands	BMPs to reduce erosion, control noxious weeds
Other		
Rocky Mountain Elk Foundation (RMEF)	Protect and enhance grassland and riparian wetland habitats	Noxious weed control; land acquisition and conservation

Source: Appendix F and (NPPC 2001).

6.2 Species Protection, Plans, and Permits

This section reviews specific aquatic and terrestrial programs within the subbasin that affect species and their habitats.

6.2.1 Aquatic Species Protection, Plans, and Permits

There are several programs operating within the Lower Snake subbasin whose main focus is on the protection of aquatic species and their habitat. The brief descriptions below give the basic background and purpose of each program. This is not a comprehensive list of existing programs, but rather a selection of those that have the greatest potential to influence the status of aquatic species and their ecosystems.

The Snake River Salmon Recovery Plan is currently being developed to protect and restore listed Snake River salmon stocks and improve the overall health of the Snake River ecosystem. The Washington portion of the plan is guided by the Snake River Regional Salmon Recovery Board, which is made up of community, business, government, and tribal representatives (http://www.snakeriverboard.org/). The plan aims to restore salmon populations by addressing the “4 H’s:” habitat, hatchery, harvest, and hydropower.

Water quality is an integral part of maintaining watershed health. Section 303(d) of the Clean Water Act (CWA) established the Total Maximum Daily Load (TMDL) program, which seeks to identify sources of pollution in 303(d) listed streams and develop plans to improve water quality and bring these streams into compliance. There are 303(d) listings in the Lower Snake subbasin for temperature, dissolved oxygen, and total dissolved gas. There are currently TMDLs for dissolved gas and there may be additional TMDLs developed in the future. For more information about the TMDL program in Washington, refer to the Department of Ecology's website: http://www.ecy.wa.gov/programs/wq/tmdl. Water quality issues continue to be addressed in the Lower Snake subbasin both through the TMDL process and via the implementation of independent projects implemented by local watershed groups.

Hatchery production of salmon was initiated in the Columbia River Basin in the late 1800s. The original purpose was to maintain commercially harvestable numbers of salmon. More recently, hatcheries have also been used to supplement declining wild populations of salmonids. In 1998 (U.S. Senate Energy and Water Development Appropriation Bill, 1998, Report 105-44), Congress directed the Northwest Power and Conservation Council to conduct a review of all of the artificial production programs within the Columbia basin. These Artificial Production Review and Evaluation (APRE) reports evaluate: the purpose of each hatchery program, success in meeting established objectives, and the benefits and risks associated with the program. In addition, NOAA is developing hatchery genetic management plans (HGMPs) under the Columbia River Hydropower Biological Opinion. HGMPs are detailed plans specifying how hatcheries are to be managed and operated. Both APRE reports and HGMPs for the Lower Snake subbasin may be viewed online at: http://www.apre.info/APRE/home.jsp.

There are currently two hatchery programs operating within the Lower Snake subbasin:

- Fall Chinook - Integrated
- Summer Steelhead (Lyons Ferry) Hatchery

Current harvest regulations in the subbasin are intended to protect steelhead and Chinook species. As noted in WDFW Lower Snake subbasin Aquatic Assessment (Appendix B), "Descriptions of fisheries and their estimated effects on listed species of fish in the Snake River basin are discussed in the WDFW Fishery Management and Evaluation Plan (FMEP) for the incidental Take of listed species in the Snake River submitted under ESA Section 10/4d (submitted to NOAA-fisheries on Dec. 2, 2002)." The WDFW FMEP may be viewed online at: http://www.nwr.noaa.gov/1fmep/proposed/SnakeRiverWDFW_FMEP.pdf. In addition, state harvest regulations for sport fisheries are listed on WDFW's website: https://fortress.wa.gov/dfw/erules/efishrules/index.jsp.

The Nez Perce tribe also has treaty harvest rights within the subbasin. The following detail regarding tribal harvest rights was provided by the Nez Perce Tribe, and has not been reviewed by the Subbasin Planning Team:

"The Nez Perce Tribe has usual and accustomed fishing locations not only within that portion of the 13,204,000 acres that have been found to been exclusively used and occupied by the Tribe including the major portions of the Snake, Salmon and Clearwater Rivers and their drainages situated in three states-Washington, Oregon, and Idaho [see Figure 6-1], but there are many Nez Perce usual and accustomed fishing sites located beyond that aboriginal territory as well. The best example of that is represented by the rights the Nez Perce Tribe to fish pursuant to treaty rights at usual and accustomed fishing areas in the lower Columbia River as determined by the U.S. v. Oregon litigation.

Salmon and other migratory fish species are an invaluable food resource and an integral part of the Nez Perce Tribe's culture. Anadromous fish have always made up the bulk of the Nez Perce tribal diet and this dependence on salmon was recognized in the treaties made with the Tribe and the United States. In 1855, representatives of the United States government negotiated a treaty with the Nez Perce in which the Tribe expressly reserved:

> The exclusive right of taking fish in all the streams where running through or bordering said reservation is further secured to said Indians; as also the right of taking fish at all usual and accustomed places in common with citizens of the Territory; and of erecting temporary buildings for curing, together with the privileges of hunting, gathering roots and berries, and pasturing their horses and cattle upon open and unclaimed land (12 Stats., 957-Article 3). Treaty of 1855.

Thus, the legal, historic, economic, social, cultural, and religious significance of the fish to the Nez Perce Tribe continues to this day, which makes the decline of fish populations in the Snake River Basin a substantial detrimental impact to the Nez Perce way of life.

The Nez Perce Tribe has what might be deemed near exclusive jurisdiction to regulate tribal members exercising treaty reserved fishing rights at all off reservation, usual and accustomed locations in the Snake River Basin. As a general rule, state jurisdiction within Indian Country is preempted both by federal protection of tribal self-government and by federal treaties and statutes on other subjects relating to Indians, tribes, their property and federal programs.

The Nez Perce Tribe's Department of Fisheries Resource Management has a Harvest program whose purpose is to provide fisheries harvest management plans, evaluations and assessments (e.g. Endangered Species Act Biological Assessments, Tribal Resource Management Plans, co-manager coordination and harvest documentation) necessary to procedurally implement treaty reserved fishing rights. Harvest monitoring activities are enormous in scope, encompassing fishing conducted year-round from the mainstem Columbia River (Zone 6) up to the headwaters of the Clearwater River on the Montana/Idaho border. Within this area, the Tribe has the reserved right to access fully 50% of the fish available for harvest. The Snake River Basin fisheries proposed by the Nez Perce Tribe have been grouped into six separate geographic management units within the Treaty of 1855 Reservation boundary where ceremonial, subsistence, and commercial fisheries have historically occurred for the Tribe: 1) Mainstem Snake River (includes Lower Snake and Lower Snake tributaries); 2) Lower Snake River Subbasin; 3) Clearwater River Subbasin; 4) Salmon River Subbasin; 5) Grande Ronde River Subbasin, and 6) Imnaha River Subbasin. The Tribe is responsible for developing the plans necessary to insure that proposed harvest is biologically and legally sound and that it occurs (i.e. take numbers, locations, dates and gear types) in the manner designed."

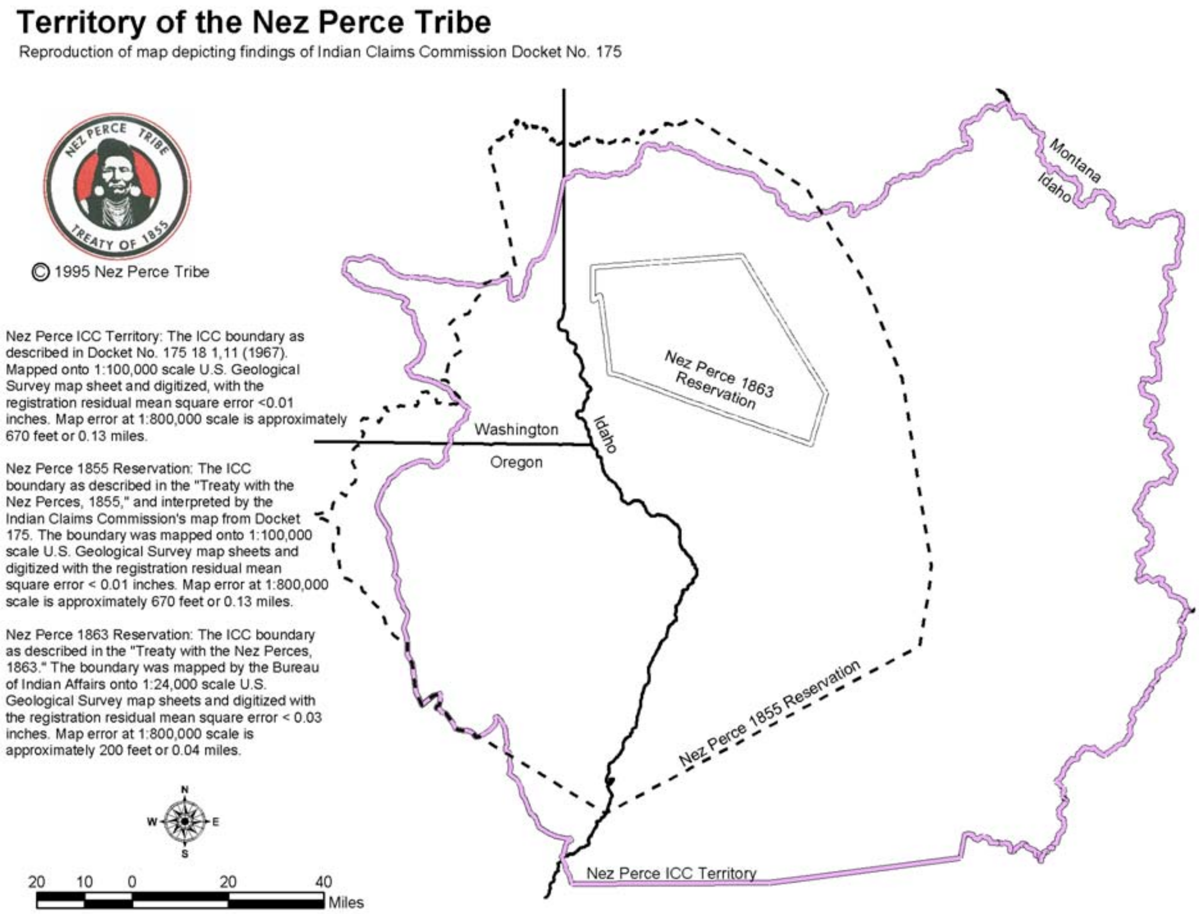

Figure 6-1 Nez Perce Ceded Territory and Reservation Land

Source: Nez Perce Tribe 2002.

6.2.2 Terrestrial Species Protection, Plans, and Permits

There are a few species of interest that are actively managed and monitored by WDFW in the Lower Snake subbasin. These include the Rocky Mountain elk and mule deer.

According to RCW 77.04.012, WDFW "shall preserve, protect, perpetuate, and manage the wildlife…" and "attempt to maximize the public recreational game fishing and hunting opportunities of all citizens…" WDFW has produced an overall Game Management Plan to outline its process for managing and sustaining species populations (WDFW 2003).

In addition, the Blue Mountains Elk Herd Management Plan was written to provide information and direction to management of elk in southeast Washington. Primary goals of this plan include:

“ (1) to manage the elk herd for a sustained yield; (2) to manage elk for a variety of recreational, educational and aesthetic purposes including hunting, scientific study, cultural and ceremonial uses by Native Americans, wildlife viewing and photography; and (3) to preserve, protect, perpetuate, manage and enhance elk and their habitats to ensure healthy, productive populations.” (WDFW 2001). This plan also contains a background and history of elk population issues, as well as specific objectives and management strategies. There have already been a number of projects aimed at improving elk habitat and resulting from collaboration between various entities such as WDFW, USFS, the Rocky Mountain Elk Foundation, and the Blue Mountain Elk Initiative. These projects are listed in Appendix 7 of this plan (WDFW 2001).

WDFW administers other programs aimed at improving habitat for terrestrial species. The Priority Habitats and Species (PHS) program provides detailed information on priority species and habitats that need to be targeted for management and conservation efforts and where these are located, along with specific management recommendations. This information is used by federal, state, local, and tribal governments, as well as other conservation and resource-oriented organizations in planning and ecosystem management. The PHS is described in detail online at: http://www.wdfw.wa.gov/hab/phspage.htm. WDFW’s Upland Restoration Program is a voluntary, incentive-based program designed to encourage farmers and private landowners to improve fish and wildlife habitat by implementing water conservation measures, planting vegetation to decrease erosion, and applying other more environmentally sound agricultural practices.

There are several initiatives designed to address declining bird populations. The Partners In Flight (PIF) program began in 1990 and is focused on the conservation of bird species not listed under ESA. This program consists of partnerships among federal, state and local government agencies, NGOs, and private organizations and has laid the foundation for the development of bird conservation plans (BCPs) across the U.S A more detailed description can be viewed online at: http://www.partnersinflight.org/. Another program is the North American Breeding Bird Survey-BBS, a joint initiative between the US Geological Survey and Canadian Wildlife Service to monitor population trends of migratory birds in North America. Each year, thousands of volunteers across the continent collect data, which is then compiled and analyzed by professionals and made available as reports online at: http://www.mp2-pwrc.usgs.gov/bbs/index.html.

6.3 Restoration and Protection Projects

This section describes and analyzes specific habitat enhancement projects that have been completed in the subbasin.

6.3.1 Aquatic Habitat Restoration and Protection Projects

The EDT analysis and inventory for the Lower Snake subbasin are focused on two streams: Deadman and Almota Creek (see chapter 3). During the past several years, a number of projects focused on enhancing water quality and infiltration in Deadman Creek have been implemented by various entities within the Lower Snake subbasin (see Appendix F). A comprehensive list of these projects was compiled and incorporated into the Lower Snake Inventory. Information on each project includes (where available): category (e.g. riparian, upland), application description, name, environmental attributes addressed, limiting factors addressed, units completed, completion data, map name and number, township, range, and section, watershed, EDT reach name, and species affected.

Available information indicates that projects on Deadman Creek focused on a variety of issues, shown in Table 6-4. Data indicate only one project completed on Almota Creek.

Table 6-4 Summary of Habitat Effort Deadman Creek Watershed, 1996 to Present

Practice	Number	Units
2 pass seeding	2,809	Acres
Direct Seed	2,002	Acres
Fencing	12,697	Feet
Grasses and Legumes in Rotation	113	acres
No-till seeding	8,552	acres
Pasture and Hayland planting	15	acres
Sediment Basins	54,270	cyds
Strip Cropping	1,073	acres
Subsoiling	3,878	acres
Terraces	80,734	feet
Grassed Waterways	23,866	feet

Source: Table 3, Appendix F.

The Level 2 Diagnosis and Project Inventory (Appendix F) for the Lower Snake subbasin identified the top limiting factors for steelhead in Deadman Creek as turbidity, maximum temperature, woody debris, riparian function, anthropogenic confinement, embeddedness, low flow, and fine sediment. For Almota Creek, the top limiting factors for steelhead are woody debris, fine sediment, riparian function, anthropogenic confinement, low flow, embeddedness, turbidity and high flow. The aquatic assessment identified two additional important limiting factors: pools and bed scour (see chapter 3).

From an ongoing management perspective, it is important to understand whether projects implemented within the subbasin have focused on geographic areas and limiting factors critical to the restoration and enhancement of fish and wildlife habitat. The extent to which these factors have been addressed may determine future restoration priorities and strategies. Table 6-5 shows the allocation of project effort for each high priority restoration/protection geographic area and among the key limiting factors in the Deadman Creek reaches. Project effort is expressed as total “hits.” The term “hit” refers to the particular environmental attribute that is being affected by a given project (e.g. sediment, water temperature, embeddedness, etc.) Although some projects may target a particular environmental attribute, in actuality, they may have a positive influence on a range of environmental attributes. For example in their project inventory, WDFW notes that a riparian project produces beneficial effects on fine sediment, riparian function, maximum and minimum temperature, turbidity and woody debris. These beneficial effects are referred to as "hits." For the projects implemented in Deadman, there were a total of 360 "hits," or environmental factors that were addressed (see Appendix F).

Table 6-5 Efforts Directed at Specific Environmental Attributes Identified as Limiting Factors in Priority Geographic Areas, Lower Snake Subbasin Since 1996

	Limiting Factor								
High Priority Restoration/ Protection Reaches	**Bed Scour**	**Confinement**	**Embeddedness**	**Fine Sediment**	**Low Flow**	**Maximum Temperature**	**Pools**	**Riparian Function**	**Woody Debris**
Deadman Creek (Ping-forks)			□	□	□	□			
Deadman Creek, Lynn Gulch Cr to confluence of NF & SF Deadman Creek	No habitat restoration effort completed since 1996								
Deadman Creek (SF Deadman)			■	■	■	■			
Almota Creek reaches	No information was available for these areas								
Penawawa Creek reaches									
Alpowa Creek reaches									

Source: Table information originated from Appendix F.
Key (see Figure 2, Appendix F for numeric values).
■ = High level of habitat restoration effort
□ = Low-Moderate level of habitat restoration effort
Empty Cell = No habitat restoration effort completed since 1996

Table 6-5 indicates that the SF Deadman Creek was the area most intensely targeted for project work. It also ranks the highest for both restoration and protection (see chapter 3). Data also indicate that certain limiting factors (embeddedness, fine sediment, low flow, and maximum temperature) were the focus of project effort, while bed scour, confinement, pools, riparian function, and woody debris were not addressed.

Finally, it is important to consider that certain types of projects often do not yield measurable benefits until several years to several decades after their implementation. For example, the effects of planting trees and revegetating stream banks to reduce instream water temperature may not be evident until this vegetation matures enough to provide effective shade to the stream. Placing LWD in streams also takes time for sediment build-up to occur and pools to develop. Thus, riparian and LWD placement projects may provide more extensive benefits than what has been currently noted in the aquatic assessment (see Chapter 3). It is difficult to accurately judge the effectiveness of habitat enhancement projects because of this temporal disjunction. In addition, because some projects do produce more immediate benefits, some aspects of the environment and habitats may have improved over time. Consequently, it may be necessary to adjust future goals, objectives, and strategies to address constantly changing environmental conditions (Appendix F).

6.3.2 Wildlife Habitat Restoration and Protection Projects

The riparian projects identified in the previous section also benefit those terrestrial species relying on riparian habitat. Additionally, the Blue Mountain Elk Plan contains a list of projects relating to improving elk habitat (Appendix G). The Game Management Plan written by WDFW contains details about current research relating to individual species of interest in the subbasin (WDFW 2003).

7. Management Plan

As the core of the subbasin plan, the management plan contains the direction in which the subbasin needs to proceed in the future regarding enhancement of aquatic and terrestrial habitats over the next 10 to 15 years. It provides testable hypotheses, measurable objectives, and implementable strategies formulated upon the geographic priorities, biological priorities, and current conditions provided in the assessment and inventory. Following are the key components of the Lower Snake Subbasin Management Plan provided in this chapter:

- Vision and Guiding Principles
- Management Plan Components and Prioritization
- Aquatic Habitats
    - Aquatic Working Hypotheses and Biological Objectives
    - Aquatic Strategies
    - Imminent Threats and Passage Barriers
    - Priority Restoration Area Strategies
    - Priority Protection Area Strategies
    - Bull Trout
    - Aquatic Strategy Special Topics
    - Numeric Fish Population Goals
    - Objectives Analysis
- Terrestrial Habitats
    - Terrestrial Working Hypotheses and Objectives
    - Terrestrial Strategies
    - Terrestrial Special Topics – Agriculture as a Cover Type of Interest
- Research, Monitoring and Evaluation

The various components of the Lower Snake Subbasin Management Plan described in this chapter have been developed from information presented in the assessment and inventory. Chapters 3 and 4 of this document, the aquatic and terrestrial assessments, provide the primary supporting background information used to develop the management plan. Chapter 6, the inventory, also contributed to the management plan by identifying specific areas where projects have occurred, and areas (geographical and biological) that remain in need of further work. This plan is intended to be implemented by landowners, conservation districts, agencies, tribes, and others that possess the appropriate responsibilities and authorities. Where possible, this is expected to occur on a voluntary basis, using BPA and other available funding sources.

Although the management plan components are based upon individual species and their habitats, none of these ecosystem components function independently. Strategies implemented to enhance species populations or habitats can impact other species in positive or negative ways and will have social, political, and economic implications.

Social, economic, and political factors in the Lower Snake Subbasin will be important considerations in determining the success of this management plan. A large proportion of strategies rely upon the cooperation of private landowners and their communities. As mentioned in the subbasin vision statement below, the social, cultural, and economic well-being of communities within the subbasin and the broader Pacific Northwest is an ultimate goal. Such factors were considered during the comparison of alternative strategies and will play a significant role in determining which strategies are ultimately implemented. Incorporating these considerations along with directives provided by the scientific assessment have provided the greatest opportunity for this subbasin plan to successfully enhance aquatic and terrestrial wildlife and their habitats.

7.1 Vision and Management Plan Components

7.1.1 Vision

The vision provides general guidance and priorities for the long-term future of the subbasin. The vision describes the common desired future condition of the subbasin. The vision is qualitative and should reflect the policies, legal requirements and local conditions, values and priorities of the subbasin in a manner that is consistent with the vision described for the Columbia Basin in the Council's program. The vision will provide the guidance and priority for implementing actions in the future, therefore driving the development of biological objectives and strategies for the subbasin (NWPCC 2001).

The following vision statement and guiding principles for the Lower Snake Subbasin were developed and approved by the Subbasin Planning Team through discussion with the WRIA 35 Planning Unit providing public review. Note that the Subbasin Planning Team includes representatives from the lead (Pomeroy Conservation District) and co-lead (Nez Perce Tribe).

The vision for the Lower Snake Subbasin is a healthy ecosystem with abundant, productive, and diverse populations of aquatic and terrestrial species that supports the social, cultural and economic well-being of the communities within the Subbasin and the Pacific Northwest.

Guiding Principles

Respect, recognize, and honor the legal authority, jurisdiction, treaty-reserved rights, and all legal rights of all parties.

Protect, enhance, and restore habitats in a way that will sustain and recover native aquatic and terrestrial species diversity and abundance with emphasis on the recovery (de-listing) of Endangered Species Act listed species.

Enhance species populations to a level of healthy and harvestable abundance to support tribal treaty and public harvest goals.

Foster ecosystem protection, enhancement, and restoration that result in ridgetop-to-ridgetop stewardship of natural resources, recognizing all components of the ecosystem, including the human component.

Provide information to residents of the Asotin, Tucannon, and Lower Snake Subbasins to promote understanding and appreciation of the need to protect, enhance, and restore a healthy and properly functioning ecosystem.

Provide opportunities for natural resource-based economies to recover in concert with aquatic and terrestrial species.

Promote and enhance local participation in, and contribution to, natural resource problem solving and subbasin-wide conservation efforts.

Assist in efforts to coordinate implementation of the Pacific Northwest Electric Power Planning and Conservation Act, the Endangered Species Act, the Clean Water Act, and other local, state, federal, and tribal programs, obligations, and authorities.

Coordinate and support planning efforts to eliminate duplication that results in prioritized protection, enhancement, and restoration projects in strategic areas.

Develop a scientific foundation, for diagnosing biological problems, for designing and prioritizing projects and for monitoring and evaluation to guide improving management to better achieve objectives.

7.1.2 Management Plan Components and Prioritization

The management plan consists of three primary components: working hypotheses, biological objectives, and strategies.

Working Hypotheses

Working hypotheses are statements regarding the identified limiting factors for aquatic species and terrestrial habitats. The limiting factors incorporated into the working hypotheses were those identified in the aquatic and terrestrial assessments (see Chapters 3 and 4, respectively). Working hypotheses are intended to be testable, in that future research and monitoring will enable evaluation of the accuracy of the working hypotheses. Hypotheses for aquatic species were developed at the level of life history stages for individual species in geographic areas that are priorities for restoration. Terrestrial working hypotheses were established for priority habitats. Although anadromous fish species and some terrestrial wildlife species are limited by out-of-subbasin factors such as migration success, in-subbasin factors related to habitat quantity, quality, complexity and connectivity were the focus of the working hypotheses.

Biological Objectives

Biological objectives are specific, measurable objectives for selected habitat components. Establishment of biological objectives will allow subbasin planners to track progress toward decreasing the impacts of the limiting factors identified in the working hypotheses. Consistent with Council guidance for development of subbasin plans, quantitative biological objectives were established developed wherever sufficient data and information was available to support development of such. Biological Objectives were developed within the context of EDT and with the EDT attributes' numerical ranking cutoff criteria in mind. In the absence of sufficient data and/or information, subbasin planners established developed objectives based upon a desired trend (e.g. Show downward trend in summer maximum water temperatures). In these areas, the gathering of such information was typically identified as a strategy. Both quantitative and qualitative objectives are measurable, provided that baseline information exists, to allow demonstration of progress. Reference reach analyses to determine attribute potentials was not possible within budgetary and temporal constraints All biological objectives were developed by technical staff, reviewed and modified by the public as appropriate, with a limited set of assumptions and a 10 to 15 year planning horizon. Biological objectives are specific, measurable objectives for selected habitat components. Establishment of biological objectives will allow subbasin planners to track progress toward decreasing the impacts of the limiting factors identified in the working hypotheses. Consistent with Council guidance for development of subbasin plans, quantitative biological objectives were established wherever sufficient data and information was available to support development of such. In the absence of sufficient data and/or information, subbasin planners established objectives based upon a desired trend (e.g. show downward trend in summer maximum water temperatures). In these areas, the gathering of such information was typically identified as a strategy. Both quantitative and qualitative objectives are measurable, provided that baseline information exists, to allow demonstration of progress. All biological objectives were developed by technical staff, them then reviewed and modified by the public as appropriate, with a limited set of assumptions and a 10 to 15 year planning horizon.

Strategies –General

Strategies identify the specific types of actions that can be implemented to achieve the biological objectives. After development of the working hypotheses and biological objectives, preliminary strategies were developed with the technical team. These were then reviewed and revised with joint meetings of technical staff and the public at Aquatic Management Plan Workshop 1, Aquatic Management Plan Workshop 2, and the Terrestrial Management Plan Workshop. Significant revisions to the strategies occurred at these workshops. These joint meetings of technical staff and the public were key to ensuring that strategies ultimately were both technically sound and consistent with public needs. Where received, written comments from the public were also used to revise the strategies.

Discussion of Land Acquisition Strategies

Land acquisition was identified and discussed extensively (in its various forms, e.g. fee simple title, conservation easements, and long-term leases) as an aquatic and terrestrial habitat protection strategy in the subbasin plan development process. Local stakeholders have been unable to reach consensus on inclusion of fee simple title land acquisition as a strategy. Conservation easements and long-term leases are supported aquatic and terrestrial strategies.

Hence, fee simple title land acquisition was deleted as strategy from the terrestrial and aquatic management plan sections, and majority and minority reports on the topic are provided in Appendix H. The appendix describes the position and basis for those against inclusion of fee simple title land acquisition strategy. The appendix also describes the position and basis for those supporting inclusion of fee simple title land acquisition strategy.

Aquatic Strategies

Working directly from the biological objectives, aquatic strategies focus on methods to achieve improvements in aquatic habitat. The general assumption is that habitat improvements will enhance fish populations. Given that biological objectives regarding specific numeric fish population goals were not developed, strategies for directly enhancing fish populations were also not developed in this subbasin plan. See Section 7.3.4 below for more detailed discussion of numeric fish population goals. For terrestrial species and habitats, the limited information available also precluded the development of biological objectives and strategies for individual focal species. Instead, terrestrial strategies focus on enhancement of priority habitat types, under the general assumption that improvements to terrestrial habitats will benefit terrestrial species.

In the Lower Snake Subbasin, aquatic strategies include both restoration and protection approaches. Discussions with Subbasin Planning Team members, technical staff, and the public identified a common concern that funding for work in this subbasin may be difficult to obtain given the relatively small population of steelhead present. It is unlikely that more expensive active restoration work will be funded with limited return potential. As such, the Subbasin Planning Team determined that passive restoration strategies (e.g. riparian buffer enhancement) would be the most appropriate to propose for this subbasin. This was based on four assumptions: 1) passive restoration strategies tend to be of lower cost than active restoration strategies; 2) habitat enhancement can be achieved through the implementation of passive restoration strategies; 3) passive enhancement strategies encompass those activities that would likely be proposed in the subbasin; and 4) there exists a need to prioritize reaches and limit the scope of potential actions to those that will have the greatest potential for success. There is debate within the subbasin regarding whether proposing only passive restoration strategies is appropriate. Focusing this subbasin plan on passive enhancement strategies does not preclude the use of active restoration within the subbasin, but does place greater weight upon passive enhancement efforts for BPA funding through the subbasin planning process.

Terrestrial Strategies

Two general categories of terrestrial strategies were developed: protection and enhancement. Applied across priority habitats, protection strategies focus on maintaining functional habitat. Enhancement strategies focus on increasing the functionality of terrestrial habitats. In addition, selected strategies also focus on increasing the functionality of land that is currently under short-term conservation easements.

Prioritization of biological objectives and strategies was addressed in the Lower Snake Subbasin plan as follows. The priority objectives identified in this plan were selected from a broad range of alternative objectives that could be addressed in the Lower Snake Subbasin based, upon the working hypotheses derived from the assessment. For aquatic species and habitats, geographic priorities were identified through identification of priority geographic areas for restoration and/or protection. Because terrestrial species could potentially use all areas of the subbasin, selection of four priority habitat types guided geographic priorities for management. The objectives have not been prioritized relative to each other. Subbasin planners did not attempt this type of prioritization because insufficient information was provided by the assessments to support this level of prioritization. Regardless, the objectives presented herein were evaluated by technical staff and the public and are considered to be those that could produce the greatest benefit over the next in 10 to 15 years, within practical sideboards and assumptions.

The aquatic and terrestrial strategy lists were developed to provide implementing entities with a menu of options. Not all strategies will be implemented, nor are all strategies appropriate in all portions of a subbasin. Determination of which strategies are implemented will depend on opportunities that become available and site-specific conditions over time. The listed strategies are intended to result in implementation of projects that will provide the most benefit to fish and wildlife species and their habitats under local ecological and social conditions at any given point in time. For this reason, strategies cannot and should not be prioritized in the subbasin plan. Prioritization of strategies is anticipated to occur at the provincial review level when proposals are considered for funding. At this time, projects that address specific strategies should be identified and ranked for funding based on biological and cost effectiveness.

Some broad categories of priorities have been developed in this plan for both the aquatic and terrestrial components. These include:

- Strategies that provide long-term protection will be a higher priority than strategies that provide shorter-term protection, all other factors being equal
- Strategies that meet multiple objectives are considered a higher priority than strategies that will provide benefit for a limited number of objectives
- Terrestrial strategies that also provide benefit for aquatic focal species will be considered a higher priority than strategies that only benefit terrestrial wildlife.

In addition to specific strategies, approaches for management plan special topics have also been developed (see Sections 7.3.5 and 7.4.1). These topics include those for which insufficient information was available to enable development of working hypotheses, objectives, and strategies through the EDT model and those issues that are of special interest to local stakeholders, e.g., agriculture as a cover type of interest.

An additional significant component of the management plan includes cultural priorities of the Nez Perce Tribe. Objectives developed to support tribal culture, and projects proposed to achieve such objectives, will be considered as an overlay to the biologically-driven hypotheses, objectives, and strategies provided in the remainder of this management plan. As such, projects that support tribal culture should be considered a higher priority than projects that provide equivalent biological benefits with no cultural benefits. In support of this subbasin plan, the Nez Perce Tribe completed a study of sites of high cultural value due to historic and current use by tribal members. This study, provided in full in Appendix I, was based upon information gathered from reports of tribal members. A map of known high priority sites can be found in the appendix. Further funding to review additional sources and expand documentation of Nez Perce cultural priorities is suggested in the study.

7.2 Aquatic Working Hypotheses and Biological Objectives

Working hypotheses were developed for each limiting factor identified by EDT in each priority restoration geographic area. Example working hypotheses for each type of limiting factor are provided in Table 7-1. The full list of working hypotheses is provided in Section 7.3. A summary of the biological objectives derived for each limiting factor by geographic area is provided in Table 7-2. Descriptions of the reaches referenced in Table 7-2 and descriptions of the various limiting factors can be found in Appendix B.

The following assumptions were used by technical staff and the public during the development of biological objectives in the Lower Snake Subbasin. Specific definitions of terms can be found in the glossary.

- General: Objectives were set at a level that can reasonably be achieved within the working horizon of this plan (10 to 15 years). Objectives were designed to achieve enough change as to cause a measurable beneficial effect on salmonid populations, or to achieve a significant transition point in survival for the species. Reach-specific geomorphic function will be considered when determining appropriate enhancement actions. Passive restoration will be the preferred method of enhancement. Active restoration methods will be considered sparingly, and only where such activities are determined to be cost-effective. As such, the objectives for some habitat attributes are more conservative than those other subbasins.
- Embeddedness: Any action taken to reduce embeddedness will likely produce commensurate reductions for percent fines and turbidity.
- Large Woody Debris: LWD distribution within the geographic area will not necessarily need to be uniform. Large, complex aggregations of LWD can be beneficial and scattered throughout the area, and some may move and re-aggregate annually. The intent is to have large pieces of woody debris available in the system that contribute to those aggregations that will have significant influences on channel morphology.
- Pools: LWD, instream structures, and meander maintenance and enhancement are considered to be critical to the creation and stability of primary pools.
- Confinement: Artificial confinement caused by road and dike locations perpetuates downstream instability. Elimination of low priority man-made structures would encourage natural stream meandering that will benefit salmonids. Greater dike setback or road relocation could significantly improve stream habitat and stability while continuing to provide protection for infrastructure and private property. The prioritization of dikes within the subbasin will occur through a coordinated effort with all stakeholders.
- Riparian Function: Riparian function depends on riparian area width, vegetative species diversity, and age. A continued recognition of the value and need for riparian function,

as has occurred in recent years, will allow riparian function to increase. Some effort to stabilize the stream channel is needed before riparian enhancement is likely to be effective. This attribute is highly dependent on time for improvement throughout the subbasin.

- Temperature: Only the daily maximum portion of this attribute was identified in the objectives below, but actions taken to address maximum daily temperature are expected to decrease daily average temperatures overall. Decreased temperatures are also expected to occur due to improvements in riparian function.
- Bedscour: Objectives are designed to reduce bedscour to less than the depth that steelhead normally deposit their eggs. It is assumed that actions taken to increase LWD and riparian function along with decreased confinement, increased sinuosity, and improved floodplain connectivity will positively affect this attribute through increased stream stability.
- Instream Flow: The following factors negatively impact instream flow: 1) flashy flows that have caused excessive bedload deposition and widened streams that contribute to periodic subsurface flows; 2) decreased watershed and riparian function (e.g. limited large-scale water infiltration); and 3) lowered water table. Enhancing upland and riparian function and increasing infiltration will increase flows; however, it is recognized that this may not be possible in all areas. This effort will be supplemented by the lease and/or purchase of water rights, where available. Increasing instream flow is assumed to provide the greatest benefit to steelhead populations in some geographic areas (including, but not limited to, Deadman and Wawawai creeks).

Table 7-1 Example Working Hypotheses

Factor	Example Working Hypothesis
Sediment	Reduction in sediment (turbidity, percent fines and embeddedness) will increase survival of steelhead in the following life stages: egg incubation, fry, & overwintering.
Large Woody Debris	Increase in large woody debris (LWD) densities will increase survival of steelhead in the following life stages: egg incubation, fry, subyearling rearing, and overwintering.
Pools	Increase in primary pool quantity and quality will increase survival of steelhead in the following life stages: fry, subyearling rearing, and overwintering.
Riparian Function	Increase in riparian function will increase survival of steelhead in the following life stages: fry, subyearling rearing, and overwintering.
Confinement	Decreasing confinement will increase survival of steelhead in the following life stages: egg incubation, fry, subyearling rearing, and overwintering.
Summer Max. Water Temperature	Decrease in summer temperatures will increase survival of steelhead in the following life stages: incubation, fry, and subyearling.
Flow	Increase in summer flows will increase survival of steelhead in the following life stages: incubation, fry, subyearling rearing, and overwintering.
Bedscour	Decrease in bedscour will increase survival of steelhead in the following life stages: fry, subyearling rearing, and overwintering.

Table 7-2 Summary of Biological Objectives by Priority Area

Priority Area		Limiting Factors for Steelhead: Substrate Embedded-ness (% of substrate)	LWD (# pieces per channel width)	Pools (% of stream surface area)	Riparian Function (% of max)	Confinement (% of bank length)	Summer Max Water Temp	Bedscour (cm)	Summer Flow
Almota Creek (mouth-L. Almota, RB trib-forks, N. Branch)	Objective	<50%	≥0.33	>8% (RB trib-forks & N. Branch)	>50% (mouth-L. Almota)	No Objective	Not an EDT-Identified Limiting Factor	15cm (RB trib-forks) 20 cm (N. Branch)	Show upward trend
	Current	70%	<0.33	8% (RB trib-forks)	37%	60% (mouth-L. Almota)		20cm (RB trib-forks) 24cm (N. Branch)	Moderately reduced
Almota Creek (L. Almota-RB trib.)	Objective	<25%	≥0.33	>10% (L. Almota-Second L. Almota)	82%	Not an EDT-Identified Limiting Factor		Not an EDT-Identified Limiting Factor	Show upward trend
	Current	37%	<0.33	10% (L. Almota-Second L. Almota)	75%				Moderately reduced
Deadman Creek (Ping-forks)	Objective	<40%	≥0.33	>12% Ping-Lynn) >5% Lynn-forks)	>50% (Ping-Lynn) >75% (Lynn-forks)	No Objective	All days < 25C; <4 days with warmest 22-25C; <12 days >16C (Ping-Lynn)	Not an EDT-Identified Limiting Factor	Show upward trend
	Current	54%	<0.33	12% (Ping-Lynn) 5% (Lynn-forks)	37% (Ping-Lynn) 62% (Lynn-forks)	25% (Ping-Lynn) 60% (Lynn-forks)	>1 day >25C; >4 days >22C; >12 days >16C (Ping-Lynn)		Moderately reduced

Priority Area		Limiting Factors for Steelhead							
		Substrate Embedded-ness (% of substrate)	LWD (# pieces per channel width)	Pools (% of stream surface area)	Riparian Function (% of max)	Confinement (% of bank length)	Summer Max Water Temp	Bedscour (cm)	Summer Flow
Deadman Creek (SF Deadman)	Objective	<25%	≥ 0.33	>20%	>50%	Not an EDT-Identified Limiting Factor	Not an EDT-Identified Limiting Factor	Not an EDT-Identified Limiting Factor	Show upward trend
	Current	37%	<0.33	20%	37%				Moderately reduced
Alpowa Creek (Stember Cr-upper forks)	Objective	Show downward trend	≥ 0.33	≥10%	Show upward trend (≥25%)*	Not an EDT-Identified Limiting Factor	Show downward trend	Not an EDT-Identified Limiting Factor	Not an EDT-Identified Limiting Factor **
Penawawa Creek (Rock Spring Gulch-~2.5 mi above Little Penawawa)	Objective	Show downward trend	≥ 0.33	≥10%	Show upward trend (≥25%)*	Not an EDT-Identified Limiting Factor	Show downward trend	Not an EDT-Identified Limiting Factor	Show upward trend

* Riparian function estimate was based upon improvements needed in Alpowa. However, riparian conditions in Alpowa and Penawawa are considered more impacted than Almota, thus the % enhancement objective was increased.

** Because Alpowa Creek is spring-fed, fewer flow enhancement opportunities are necessary.

7.3 Aquatic Strategies

The following two categories of aquatic strategies were developed for the Lower Snake Subbasin:

- strategies to address imminent threats throughout the subbasin,
- strategies for priority restoration/protection areas

All are considered equally important for implementation. Activities such as riparian planting and upland infiltration enhancement are not considered active restoration actions. Passive restoration takes advantage of natural processes and out-of-stream activities to achieve instream habitat enhancement. Examples includes planting riparian vegetation, implementing conservation easements, increasing upland infiltration (e.g. direct seed/no-till), use of sediment basins, developing alternative livestock watering facilities, and water conservation. Note that this is the definition of passive restoration for the terms of this subbasin plan, and may not be consistent with the typical conception of what constitutes passive restoration.

Although passive restoration is a valuable approach in many cases, it will take longer to show measurable results. These results may be achieved only in part during the 10 to 15 year time-frame of this plan.

7.3.1 Imminent Threats

As the management plan process was developing, it became clear that some actions in the subbasin needed to be held apart from the process and given special status. The strategy of our management plan was to narrow the subbasin into a few geographic areas where the focal species would receive the most benefit by the work being done. While this is appropriate for most management actions, it does not address conditions that are likely to cause immediate mortality to the salmonids that serve as our focal species. We identified three areas that fit into this category: passage obstructions, fish screens, and areas of the stream that seasonally go dry. These conditions should be a priority for funding wherever they occur in the subbasin, whether or not they are located in a priority geographic area.

Obstructions

Passage obstructions are considered a source of potential immediate mortality to fish. Delay in passage can expose fish to habitat conditions that could be adverse to survival without the opportunity to escape, and can affect the ability of salmonids to successfully spawn. Fish can also be physically injured by inadequate passage facilities thus increasing exposure to disease or possibly causing direct mortality from the injuries. In the Lower Snake Subbasin, two obstructions were identified during the EDT modeling process, one each in the Almota and Deadman creek. Obstructions were also identified in the rest of the subbasin streams, although passage was not estimated. See Table 7-3 for a list of known passage obstructions. Obstructions should be removed or modified throughout in the basin whenever the opportunity arises. Priority should be given to those obstructions that affect multiple focal species, occur lower in the basin, and are considered to be the greatest obstructions to passage. A comprehensive inventory, analysis and prioritization of passage barriers are a high priority and needs to be completed on all locations within the subbasin that may limit migration of both anadromous/resident fish in their juvenile and adult life stages.

Although the management work groups did not rank obstructions in order of priority, assumptions can be made about priorities, given the knowledge of the fish managers in this area. Neither of the two obstructions identified in the EDT process are considered a priority for modification. The areas that they limit access to are not considered to be high production potential areas and are relatively small portions of the basin. There are several obstructions in the other Lower Snake tributaries that would have a high value to the focal species, if addressed. The culvert on Wawawai Creek significantly obstructs passage to most of the drainage and is considered a high priority for removal. The perched culvert on Steptoe Creek is probably almost a full barrier to steelhead passage. Steptoe also has a large depositional barrier near the mouth. This forms a delta barrier that is impassable at low flows. Other barriers to passage that should be noted are the occasional beaver dams on Penawawa Creek and the headcut falls below the highway on Alkali Flat.

Table 7-3 Salmonid Fish Passage Obstructions in the Lower Snake Subbasin Tributaries

Drainage/Obstruction	River Mile	Steelhead % Passage
Almota Drainage		
Little Almota Cr: Impassable headcut	1.1	0%
Deadman Drainage		
Lynn Gulch: Lynn Gulch culvert	.4	50%
Penawawa Drainage		
No permanent obstructions	NA	NA
Alpowa Drainage		
No permanent obstructions	NA	NA
Wawawai Drainage		
Wawawai Creek: Perched culvert	.1	Partial
Steptoe Drainage		
Steptoe Creek: Deposition in delta	0.0	Partial to Full
Steptoe Creek: 1st road crossing culvert	.2	Partial to Full
Steptoe Creek: 2nd road crossing culvert	.8	Partial to Full
Alkali Flat Drainage		
Alkali Flat Creek: Headcut Falls	7.0	Partial to Full

Note: Passage obstructions on Almota and Deadman Creeks were identified and percentages were estimated for EDT analysis; however, these structures have not been evaluated for passage. Other streams are identified obstructions by Washington Department of Fish and Wildlife personnel. This list is not to be considered comprehensive, as none of these creeks have been inventoried for passage barriers. Percentages represent the likelihood of adult passage in low flow conditions unless otherwise indicated. Obstructions are in order for each drainage, from closest to mouth to farthest from mouth. In addition to the obstructions listed in the table above, the Lower Snake River mainstem dams clearly represent significant barriers to fish passage (see Chapter 3 for discussion of out-of-subbasin effects). Further, Table 7-3 is not complete in regard to Little Almota Cr, as further obstructions exists upstream of those noted.

Fish Diversions/Screens

Water diversions that are not screened or are inadequately screened are a well-documented source of mortality to salmonids, particularly juveniles. If fish screens do not have the correct flows across the screen or if the mesh size is wrong, fish may be impinged on the surface. A pump or gravity water diversion that is not screened or has too large mesh may physically divert the fish out of the stream and into a waterway that is not suitable for survival. The installation of screens that meet current NOAA standards is considered a priority for the basin. In addition, projects that move diversions out of salmonid bearing waters do, in effect, remove a potential source of mortality and should also be considered a priority under this management strategy. The EDT analysis rated reaches for water withdrawals as a habitat attribute. This rating was based on the number of withdrawals within a reach and the degree to which they were screened (see Appendix B for rating definitions). Almota Creek and Deadman Creek were both evaluated for the analysis. Almota has no known diversions. Deadman had two reaches that were rated as having minor withdrawals that may or may not be properly screened. Improperly screened withdrawals are not known to be a major source of mortality in any of the Lower Snake Subbasin tributaries. Diversions that are not screened in accordance with current criteria should be modified to meet that criterion when identified.

Dry Stream Reaches

There are some reaches within the Lower Snake Subbasin that go dry on a seasonal basis. Some of these may be caused by the natural hydrological regime of the area; others may be anthropogenic in origin. Anthropogenic causes can be water diversions or vegetation removal, which reduces infiltration of water in the watershed. While this plan does not advocate the implementation of resources for introducing water to a section of the stream at a time of year when water historically was not present, every effort should be made to return water to areas that are de-watered due to the causes mentioned above. Projects could include water leases or purchases. In addition larger projects that restore the riparian areas or otherwise encourage the raising of the water table and water retention of the affected areas should be encouraged. Deadman, Wawawai and Steptoe creeks all have areas that go dry seasonally.

7.3.2 Priority Restoration/Protection Area Strategies

Strategies developed for the priority restoration/protection geographic areas are provided in Table 7-4. This table lists the working hypotheses, associated biological objectives, and associated strategies for each geographic area. For example, in the Almota Creek Geographic Area, Strategies AC1.1.1 through AC1.1.16 are proposed to achieve Objective AC1.1, which was developed as a measurable target for improvements in Hypothesis AC1. All related hypotheses, objectives, and strategies are numbered similarly. As discussed above, strategies are not prioritized and will be implemented based upon opportunities available. In Table 7-4, the historical and current estimates were derived from the EDT assessment. Proposed causes were developed by local technical staff. Strategies presented in Table 7-4 are focused primarily on a protection-type approach. Additional general strategies that could be applied in these geographic areas follow the table.

Table 7-4 Priority Restoration Area Working Hypotheses, Limited Life History Stages, Causes, Biological Objectives, and Strategies

Hypothesis AC1: Reduction in sediment (turbidity, percent fines and embeddedness) will increase survival of steelhead in the following life stages: egg incubation, fry, & overwintering.

Causes: Road development near streams, agricultural land use near streams.

Assumptions: Strategies will include only passive measures.

Objective AC1.1-Reduce embeddedness within the area to <50% from mouth-L. Almota, RB trib. - forks and in North Branch, and <25% from L. Almota-RB trib. This will also stimulate a corresponding decrease in percent fines and turbidity. Current estimate: 70% (mouth-L. Almota, RB trib.-forks, & North Branch) 37% (L. Almota-RB trib.)	**Note- Strategies are not prioritized and will be implemented based upon opportunities available.**
	Strategy AC 1.1.1-Improve the extent, structure, and function of riparian buffers through vegetation planting (native species unless otherwise required), managed grazing, selective livestock fencing, and similar practices.
	Strategy AC 1.1.2-Decrease sediment delivery from upland practices through expanded use of conservation tillage, sediment basins, mowing of road shoulders in place of herbicide use, vegetative buffers on road shoulders, and other practices.
	Strategy AC1.1.4-Implement the most economical and effective treatment methods to control noxious weeds (including false indigo), including the encouragement of biological control methods where feasible and appropriate.
	Strategy AC1.1.6-Use appropriate BMPs for road maintenance and decommissioning.
	Strategy AC1.1.7- Continue development and implementation of watershed scale efforts to decrease sediment inputs.
	Strategy AC1.1.8- Reduce sediment inputs through implementation of upland forestry and agricultural BMPs, including activities such as sediment basins on intermittent streams, and continue maintenance of current sediment basins.
	Strategy AC1.1.9-Develop and implement strategy for monitoring improvements in embeddedness.
	Strategy AC1.1.10-Uphold existing land use regulations (e.g., critical area ordinances, HPA requirements, etc.) that limit channel, floodplain, and riparian area impacts.
	Strategy AC1.1.11-Identify jurisdictions with inadequate land use regulations, and work to strengthen existing or pass new regulations that better protect streams from floodplain development that leads to loss or degradation of riparian vegetation.
	Strategy AC1.1.12-Increase landowner participation in federal, state, tribal, and local programs that enhance watershed health (e.g., CRP, CREP, Wetlands Reserve Program, EQIP, Partners for Fish & Wildlife, WDFW Landowner Incentive Program, Conservation Security Program, etc.).
	Strategy AC1.1.13-Seek additional funding sources consistent with current CRP and CREP guidelines to increase individual landowner enrollment in programs that achieve similar goals, including prioritization of landowners who have already reached their payment limitations.
	Strategy AC1.1.14-Seek funding sources to develop programs consistent with the goals of CRP, EQIP, and CREP in those areas where such programs are not available.
	Strategy AC1.1.15-Develop off-stream livestock watering facilities wherever feasible, or access to a water gap if necessary.
	Strategy AC1.1.16-Prior to implementation of off-stream watering projects, clarify how to protect water rights when livestock watering is moved off-stream.

Almota Creek (mouth to forks & N. Branch):
Priority Restoration Area Working Hypotheses, Limited Life History Stages, Causes, Biological Objectives, and Strategies, cont.

Hypothesis AC2: Increase in riparian function will increase survival of steelhead in the following life stages: fry, subyearling rearing, and overwintering.

Causes: Road development near streams, agricultural land use near streams, channelization.

Assumptions: Almota from RB trib.-fork and the North Branch were rated as >90% functional, and were not considered limiting. It was assumed that improvements in this area would not be significant. Passive measures can affect riparian function through the enhancement of stream buffers. Enhancement of most riparian buffers in this area will require re-vegetation. This does not, however, increase riparian function to the degree that it would if combined with decreases in confinement (see Hypothesis AC3).

Objective AC2.1- Facilitate riparian recovery in heavily degraded areas to achieve >82% riparian function from L. Almota-RB trib. and >50% from the mouth-L. Almota. Current estimate: 75% (L. Almota-RB trib) 37% (Mouth-L. Almota)	**Note- Strategies are not prioritized and will be implemented based upon opportunities available**
	Strategy AC2.1.1- Improve the extent, structure, and function of riparian buffers through vegetation planting (native species unless otherwise required), managed grazing, selective livestock fencing, and similar practices.
	Strategy AC2.1.2-Uphold existing land use and instream work regulations (e.g., critical area ordinances, HPA requirements, etc.) that limit channel, floodplain, and riparian area impacts.
	Strategy AC2.1.3- Identify jurisdictions with inadequate land use regulations, and work to strengthen existing or pass new regulations that better protect streams from floodplain development that leads to loss or degradation of riparian vegetation.
	Strategy AC2.1.4- Increase landowner participation in federal, state, tribal, and local programs that enhance watershed health (e.g., CRP, CREP, Wetlands Reserve Program, EQIP, Partners for Fish & Wildlife, WDFW Landowner Incentive Program, Conservation Security Program, etc.).
	Strategy AC2.1.5-Seek additional funding sources consistent with current CRP and CREP guidelines to increase individual landowner enrollment in programs that achieve similar goals, including prioritization of landowners who have already reached their payment limitations.
	Strategy AC2.1.6-Seek funding sources to develop programs consistent with the goals of CRP, EQIP, and CREP in those areas where such programs are not available.
	Strategy AC2.1.7-Adjust seasonal timing of livestock grazing within riparian areas to minimize soil compaction, minimize erosion, and maintain or enhance riparian vegetation.
	Strategy AC2.1.8-Increase understanding of the importance of riparian habitat through education and outreach programs for both the general public and road maintenance personnel.
	Strategy AC2.1.9- Continue development and implementation of watershed scale efforts to decrease sediment inputs.
	Strategy AC2.1.10-Increase size and connectivity of existing patches of riparian habitat through restoration and acquisition efforts.
	Strategy AC2.1.11-Wherever feasible, allow stream channels to develop and flood naturally, while protecting personal and public property rights and uses.
	Strategy AC2.1.12-Develop off-stream livestock watering facilities, wherever feasible and where access to a water gap is available.
	Strategy AC2.1.13- Prior to implementation of off-stream watering projects, clarify how to protect water rights when livestock watering

	is moved off-stream.

Almota Creek (mouth to forks):
Priority Restoration Area Working Hypotheses, Limited Life History Stages, Causes, Biological Objectives, and Strategies, cont.

Hypothesis AC3: Decreasing confinement will increase survival of steelhead in the following life stages: egg incubation, fry, subyearling rearing, and overwintering (Mouth-L. Almota only).

Causes: Road development near streams.

Assumptions: Protection strategies will not reduce confinement from the mouth to L. Almota. The estimate of <10% confinement for the remainder of Almota cannot be significantly improved upon, even with active measures, and is not considered limiting in the remainder of Almota.

Objective: No objective defined. Reduction in confinement is not possible through passive measures.

Current estimate: 60% (mouth-L. Almota).

Almota Creek (mouth to forks & N. Branch):
Priority Restoration Area Working Hypotheses, Limited Life History Stages, Causes, Biological Objectives, and Strategies, cont.

Hypothesis AC4: Increase in large woody debris (LWD) densities will increase survival of steelhead in the following life stages: egg incubation, fry, subyearling rearing, and overwintering.

Causes: Road development near streams, agricultural land use near streams, channelization.

Assumptions: LWD placement under protection strategies would not occur. Any contribution to wood in the stream would be from natural recruitment, and is assumed to be minimal. Access above L. Almota is limited.

Objective	Strategies
Objective AC4.1-Reach >0.33 pieces of large wood per channel width. Current estimate: <0.33 pieces/channel width.	**Note- Strategies are not prioritized and will be implemented based upon opportunities available**
	Strategy AC4.1.1-Increase the density, maturity, and appropriate species composition of woody vegetation in riparian buffers for long-term recruitment of LWD.
	Strategy AC4.1.2-Develop and implement strategy for monitoring improvements in LWD density, using existing protocols if available.
	Strategy AC4.1.3- Uphold existing land use and instream work regulations (e.g., critical area ordinances, HPA requirements, etc.) that limit channel, floodplain, and riparian area impacts.
	Strategy AC4.1.4- Identify jurisdictions with inadequate land use regulations, and work to strengthen existing or pass new regulations that better protect streams from floodplain development that leads to loss or degradation of riparian vegetation.
	Strategy AC4.1.5-Decommission low-use roads and low-priority dikes that are near the stream to enhance floodplain connectivity, natural stream meanders, and long-term recruitment of LWD, where applicable.

Almota Creek (mouth to forks & N. Branch):
Priority Restoration Area Working Hypotheses, Limited Life History Stages, Causes, Biological Objectives, and Strategies, cont.

Hypothesis AC4: Increase in large woody debris (LWD) densities will increase survival of steelhead in the following life stages: egg incubation, fry, subyearling rearing, and overwintering.

Causes: Road development near streams, agricultural land use near streams, channelization.

Assumptions: LWD placement under protection strategies would not occur. Any contribution to wood in the stream would be from natural recruitment, and is assumed to be minimal. Access above L. Almota is limited.

	Strategy AC4.1.6-Retain existing LWD to the greatest extent possible through outreach, education, regulatory, and other means, given limitations regarding protection of infrastructure and urban flood management needs.
	Strategy AC4.1.7- Improve the extent, structure, and function of riparian buffers through vegetation planting (native species unless otherwise required), managed grazing, selective livestock fencing, and similar practices.
	Strategy AC4.1.8-Increase landowner participation in federal, state, tribal, and local programs that enhance watershed health (e.g., CRP, CREP, Wetlands Reserve Program, EQIP, Partners for Fish & Wildlife, WDFW Landowner Incentive Program, Conservation Security Program, etc.).
	Strategy AC4.1.9-Seek additional funding sources consistent with current CRP and CREP guidelines to increase individual landowner enrollment in programs that achieve similar goals, including prioritization of landowners who have already reached their payment limitations.
	Strategy AC4.1.10-Seek funding sources to develop programs consistent with the goals of CRP, EQIP, and CREP in those areas where such programs are not available.

Almota Creek (mouth to forks & N. Branch):
Priority Restoration Area Working Hypotheses, Limited Life History Stages, Causes, Biological Objectives, and Strategies, cont.

Hypothesis AC5: Increase in primary pool quantity and quality will increase survival of steelhead in the following life stages: fry, subyearling rearing, and overwintering.

Causes: Road development near streams, agricultural land use near streams, channelization.

Assumptions: Given that LWD increases are all from natural recruitment and that no active pool building will take place, the expected gain in pool area will be minimal.

Objective AC5.1-Facilitate an increase in primary pools to >10% of the stream surface area from L. Almota-Second L. Almota and >8% from RB trib to the	**Note- Strategies are not prioritized and will be implemented based upon opportunities available**
	Strategy AC5.1.1-Retain existing LWD and limit removal of recruited LWD (also see Hypothesis AC4).
	Strategy AC5.1.2-Improve the extent, structure, and function of riparian buffers through vegetation planting (native species unless otherwise required), managed grazing, selective livestock fencing, and similar practices.
	Strategy AC5.1.3- Develop and implement strategy for monitoring improvements in primary pool quantity, quality and complexity.

Almota Creek (mouth to forks & N. Branch):
Priority Restoration Area Working Hypotheses, Limited Life History Stages, Causes, Biological Objectives, and Strategies, cont.

Hypothesis AC5: Increase in primary pool quantity and quality will increase survival of steelhead in the following life stages: fry, subyearling rearing, and overwintering.

Causes: Road development near streams, agricultural land use near streams, channelization.

Assumptions: Given that LWD increases are all from natural recruitment and that no active pool building will take place, the expected gain in pool area will be minimal.

forks and in North Branch. Current estimate: 10% L. Almota-Second L. Almota 8% RB trib-forks.	Strategy AC5.1.4-Wherever feasible, allow stream channels to develop and flood naturally, while protecting personal and public property rights and uses.
	Strategy AC5.1.5-Pursue instream flow enhancement opportunities (also see Hypothesis AC7).
	Strategy AC5.1.6-Increase landowner participation in federal, state, tribal, and local programs that enhance watershed health (e.g., CRP, CREP, Wetlands Reserve Program, EQIP, Partners for Fish & Wildlife, WDFW Landowner Incentive Program, Conservation Security Program, etc.).
	Strategy AC5.1.7-Seek additional funding sources consistent with current CRP and CREP guidelines to increase individual landowner enrollment in programs that achieve similar goals, including prioritization of landowners who have already reached their payment limitations.
	Strategy AC5.1.8-Seek funding sources to develop programs consistent with the goals of CRP, EQIP, and CREP in those areas where such programs are not available .

Almota Creek (mouth to forks & N. Branch):
Priority Restoration Area Working Hypotheses, Limited Life History Stages, Causes, Biological Objectives, and Strategies, cont.

Hypothesis AC6: Decrease in bedscour will increase survival of steelhead in the following life stages: fry, subyearling rearing, and overwintering. (RB trib-forks and North Branch only).

Causes: Road development near streams, agricultural land use near streams, channelization.

Assumptions: Protection strategies will decrease bedscour by increasing the ability of the watershed to retain water and reduce flashy runoff. High levels of bedscour are seen in the rest of Almota, but are not considered limiting.

Objective AC6.1- Decrease bedscour to 15cm or less in Almota from RB trib-forks and 20cm or less in the North Branch. Current estimate: 20cm (RB trib-forks) 24cm (North Branch).	**Note- Strategies are not prioritized and will be implemented based upon opportunities available**
	Strategy AC6.1.1- Increase the density, maturity, and appropriate species composition of woody vegetation in riparian buffers for long-term recruitment of LWD (See Hypothesis AC4).
	Strategy AC6.1.2- Uphold existing land use and instream work regulations (e.g. critical area ordinances, HPA requirements, etc.) that limit riparian area, floodplain and wetland development
	Strategy AC6.1.3- Identify jurisdictions with inadequate land use regulations, and work to strengthen existing or pass new regulations that better protect riparian areas.

Almota Creek (mouth to forks & N. Branch):
Priority Restoration Area Working Hypotheses, Limited Life History Stages, Causes, Biological Objectives, and Strategies, cont.

Hypothesis AC6: Decrease in bedscour will increase survival of steelhead in the following life stages: fry, subyearling rearing, and overwintering. (RB trib-forks and North Branch only).

Causes: Road development near streams, agricultural land use near streams, channelization.

Assumptions: Protection strategies will decrease bedscour by increasing the ability of the watershed to retain water and reduce flashy runoff. High levels of bedscour are seen in the rest of Almota, but are not considered limiting.

	Strategy AC6.1.4-Improve watershed conditions (e.g., upland water infiltration) through road decommissioning, reduced soil compaction, direct seeding activities, increasing native vegetation cover, CRP participation, etc.
	Strategy AC6.1.5- Improve the extent, structure, and function of riparian buffers through vegetation planting (native species unless otherwise required), managed grazing, selective livestock fencing, and similar practices
	Strategy AC6.1.6-Wherever feasible, allow stream channels to develop and flood naturally, while protecting personal and public property rights and uses.
	Strategy AC6.1.7-Increase landowner participation in federal, state, tribal, and local programs that enhance watershed health (e.g., CRP, CREP, Wetlands Reserve Program, EQIP, Partners for Fish & Wildlife, WDFW Landowner Incentive Program, Conservation Security Program, etc.)
	Strategy AC6.1.8-Seek additional funding sources consistent with current CRP and CREP guidelines to increase individual landowner enrollment in programs that achieve similar goals, including prioritization of landowners who have already reached their payment limitations.
	Strategy AC6.1.9-Seek funding sources to develop programs consistent with the goals of CRP, EQIP, and CREP in those areas where such programs are not available .

Almota Creek (mouth to forks & N. Branch):
Priority Restoration Area Working Hypotheses, Limited Life History Stages, Causes, Biological Objectives, and Strategies, cont.

Hypothesis AC7: Increase in summer flows will increase survival of steelhead in the following life stages: incubation, fry, subyearling rearing, and overwintering.

Causes: Road development near streams, agricultural land use near streams, channelization.

Assumptions: Protection strategies will benefit summer flows by increasing the ability of the watershed to retain water.

Objective AC7.1- Show upward trend in summer flows Current estimate:	**Note- Strategies are not prioritized and will be implemented based upon opportunities available**
	Strategy AC7.1.1- Improve the extent, structure, and function of riparian buffers through vegetation planting (native species unless otherwise required), managed grazing, selective livestock fencing, and similar practices.

Almota Creek (mouth to forks & N. Branch):
Priority Restoration Area Working Hypotheses, Limited Life History Stages, Causes, Biological Objectives, and Strategies, cont.

Hypothesis AC7: Increase in summer flows will increase survival of steelhead in the following life stages: incubation, fry, subyearling rearing, and overwintering.

Causes: Road development near streams, agricultural land use near streams, channelization.

Assumptions: Protection strategies will benefit summer flows by increasing the ability of the watershed to retain water.

Flows moderately reduced (EDT rating of 3)	Strategy AC7.1.2- Uphold existing land use and instream work regulations (e.g., critical area ordinances, HPA requirements, etc.) that limit riparian area development.
	Strategy AC7.1.3- Identify jurisdictions with inadequate land use regulations, and work to strengthen existing or pass new regulations that better protect riparian areas.
	Strategy AC7.1.4-Improve watershed function, including increased upland water infiltration, through road decommissioning, reduced soil compaction, direct seeding activities, increasing native vegetation cover, CRP, etc.
	Strategy AC7.1.5-Protect springs, seeps and wetlands that function as water storage during spring flows and provide recharge during summer drought periods.
	Strategy AC7.1.6-Continue to refine understanding of and/or determine location and timing of dewatered and flow-limited stream reaches.
	Strategy AC7.1.7-Although opportunities may be limited, minimize surface water withdrawals through implementation of efficiencies, quantify legal withdrawals, identify and eliminate illegal withdrawals, lease of water rights and purchase of water rights, where applicable.
	Strategy AC7.1.8- Develop off-stream livestock watering facilities wherever feasible and access to a water gap is available.
	Strategy AC7.1.9- Prior to implementation of off-stream watering projects, clarify how to protect water rights when livestock watering is moved off-stream.
	Strategy AC7.1.10-Increase landowner participation in federal, state, tribal, and local programs that enhance watershed health (e.g., CRP, CREP, Wetlands Reserve Program, EQIP, Partners for Fish & Wildlife, WDFW Landowner Incentive Program, Conservation Security Program, etc.).
	Strategy AC7.1.11-Seek additional funding sources consistent with current CRP and CREP guidelines to increase individual landowner enrollment in programs that achieve similar goals, including prioritization of landowners who have already reached their payment limitations.
	Strategy AC7.1.12-Seek funding sources to develop programs consistent with the goals of CRP, EQIP, and CREP in those areas where such programs are not available.

Deadman Creek (Ping-SF Deadman):
Priority Restoration Area Working Hypotheses, Limited Life History Stages, Causes, Biological Objectives, and Strategies

Hypothesis DC1: Reduction in sediment (turbidity, percent fines and embeddedness) will increase survival of steelhead in the following life stages: egg incubation, fry, & overwintering. Causes: Road development near streams, agricultural land use near streams. Assumptions: A group of strategies that include only passive measures.	
Objective DC1.1-Reduce embeddedness within the area to <40% from Ping-forks and <25% in SF Deadman Current estimate: 54% (Ping-Forks) 37% (SF Deadman)	See Strategies for Objective AC1
Hypothesis DC2: Increase in riparian function will increase survival of steelhead in the following life stages: fry, subyearling rearing, and overwintering. Causes: Road development near streams, agricultural land use near streams, channelization. Assumptions: Almota from RB trib.-fork and the North Branch were rated as >90% functional, and was not considered limiting. It was assumed that improvements in this area would not be significant. Passive measures can affect riparian function through the enhancement of stream buffers. Enhancement of most riparian buffers in this area will require re-vegetation. This does not, however, increase riparian function to the degree that it would if combined with decreases in confinement (see Hypothesis DC3).	
Objective DC2.1- Facilitate riparian recovery in heavily degraded areas to achieve >50% riparian function from Ping-Lynn and in the SF Deadman, and >75% from Lynn-forks. Current estimate: 37% (Ping-Lynn & SF Deadman) 62% (Lynn-forks)	See Strategies for Objective AC2

Deadman Creek (Ping-SF Deadman): **Priority Restoration Area Working Hypotheses, Limited Life History Stages, Causes, Biological Objectives, and Strategies, cont.**
Hypothesis DC3: Decreasing confinement will increase survival of steelhead in the following life stages: egg incubation, fry, subyearling rearing, and overwintering (Ping-forks only). Causes: Road development near streams. Assumptions: Protection strategies will not significantly reduce confinement on SF Deadman, currently estimated at <10% confined.
Objective: No objective defined. Reduction in confinement is not possible through passive measures. Current estimate: 25% (Ping-Lynn) 60% (Lynn-forks)

Deadman Creek (Ping-SF Deadman): **Priority Restoration Area Working Hypotheses, Limited Life History Stages, Causes, Biological Objectives, and Strategies, cont.**	
Hypothesis DC4: Increase in large woody debris (LWD) densities will increase survival of steelhead in the following life stages: egg incubation, fry, subyearling rearing, and overwintering. Causes: Road development near streams, agricultural land use near streams, channelization. Assumptions: LWD placement under protection strategies would not occur. Any contribution to wood in the stream would be from natural recruitment, and is assumed to be minimal.	
Objective DC4.1-Reach >0.33 pieces of large wood per channel width. Current estimate: <0.33 pieces/channel width	See Objectives for Hypothesis AC4

Deadman Creek (Ping-SF Deadman):
Priority Restoration Area Working Hypotheses, Limited Life History Stages, Causes, Biological Objectives, and Strategies, cont.

Hypothesis DC5: Increase in primary pool quantity and quality will increase survival of steelhead in the following life stages: fry, subyearling rearing, and overwintering.

Causes: Road development near streams, agricultural land use near streams, channelization.

Assumptions: Given that LWD increases are all from natural recruitment and that no active pool building will take place, the expected gain in pool area will be minimal.

Objective DC5.1-Facilitate an increase in primary pools to >12% (Ping-Lynn), >5% (Lynn-forks), and >20% (SF Deadman)	
Current estimate: 12% (Ping-Lynn) 5% (Lynn-forks) 20% (SF Deadman)	See Objectives for Hypothesis AC5

Deadman Creek (Ping-SF Deadman):
Priority Restoration Area Working Hypotheses, Limited Life History Stages, Causes, Biological Objectives, and Strategies, cont.

Hypothesis DC6: Increase in summer flows will increase survival of steelhead in the following life stages: incubation, fry, subyearling rearing, and overwintering.

Causes: Road development near streams, agricultural land use near streams, channelization.

Assumptions: Protection strategies will benefit summer flows by increasing the ability of the watershed to retain water.

Objective DC6.1- Show upward trend in summer flows	
Current estimate: Flows moderately reduced (EDT rating of 3)	See Strategies for Objective AC7

Deadman Creek (Ping-SF Deadman):
Priority Restoration Area Working Hypotheses, Limited Life History Stages, Causes, Biological Objectives, and Strategies, cont.

Hypothesis DC7: Decrease in summer temperatures will increase survival of steelhead in the following life stages: incubation, fry, and subyearling rearing. (Deadman Creek from Ping-Lynn only).

Causes: High-temperature overland runoff due to road development and agricultural land use near streams, channelization.

Assumptions: Increased riparian cover from stream buffers and increased water infiltration due to improvements in upland practices will decrease summer temperatures. Deadman from Lynn to the forks and the South Fork Deadman are not considered temperature limited according to EDT, although marginal water temperatures may exist in some places.

Objective DC7.1- Achieve the three following standards: 1. All days less than 25C (77F); 2. Less than 4 non-consecutive days with warmest day 22-25C (72-77F); and 3. Less than 12 days greater than 16C (61F) annually, where appropriate. and show progress toward meeting Washington State temperature standards and TMDL goals. Current estimate: More than 1 day greater than 25C (77F), or more than 4 days greater than 22C (72F), or more than 12 days greater than 16C (61F).	**Note- Strategies are not prioritized and will be implemented based upon opportunities available**
	Strategy DC7.1.1- Improve the extent, structure, and function of riparian buffers through vegetation planting (native species unless otherwise required), managed grazing, selective livestock fencing, and similar practices.
	Strategy DC7.1.2- Uphold existing land use and instream work regulations (e.g., critical area ordinances, HPA requirements, etc.) that protect riparian vegetation and wetlands and maintain low-density zoning.
	Strategy DC7.1.3- Identify jurisdictions with inadequate land use regulations, and work to strengthen existing or pass new regulations that better protect the structure and function of riparian areas and wetlands.
	Strategy DC7.1.4-Protect riparian vegetation through promotion of livestock BMPs such as alternative grazing rotations and the installation of alternative forms of water for livestock.
	Strategy DC7.1.5-Minimize surface water withdrawals through implementation of efficiencies, quantify legal withdrawals, identify and eliminate illegal withdrawals, lease of water rights and purchase of water rights, where applicable.
	Strategy DC7.1.6-Improve upland water infiltration through reduced soil compaction, direct seeding activities, increasing native vegetation cover, CRP participation, etc.
	Strategy DC7.1.7- Continue development and implementation of watershed scale efforts to decrease temperatures.
	Strategy DC7.1.8-Protect wetland and riparian habitats through land acquisition, fee title acquisitions, conservation easements, land exchanges, public education, and promotion of forestry, and agricultural BMPs.
	Strategy DC7.1.9-Assess and remedy significant sources of high-temperature inputs to surface waters.
	Strategy DC7.1.10-Increase landowner participation in federal, state, tribal, and local programs that enhance watershed health (e.g., CRP, CREP, Wetlands Reserve Program, EQIP, Partners for Fish & Wildlife, WDFW Landowner Incentive Program, Conservation Security Program, etc.)
	Strategy DC7.1.11-Seek additional funding sources consistent with current CRP and CREP guidelines to increase individual landowner enrollment in programs that achieve similar goals, including prioritization of landowners who have already reached their payment limitations.
	Strategy DC7.1.12-Seek funding sources to develop programs consistent with the goals of CRP, EQIP, and CREP in those areas where such programs are not available.
	Strategy DC7.1.13- Develop and implement strategy for monitoring improvements in summer water temperatures.

Alpowa Creek (Stember Cr-upper forks): Priority Restoration Area Working Hypotheses, Limited Life History Stages, Causes, Biological Objectives, and Strategies	
Hypothesis ALP1: Reduction in sediment (turbidity, percent fines and embeddedness) will increase survival of steelhead in the following life stages: egg incubation, fry, & overwintering. Causes: Road development near streams, agricultural land use near streams. Assumptions: Strategies will include only passive measures.	
Objective ALP1.1-Show a downward trend in embeddedness. This will also stimulate a corresponding decrease in percent fines and turbidity. Current estimate not available.	See strategies for Objective AC1.1.
Hypothesis ALP2: Increase in riparian function will increase survival of steelhead in the following life stages: fry, subyearling rearing, and overwintering. Causes: Road development near streams, agricultural land use near streams, channelization. Assumptions: Passive measures can affect riparian function through the enhancement of stream buffers. Enhancement of most riparian buffers in this area will require re-vegetation. This does not, however, increase riparian function to the degree that it would if combined with decreases in confinement.	
Objective ALP2.1- Show upward trend in riparian function to achieve ≥25%. Current estimate not available.	See strategies for Objective AC2.1
Hypothesis ALP3: Increase in large woody debris (LWD) densities will increase survival of steelhead in the following life stages: egg incubation, fry, subyearling rearing, and overwintering. Causes: Road development near streams, agricultural land use near streams, channelization. Assumptions: LWD placement under protection strategies would not occur. Any contribution to wood in the stream would be from natural recruitment, and is assumed to be minimal.	
Objective ALP3.1-Reach ≥0.33 pieces of large wood per channel width. Current estimate not available.	See strategies for Objective AC4.1

Alpowa Creek (Stember Cr-upper forks): Priority Restoration Area Working Hypotheses, Limited Life History Stages, Causes, Biological Objectives, and Strategies, cont.	
Hypothesis ALP4: Increase in primary pool quantity and quality will increase survival of steelhead in the following life stages: fry, subyearling rearing, and overwintering Causes: Road development near streams, agricultural land use near streams, channelization. Assumptions: Given that LWD increases are all from natural recruitment and that no active pool building will take place, the expected gain in pool area will be minimal.	
Objective ALP4.1- Facilitate an increase in primary pools to >10%. Current estimate not available.	See strategies for Objective AC5.1
Hypothesis ALP5: Decrease in summer temperatures will increase survival of steelhead in the following life stages: incubation, fry, and subyearling rearing. Causes: High-temperature overland runoff due to road development and agricultural land use near streams, channelization. Assumptions: Increased riparian cover from stream buffers and increased water infiltration due to improvements in upland practices will decrease summer temperatures.	
Objective ALP5.1-Show downward trend in temperature. Current estimate not available.	See strategies for Objective DC7.1

Penawawa Creek (Rock Spring Gulch-~2.5 miles above Little Penawawa):
Priority Restoration Area Working Hypotheses, Limited Life History Stages, Causes, Biological Objectives, and Strategies

Hypothesis PC1: Reduction in sediment (turbidity, percent fines and embeddedness) will increase survival of steelhead in the following life stages: egg incubation, fry, & overwintering. Causes: Road development near streams, agricultural land use near streams. Assumptions: Strategies will include only passive measures.	
Objective PC1.1-Show a downward trend in embeddedness. This will also stimulate a corresponding decrease in percent fines and turbidity. Current estimate not available.	See strategies for Objective AC1.1.
Hypothesis PC2: Increase in riparian function will increase survival of steelhead in the following life stages: fry, subyearling rearing, and overwintering. Causes: Road development near streams, agricultural land use near streams, channelization. Assumptions:. Passive measures can affect riparian function through the enhancement of stream buffers. Enhancement of most riparian buffers in this area will require re-vegetation. This does not, however, increase riparian function to the degree that it would if combined with decreases in confinement.	
Objective PC2.1- Show upward trend in riparian function to achieve >25%. Current estimate not available.	See strategies for Objective AC2.1
Hypothesis PC3: Increase in large woody debris (LWD) densities will increase survival of steelhead in the following life stages: egg incubation, fry, subyearling rearing, and overwintering. Causes: Road development near streams, agricultural land use near streams, channelization. Assumptions: LWD placement under protection strategies would not occur. Any contribution to wood in the stream would be from natural recruitment, and is assumed to be minimal.	
Objective PC3.1-Reach >0.33 pieces of large wood per channel width. Current estimate not available.	See strategies for Objective AC4.1

Penawawa Creek (Rock Spring Gulch-~2.5 miles above Little Penawawa):
Priority Restoration Area Working Hypotheses, Limited Life History Stages, Causes, Biological Objectives, and Strategies, cont.

Hypothesis PC4: Increase in primary pool quantity and quality will increase survival of steelhead in the following life stages: fry, subyearling rearing, and overwintering

Causes: Road development near streams, agricultural land use near streams, channelization.

Assumptions: Given that LWD increases are all from natural recruitment and that no active pool building will take place, the expected gain in pool area will be minimal.

Objective PC4.1- Facilitate an increase in primary pools to >10%. Current estimate not available.	See strategies for Objective AC5.1

Hypothesis PC5: Decrease in summer temperatures will increase survival of steelhead in the following life stages: incubation, fry, and subyearling rearing.

Causes: High-temperature overland runoff due to road development and agricultural land use near streams, channelization.

Assumptions: Increased riparian cover from stream buffers and increased water infiltration due to improvements in upland practices will decrease summer temperatures.

Objective PC5.1-Show downward trend in temperature. Current estimate not available.	See strategies for Objective DC7.1

Hypothesis PC6: Increase in summer flows will increase survival of steelhead in the following life stages: incubation, fry, subyearling rearing, and overwintering.

Causes: Road development near streams, agricultural land use near streams, channelization.

Assumptions: Protection strategies will benefit summer flows by increasing the ability of the watershed to retain water.

Objective PC6.1-Show upward trend in flow. Current estimate not available.	See strategies for Objective AC7.1

Incorporating strategies presented in the table above, "passive restoration" is considered the most appropriate action to take in the Lower Snake priority restoration/protection areas, given the technical and social evidence, as well as the limited resources available in the subbasin. These are actions that will protect the habitat on which the focal species depend from degrading any further. In most cases marginal improvements in habitat attributes can be expected from these measures. The following general protection strategies are provided in addition to those outlined in Table 7-4. These additional strategies are organized in three main categories: riparian buffer implementation, upland enhancement, and alternative water development/water conservation.

These strategies generally address ecological health and will further assist with meeting the objectives listed above for Lower Snake Subbasin priority protection/restoration areas.

Riparian Buffer Implementation

These are actions that provide a buffer area of reduced anthropogenic disturbance along the stream corridor. The intention is that these areas will be allowed to regenerate and repair with limited implementation of resources. It is understood by the subbasin group that many funding and regulatory entities require re-vegetation of streamside land placed into protected status. As such, riparian planting may be incorporated as part of a protection strategy. Installing riparian buffers can take many forms and the resources can come from many sources. Typically, resources made available to the subbasin can be used to increase the area of stream in protective buffers by direct funding or by providing assistance with landowner cost share. This has been and will continue to be an extremely effective method for stream buffer implementation in the subbasin. Riparian buffer strategies include, but are not limited to, the following.

- Conservation Reserve Enhancement Program (CREP) - The Conservation Reserve Enhancement Program is a joint partnership between the State of Washington and USDA, and is administered by the Washington State Conservation Commission and the Farm Services Agency (FSA). The agreement was signed in 1998 and provides incentives to restore and improve salmon and steelhead habitat on private land. The program is voluntary for landowners. Land enrolled in CREP is removed from production and grazing under 10 or 15 year contracts. In return, landowners plant trees and shrubs to stabilize the stream bank and to provide a number of additional ecological functions. Landowners receive annual rent, incentive and maintenance payments, and cost share for practice installations. This plan encourages the use of resources to assist in cost share in order to maximize participation in this program.
- Conservation Easements – The use of conservation easements has been somewhat limited in the Pacific Northwest but is common in other parts of the country. A conservation easement is a voluntary agreement that allows landowners to limit the type or amount of development on their property while retaining private ownership of the land. The easement is signed by the landowner, who is the easement donor, and the funding or sponsoring entity, who is the party receiving the easement. The sponsoring entity accepts the easement with understanding that it must enforce the terms of the easement in perpetuity. After the easement is signed, it is recorded with the County Register of Deeds or similar agency and applies to all future owners of the land. The activities allowed by a

conservation easement depend on the landowner's wishes and the characteristics of the property. In some instances, no further development is allowed on the land. In other circumstances some additional development is allowed, but the amount and type of development is less than it would otherwise be. Conservation easements may be designed to cover all or only a portion of a property. Every easement is unique, tailored to a particular landowner's goals and their land. Increasing conservation easements in streams bearing salmonids is considered a responsible use of subbasin resources. Conservation easement agreements that allow the least disturbance should have priority over less protective agreements.

- Continuous Conservation Reserve Program (CCRP) – This USDA program is similar to CREP as outlined above. The focus for this program, however, is on non-salmonid bearing streams, which are not eligible under CREP RULES. CCRP projects should be encouraged and recommended for cost share status when the stream in question flows into a geographic area that has a priority for protection. Within Southeast Washington the reduction of sediment input from these small "feeder" streams and the maintenance of their seasonal flow input to salmonid streams is vital to the protection of the focal species. Minimum buffer widths are still required and vary by plan and location, as is the planting of appropriate vegetation. Contract length is similar to CREP as are the arrangements for payments and maintenance. Though this program focuses on non-salmonid bearing streams, use of this program is potentially beneficial to other species.
- Other Cost Share Programs –The three types of programs listed above do not form a comprehensive list of the actions that can be taken to install riparian buffers. There are a myriad of funding sources and procedures available. This strategy recommends that all programs and agreements that are similar to the above be eligible for cost-share or direct funding. This can include other federal or state funding entities or agreements signed with private funding sources. These should all require a minimum average buffer width not less than the minimum requirements under CREP, an agreement to maintain the fence or exclosures, and a time length agreement similar to the CREP requirements.

There are other methods, such as simple riparian fencing and structures, that can help in herding or managing livestock in such a way as to reduce the impact to the stream. Innovative methods that do not fit the above, but that still result in a net protection increase for salmonid bearing streams, should be encouraged and be eligible for funding.

Upland Enhancement

In addition to the riparian areas above, citizens and technical groups recognize the importance of upland actions to the priority protection geographic areas. Sediment is a limiting factor on production of all of the focal species, not just in this subbasin but throughout the region. Programs designed to maintain ground cover in the upland areas that drain directly into priority restoration/protection areas are needed to control and reduce sediment input. Increased upland vegetation can also encourage infiltration of water, slowing runoff and preserving flows in the affected streams further into the typically dry summer months. Many of the areas listed as priority for protection can benefit from greater summer flows as they will increase living area for the focal species and can reduce temperatures. In addition to the upland areas that drain directly into priority areas, other areas upstream should be considered for funding if a linkage can be established between these areas and the priority areas. Upland strategies include, but are not limited to, the following:

- Conservation Reserve Program (CRP) – CRP is a voluntary program available to agricultural producers to help them safeguard environmentally sensitive land. Producers enrolled in CRP plant long-term, resource-conserving covers to improve the quality of water and control soil erosion. In return, FSA provides participants with rental payments and cost-share assistance. Contract duration is between 10 and 15 years. CRP provides continuous ground cover over wide expanses of upland areas. Subbasin resources used to increase the amount of CRP would benefit the protection of these priority areas.
- Direct Seed/No-Till – Direct Seed and No-Till are a set of innovative farming practices designed to increase the amount of time that farmland has vegetative cover and to reduce the amount of soil disturbance, while still allowing for the production of crops. Farming techniques such as these should be encouraged and eligible for direct or cost-share funding. These methods have been shown to be very effective in reducing the amount of sediment introduction into salmonid bearing streams.
- Sediment Basins - As the name implies, these are depressions strategically placed on or near agricultural land to provide for "settling" of sediment in run-off. These are relatively inexpensive methods for reducing sediment and should be encouraged and be eligible for cost-share or direct funding. Sediment basins should be designed and constructed in consultation with Conservation District, NRCS, or other experienced personnel to ensure effectiveness. Agreements and procedures for maintenance (clean-out) of the basins should accompany any project.
- Upland Terrace Construction – This is a land-reforming procedure designed to slow run-off from agricultural lands. This procedure can be very effective, particularly in reducing the impacts from large rain events. The terracing of slopes redirects run-off and increases contact time with the upland soils, thereby increasing infiltration and reducing sedimentation of streams. These project types can be very effective at reducing sedimentation. They are cost-effective, as they often entail a one-time expenditure of money but offer a permanent solution. Projects such as this should be eligible for cost-share or direct funding.
- Other Upland Projects and Practices - The above types of projects do not represent a comprehensive list of actions that can be taken in the upland areas to benefit aquatic life in streams. This subbasin plan encourages innovative techniques that can offer further protection in these priority areas. There are also a variety of funding sources that should be considered in addition to CRP that can then be cost-shared with subbasin funds.

Alternative Water Development/Water Conservation

In the Blue Mountains and surrounding lowland areas, water is often the limiting factor for both fish and livestock operations. Quite often, in order to provide protection for salmonid bearing streams, including this subbasin's priority restoration/protection areas, alternative sources of drinking water must be found or developed. Alternative water sources can greatly reduce the amount of time livestock spend in riparian areas, therefore, reducing the impacts to the stream. The subbasin management group recognizes this limitation on protection areas and encourages the development of off-stream water resources. These include, but are not limited to:

- Well development out of riparian areas
- Spring development and upland stream development
- Point of diversion Transfer
- Water transport development

Projects that reduce the amount of water removed from the stream can also protect priority areas. Some of the above project types reduce both grazing intensity and water removal. In addition, when there are interested parties, water right lease or purchase should be encouraged and eligible for direct or cost-share funding when it will directly benefit priority restoration/protection areas. The Washington Water Trust is one organization that can help arrange for water leasing or purchase. Irrigation efficiency projects are also important to the protection of priority areas. Water diversions that extract as little water as possible from the stream while still satisfying the water rights of users provide a needed protection for the focal species. Projects of this type include, but are not limited to:

- Lining open ditches
- Water conveyance piping
- Point of diversion transfers

7.3.3 Aquatic Strategy Special Topic – Instream Flows

Low summer flow was identified as a limiting factor in several geographic areas. Other processes such as watershed planning have also identified flow enhancement as a priority and are working in coordination with this subbasin plan to identify flow-limited reaches and those areas where increasing flow can have the greatest benefit for fish while continuing to provide for out-of-stream needs.

Approach

- Implement flow enhancement objectives discussed in Section 7.3 (P for priority Restoration/Protection Areas) for those geographic areas where flow was determined to be a limiting factor.
- Coordinate with flow enhancement efforts currently underway in the subbasin
- Complete further analyses to identify reaches where increasing flow will provide suitable habitat conditions
- Complete further analyses to determine which areas are naturally flow-limited and which areas are flow limited due to human causes

7.3.4 Numeric Fish Population Goals

The management plan aquatic hypotheses, objectives and strategies in this subbasin were derived from the EDT modeling effort used in the assessment. As a habitat-based model, EDT is not designed to provide accurate projections of the numbers of fish present in a subbasin, geographic area, or reach. Adult return objectives have been developed through other planning efforts (total, natural, hatchery and harvest components). Management agencies have yet to agree on adult return objectives for Lower Snake Mainstem Subbasin tributaries or the Snake River Mainstem. Artificial production and out of subbasin efforts may be required if return objectives are set above that which can be achieved through habitat restoration plans such as this subbasin plan.

The NWPCC subbasin planning guidelines have identified a need for subbasin plans to describe how the objectives and strategies are reflective of, and integrated with, the recovery goals for listed species within the subbasin. Further, coordination with the National Marine Fisheries Service Technical Review Teams (TRT) and state water quality management plans is recommended to facilitate consistency with ESA and CWA requirements. The Lower Snake Subbasin plan, although not having set direct fish population goals against which recovery can be measured, is supportive of recovery through its goal of habitat enhancement. Integration with the TRT was limited, as recovery goals have not yet been developed for the subbasin. The interim recovery goals provided by the TRT are presented later in this chapter within the context of preliminary numeric fish population goals, which also includes goals from tribal and state agency interests. The Pomeroy Conservation District and other entities within the subbasin intend to work with the TRT primarily through the Snake River Salmon Recovery Plan process.

7.3.5 Objectives Analysis

Although numeric fish population objectives were not set in this plan, an analysis of the anticipated benefits of achieving the objectives outlined above was generated. This work, completed by Mobrand Biometrics, Inc., made use of the same EDT model used during the aquatic assessment. These numbers are provided for comparison between historic, current, properly functioning, and post-management plan implementation conditions. Although they are not calibrated to reflect actual numeric fish populations within the subbasin, they do accurately reflect the anticipated relative change in the subbasin upon achievement of the biological objectives.

Appendix J provides the full objectives analysis completed for the Lower Snake Subbasin. This includes discussion of how close to historic conditions the basin would become if all objectives were implemented. Further, the analysis also provides relative estimates of improvements in adult abundance, adult productivity, adult carrying capacity, life history diversity, smolt productivity, and mean smolt abundance if all objectives were achieved. These results are summarized in Tables 7-5 and 7-6 for steelhead in Almota and Deadman Creeks, respectively.

The following description of the objectives analysis is taken directly from Appendix J:

> "While attainment of habitat objectives is estimated to result in an average steelhead abundance that is only 57 and 31% as great as PFC and historical, respectively,

attainment of habitat objectives does transform the population qualitatively in terms of productivity and, to a lesser degree, life history diversity. Both the EDT model and the limited empirical observations suggest that the current steelhead population is quite unproductive. The EDT estimate of current productivity, 1.6 returns/spawner, is characteristic of populations in decline. Natural production in such a population is typically sporadic, with small number of spawners in some years and none in others. In metapopulation terms, Almota Creek under current conditions could be described as a 'satellite population' that cannot persist without a continual infusion of colonists from a larger, more productive 'core population'. The current life history diversity value of 26% implies that 74% of the 'biologically possible' life history patterns are no longer viable – return fewer adult progeny than parents. This in turn means that the population is extremely vulnerable to random events impacting the handful of reaches capable of supporting a self-sustaining population.

However, if all habitat objectives are attained, the resilience of Almota steelhead should increase substantially. Not only does productivity increase to 3 returning adults/spawner, but life history diversity nearly doubles, increasing from 26 to 43%. From previous EDT analyses of populations known empirically to be self-sustaining or in decline, it has been observed that a productivity estimate of 3.0 marks the approximate boundary between stable and declining populations. The predicted increase in life history diversity also suggests that natural production would become more robust if habitat objectives were attained, because the population would be less dependent on a limited number of higher quality reaches…habitat objectives for Deadman Creek, at least in terms of percent restoration of historical/normative conditions, were less ambitious than for Almota Creek. The objective for restoring erosion-related attributes was as high as Almota Creek only in one reach (SF Deadman), and the objectives for riparian function (17 and 25%) were also significantly lower than for Almota Creek (33%). Moreover, objectives of any sort were set for relatively fewer reaches in Deadman Creek than Almota.

This reduction in the intensity and scope of objectives, not surprisingly, translates to a lower level of benefits to Deadman Creek steelhead production. Although the relative increase in life history diversity is substantial, the absolute value attained under the restoration scenario is still quite low. Moreover, the productivity value estimated under the habitat restoration objective, 1.6, is exactly the value estimated for Almota Creek under current conditions. Indeed, the performance of Deadman Creek steelhead assuming full attainment of habitat objectives would probably be quite comparable to steelhead performance in Almota Creek under current conditions. The overall impact of the proposed habitat objectives for Deadman Creek steelhead would perhaps be best summarized as a change from frankly endangered to threatened status in terms of the prospects for long-term survival."

Table 7-5 Objectives Analysis – Comparison of Almota Creek Steelhead Performance if All Habitat Restoration Objectives were Attained

Scenario	Life History Diversity	Productivity (adult returns/spawner)	Carrying Capacity (adults)	Average Abundance (adults)
Current without harvest	26%	1.6	75	29
Habitat objectives attained	43%	3.0	92	62
PFC	60%	6.3	129	108
Historic potential	60%	13.1	217	201

Source: Table 2, Appendix J.

Table 7-6 Objectives Analysis – Comparison of Deadman Creek Steelhead Performance if All Habitat Restoration Objectives were Attained

Scenario	Life History Diversity	Productivity (adult returns/spawner)	Carrying Capacity (adults)	Average Abundance (adults)
Current without harvest	1%	1.2	160	21
Habitat objectives attained	11%	1.6	219	80
PFC	83%	4.8	420	333
Historic potential	83%	8.0	651	569

Source: Table 4, Appendix J.

7.3.6 Additional Fish Enhancement Efforts

According to the objectives analysis provided in the previous section, the EDT-based in-basin habitat enhancement strategies proposed in this plan will not be sufficient to achieve the interim fish production objectives suggested by various entities as described above. A combination of other enhancement efforts will be needed if these numeric objectives are to be achieved.

If the most aggressive subbasin restoration scenario were implemented and all objectives outlined in this plan were achieved, EDT predicts increases in mean adult abundance of 52 percent for steelhead and 324c for spring Chinook over the time period of the plan. Increases in productivity are also predicted, 1.98 to 2.39 for steelhead and 1.32 to 2.50 for spring Chinook. However, these increases as predicted will not be sufficient to meet even the lowest of numeric fish goals for naturally-produced fish as outlined in Section 7.3.6.

As discussed in Section 3.5.8, out-of-subbasin factors—including estuarine and ocean conditions, hydropower impacts such as water quality and fish passage, mainstem Snake/Columbia river water quality and quantity conditions, and downriver and oceanic fisheries—are key factors limiting recruitment of anadromous spawners to the Lower Snake subbasin. Out-of-subbasin work combined with in-subbasin work is needed to achieve any of the proposed numeric fish population goals listed above. Achieving these goals for anadromous species will reflect progress made toward improving out-of-basin conditions. Increases in both anadromous adult escapement and habitat carrying capacity will be required to achieve numeric anadromous fish goals. Minimizing the impact of out-of-subbasin effects on subbasin restoration efforts will require coordination and cooperation in province- and basinwide efforts to address problems impacting Lower Snake subbasin fish stocks.

Increasing anadromous fish productivity and production, as well as life stage-specific survival, through artificial production may need to continue or expand within the subbasin. Specific strategies to accomplish this can include the following:

- Maximize hatchery effectiveness in the subbasin--continue existing and/or implement innovative hatchery production strategies in appropriate areas to support fisheries, natural production augmentation and rebuilding, reintroduction, and research.
- Apply safety net hatchery intervention based on extinction risk analysis and benefit risk assessments
- Implement artificial propagation measures and continue existing artificial and natural production strategies.
- Monitor and evaluate effectiveness of implementation of hatchery and natural production strategies.

Salmon recovery planning in the Snake River Region will be the forum through which a common set of numeric fish population objectives, and the additional artificial propagation and/or out-of-subbasin strategies needed to meet those objectives, will be developed. Until that time, work will continue on enhancing in-basin habitat for those fish that are present.

7.4 Terrestrial Habitats

Section 7.3 reviewed strategies unique to aquatic species and their habitats. This section reviews those strategies unique to terrestrial habitats. Priority habitats within the Lower Snake Subbasin include riparian riverine, ponderosa pine, interior grasslands, and shrub-steppe. Note that canyon grasslands are a subset of interior grasslands.

Appendix K includes the full management plan developed by WDFW for the Lower Snake Subbasin, including background on its development and assumptions used. Selected portions of this attachment are provided below.

7.4.1 Terrestrial Working Hypotheses and Objectives

All ecoregion focal habitat types occur in the Lower Snake River Subbasin, including riparian/riverine wetlands, ponderosa pine, interior grasslands, and shrub-steppe (agriculture is a cover type of interest). The recommended range of management conditions provided in Table 4 of Appendix K describes the conditions that must be met for a habitat to be considered "functional." These parameters will be key when evaluating the relative success of particular strategies.

Similar to aquatics, the working hypotheses for focal terrestrial habitat types are based on factors that affect/limit focal habitats (the term "factors that affect habitat" is synonymous with "limiting factors"). Working hypotheses were developed that capture the primary factors that affect the habitat.

Riparian/Riverine Wetlands Working Hypothesis

The short-term or major factors affecting this focal habitat type are direct loss of habitat due primarily to urban/agricultural development, reduction of habitat diversity and function resulting from exotic vegetation, livestock overgrazing, fragmentation, and recreational activities. The principal habitat diversity stressor is the spread and proliferation of invasive exotics. This coupled with poor habitat quality of existing vegetation have resulted in extirpation or significant reductions in riparian habitat obligate wildlife species.

Factors Affecting the Habitat

- Loss of habitat due to numerous factors, including riverine recreational developments, inundation from impoundments, cutting and spraying of riparian vegetation, etc.
- Alteration of natural hydrology due to diking, channelization, etc. this results in reduced stream flows, reduction of overall area and extent of riparian habitat, streambank stabilization, loss of vegetative structure, and narrowed stream channels.
- Habitat alteration from 1) hydrological diversions, dams, and control of natural flooding regimes that results in reduced stream flows and reduction of overall area of riparian habitat, loss of riparian vegetative structure, and lack of recruitment of young cottonwoods, ash, willows, etc. and 2) stream bank stabilization which narrows; the stream channel, reduces the flood zone, and reduces the extent of riparian vegetation.
- Habitat degradation from livestock overgrazing, which can widen channels, raise water temperatures, reduce understory cover, etc.
- Habitat degradation from conversion of native riparian shrub and herbaceous vegetation to invasive exotics.
- Fragmentation and loss of large tracts necessary for area-sensitive species.
- Landscapes in proximity to agricultural, residential, and recreational development may be subject to high levels of human disturbance and may disproportionately support non-native species that displace and/or impact native species productivity; such species may include nest competitors (European starlings and house sparrows), nest parasites (brown headed cowbird), and domestic predators (cats and dogs).
- Recreational disturbances (e.g., ORVs), particularly during nesting season, and particularly in high-use recreation areas.

Ponderosa Pine Working Hypothesis

Edaphic conditions for ponderosa pine are marginal within the Lower Snake River Subbasin. Although ponderosa pine has doubled in extent since circa 1850 (from 495 acres to 1,014 acres), this habitat type occurs only within a very limited area. Major factors affecting this focal habitat type stem from changes in climax forest structure and floristic conditions due primarily to timber harvesting, fire reduction/wildfires, mixed forest encroachment, development, recreational activities, reduction of habitat diversity and function resulting from invasion by exotic species and vegetation and overgrazing. The principal habitat diversity stressor is the spread and proliferation of mixed forest conifer species within ponderosa pine communities, due primarily to fire reduction and intense wildfires. Habitat loss and fragmentation (including fragmentation resulting from extensive areas of undesirable vegetation) coupled with poor habitat quality of existing vegetation have resulted in extirpation or significant reductions in ponderosa pine habitat obligate wildlife species.

Factors Affecting the Habitat

- Timber harvesting has reduced the amount of old growth forest and associated large diameter trees and snags.
- Changes in land use for urban, residential, and agricultural purposes have contributed to loss and degradation of properly functioning ecosystems.
- Fire suppression/exclusion has contributed towards habitat degradation, particularly declines in characteristic herbaceous and shrub understory from increased density of small shade-tolerant trees. High risk of loss of remaining ponderosa pine overstories from stand-replacing fires due to high fuel loads in densely stocked understories.
- Overgrazing has resulted in loss of properly functioning conditions, including recruitment of sapling trees and modification of understory vegetation.
- Invasion of exotic plants has altered understory conditions and increased fuel loads.
- Fragmentation of remaining tracts has negatively impacted species with large area requirements.
- Landscapes in proximity to agricultural, residential, and recreational areas may be subject to high levels of human disturbance and disproportionately support non-native species that displace and/or impact native species productivity; such species include nest competitors (European starlings and house sparrows), nest parasites (brown headed cowbird), and domestic predators (cats and dogs).
- Spraying insects that are detrimental to forest health may have negative ramifications on beneficial moths, butterflies, and non-focal bird species.

Interior Grassland Working Hypothesis

The short-term or major factors affecting this focal habitat type are direct loss of habitat due primarily to conversion to agriculture and urban development, reduction of habitat diversity and function resulting from invasion of exotic vegetation and wildfires, and overgrazing. The principal habitat diversity stressor is the spread and proliferation of annual grasses and noxious weeds such as cheatgrass and yellow-star thistle. These either supplant or radically alter entire native bunchgrass communities, significantly reducing wildlife habitat quality. Habitat loss and fragmentation (including fragmentation resulting from extensive areas of undesirable vegetation) coupled with poor habitat quality of existing vegetation have resulted in extirpation or significant reductions in grassland obligate wildlife species.

Factors Affecting the Habitat

- Extensive permanent habitat conversions of grassland habitats that result in fragmentation of remaining tracts.
- Changes in land use for urban, residential, and agricultural purposes that contribute to loss and degradation of properly functioning ecosystems.
- Degradation of habitat from overgrazing and invasion of exotic plant species.
- Fire management, either suppression or over-use, and wildfires.
- Invasion and seeding of crested wheatgrass and other introduced plant species that reduce wildlife habitat quality and/or availability.
- Loss and reduction of cryptogamic crusts, which help maintain the ecological integrity of grassland communities.
- Conversion of CRP lands back to cropland.
- Landscapes in proximity to agricultural, residential, and recreational areas that may be subject to high levels of human disturbance and may disproportionately support non-native species that displace and/or impact native species productivity. Such species may include nest competitors (European starlings and house sparrows), nest parasites (brown headed cowbird), and domestic predators (cats and dogs).

Shrub-steppe Working Hypothesis

The near term or major factors affecting this focal habitat type are direct loss of habitat due primarily to conversion to agriculture and urban development, reduction of habitat diversity and function resulting from invasion of exotic vegetation and wildfires, and overgrazing. The principal habitat diversity stressor is the spread and proliferation of annual grasses and noxious weeds such as cheatgrass and yellow-star thistle; these may supplant or radically alter entire shrub-steppe communities, significantly reducing wildlife habitat quality. Habitat loss and fragmentation (including fragmentation resulting from extensive areas of undesirable vegetation) coupled with poor habitat quality of existing vegetation have resulted in extirpation or significant reductions in shrub-steppe obligate wildlife species.

Factors Affecting the Habitat

- Extensive permanent habitat conversions of shrub-steppe habitats resulting in fragmentation of remaining tracts.
- Changes in land use for urban, residential, and agricultural purposes that have contributed to loss and degradation of properly functioning ecosystems.
- Degradation of habitat from overgrazing and invasion of exotic plant species.
- Fire management, either suppression or over-use, and wildfires.
- Invasion and seeding of crested wheatgrass and other introduced plant species that reduce wildlife habitat quality and/or availability.
- Loss and reduction of cryptogamic crusts, which help maintain the ecological integrity of grassland communities.
- Conversion of CRP lands back to cropland.
- Landscapes in proximity to agricultural, residential, and recreational areas that may be subject to high levels of human disturbance and may disproportionately support non-native species that displace and/or impact native species productivity. Such species may include nest competitors (European starlings and house sparrows), nest parasites (brown headed cowbird), and domestic predators (cats and dogs).

Biological Objectives

Biological objectives describe physical and biological changes within the subbasin needed to achieve the vision and address factors affecting focal habitats. Biological objectives for all Ecoregion subbasins are habitat based and describe priority areas and environmental conditions needed to achieve functional focal habitat types. Where possible, biological objectives are empirically measurable and based on an explicit scientific rationale (the working hypothesis).

Biological objectives are:

- Consistent with subbasin-level visions and strategies
- Developed from a group of potential objectives based on the subbasin assessment and resulting working hypotheses
- Realistic and attainable within the subbasin
- Consistent with legal rights and obligations of fish and wildlife agencies and tribes with jurisdiction over fish and wildlife in the subbasin, and agreed upon by co-managers in the subbasin
- Complementary to programs of tribal, state and federal land or water quality management agencies in the subbasin
- Quantitative and have measurable outcomes where practical.

Biological objectives are organized into two categories: 1) protection of habitats and 2) habitat function (enhancement and maintenance). Protection objectives focus primarily on identification and protection of focal habitats through education and outreach, leases, easements, acquisitions, and upholding existing land use and environmental protection regulations. Habitat enhancement objectives focus on improving habitat function based on recommended habitat management conditions. Subbasin planners also took into account three broad land categories when developing objectives. These include:

- Ecoregion Assessment and Conservation identified lands
- Lands currently assigned GAP protection status
- Other lands of ecological importance

Objectives are based primarily upon the ECA and GAP databases reviewed in the terrestrial assessment (Chapter 4). In addition to ECA identified lands and GAP protection status areas, subbasin planners support and encourage protection and enhancement of private lands that:

- directly contribute to the restoration of aquatic focal species
- have high ecological function
- are adjacent to public lands
- contain rare or unique plant communities
- support threatened or endangered species/habitats
- provide connectivity between high quality habitat areas
- have high potential for reestablishment of functional habitats

Table 7-7 provides the biological objectives for priority habitat types in the Lower Snake Subbasin. Further detail on the relationship between these objectives and strategies can be found in Appendix K.

7.4.2 Terrestrial Strategies

Rather than focus solely on acquisitions as the major protection strategy, subbasin planners examined a number of alternate strategies from which preferred strategies were identified, including easements, leases, acquisitions, existing/new environmental regulations, USDA programs (CRP and CREP), cooperative projects and programs, and research. The rationale behind this flexible approach is to simultaneously employ a variety of non-prioritized conservation "tools" to accomplish subbasin objectives in order to make the most of habitat protection/enhancement opportunities. For example, in addition to using acquisitions as a habitat protection tool, habitat managers will concurrently examine whether habitat objectives can be achieved all or in part on extant public lands, through leases and easements with private landowners, with USDA programs, and/or through cooperative projects/programs.

Subbasin planners also recognized the efficacy of focusing future protection efforts around large blocks of extant public lands and adjacent private lands. Clearly, a multi-tiered, flexible, cooperative approach to protecting wildlife/aquatic habitats and associated species is key to the success of any long-term habitat protection/enhancement plan.

Terrestrial habitat strategies are summarized in Table 7-8. Note that terrestrial strategies are focused entirely upon improvements in functional habitat. Strategies for specific focal species were not identified, due to lack of adequate information upon which to base biological objectives. However, the population numbers and strategies developed in state mule deer and elk management plans will provide direction for management of these species (see Chapter 6 for discussion). These and other focal species that are not actively managed will impact strategies through the use of their needs to define "functional" habitat and in the research, monitoring, and evaluation component of this plan (see Section 7.7).

Table 7-7 Summary of Terrestrial Habitat Biological Objectives

Habitat	Objectives	Biological Objectives Note – Objectives are not prioritized within or across habitat types
Riparian Riverine	R-A	Protect riparian riverine function on a minimum of 21,800 acres (conservative estimated historic acreage), with an initial focus on areas that directly contribute to the restoration of aquatic focal species.
Ponderosa Pine	P-A	Protect P. Pine habitat classified as ECA Class 1&2 (1,000 acres), within protected areas (GAP) and areas of private land that meet one or more of the following conditions: directly contribute to the restoration of aquatic focal species, have high ecological function, are adjacent to public land, contain rare or unique plant communities, have threatened, endangered, or sensitive species habitat or populations, or provide connectivity between high quality habitat areas.
	P-B	Enhance P. Pine functionality to achieve habitat parameters for focal and other obligate species in areas classified as ECA Class 1&2 (1,000 acres), in protected areas (GAP) and areas of private land that meet one or more of the following conditions: directly contribute to the restoration of aquatic focal species, have high ecological function, are adjacent to public land, contain rare or unique plant communities, have threatened, endangered, or sensitive species habitat or populations, or provide connectivity between high quality habitat areas.
Interior Grassland	G-A	Protect Interior Grassland habitat classified as ECA Class 1&2 (140,000 acres), within protected areas (GAP) and areas of private land that meet one or more of the following conditions: directly contribute to the restoration of aquatic focal species, have high ecological function, are adjacent to public land, contain rare or unique plant communities, have threatened, endangered, or sensitive species habitat or populations, or provide connectivity between high quality habitat areas.
	G-B	Enhance Interior Grassland functionality to achieve habitat parameters for focal and other obligate species in areas classified as ECA Class 1&2 (140,000 acres), in protected areas (GAP) and areas of private land that meet one or more of the following conditions: directly contribute to the restoration of aquatic focal species, have high ecological function, are adjacent to public land, contain rare or unique plant communities, have threatened, endangered, or sensitive species habitat or populations, or provide connectivity between high quality habitat areas.
	G-C	Show an upward trend in CRP acreage and functionality.

Habitat	Objectives	Biological Objectives Note – Objectives are not prioritized within or across habitat types
Shrub-steppe	S-A	Protect shrubsteppe habitat classified as ECA Class 1&2 (6,505 acres), within protected areas (GAP) and areas of private land that meet one or more of the following conditions: directly contribute to the restoration of aquatic focal species, have high ecological function, are adjacent to public land, contain rare or unique plant communities, have threatened, endangered, or sensitive species habitat or populations, or provide connectivity between high quality habitat areas.
	S-B	Enhance shrubsteppe functionality to achieve habitat parameters in areas classified as ECA class 1&2 (6,505 acres), for focal and other obligate species in protected areas (GAP) and areas of private land that meet one or more of the following conditions: directly contribute to the restoration of aquatic focal species, have high ecological function, are adjacent to public land, contain rare or unique plant communities, have threatened, endangered, or sensitive species habitat or populations, or provide connectivity between high quality habitat areas.
	S-C	Show an upward trend in CRP acreage and functionality.

Table 7-8 Terrestrial Habitat Strategies

Habitat Type	Objectives	Strategies NOTE – Strategies are not prioritized and will be implemented based upon available opportunities.
Riparian- Riverine Wetland	R-A	Strategies listed under riparian function for aquatic species are incorporated herein by reference. (aquatic riparian function strategies are listed under Objective AC2.1 in Table 7-3)
Ponderosa Pine	P-A	Strategy P-A.1 Identify functioning ponderosa pine habitats, corridors, and linkages classified as ECA Class 1&2 for protection. Strategy P-A.2 Provide information, education, and outreach to protect habitats. Strategy P-A.3 Use easements, leases, cooperative agreements, and acquisitions to protect habitat (long-term protection strategies are preferred over short-term). Strategy P-A.4 Uphold existing land use and environmental regulations (e.g. critical area ordinances, etc.). Strategy P-A.5 Identify inadequate land use regulations. Work to strengthen existing regulations or pass new regulations to improve protection of habitats. Strategy P-A.6 Complete a more detailed assessment of focal species, focal species assemblages, and obligate species needs to determine their habitat requirements (quantity and quality). Assessment/research would ultimately determine what acreage and distribution of functional habitat is necessary to achieve habitat recovery in the context of focal species needs. Strategy P-A.7 Identify functioning ponderosa pine habitats, corridors and linkages within protected areas (GAP) and areas of private land that meet one or more of the following conditions: directly contribute to the restoration of aquatic focal species, have high ecological function, are adjacent to public land, contain rare or unique plant communities, have threatened, endangered, or sensitive species habitat or populations, or provide connectivity between high quality habitat areas

Habitat Type	Objectives	Strategies **NOTE – Strategies are not prioritized and will be implemented based upon available opportunities.**
Ponderosa Pine	P-B	Strategy P-B.1 Identify non-functioning ponderosa pine habitats, corridors, and linkages within ECA Class 1 & 2 areas. Strategy P-B.2 Identify sites that are currently not in ponderosa pine habitat that have the potential to be of high ecological value, if restored. Strategy P-B.3 Provide information, outreach, and coordination with public and private land managers on the use of prescribed fire and silviculture practices to restore and conserve habitat functionality. Strategy P-B.4 Enter into cooperative projects and management agreements with Federal, State, Tribal, and private landowners to restore and conserve habitat function. Strategy P-B.5 Assist in long-term development and implementation of a Southeast Washington Comprehensive Weed Control Management Plan in cooperation with local weed boards. Strategy P-B.6 Fund noxious weed control projects to improve habitat function. Strategy P-B.7 Work with county, state, and federal agencies and private landowners to develop livestock grazing programs on federal and private lands that do not contribute to the invasion of noxious weeds or negatively alter understory vegetation. Strategy P-B.8 Identify non functioning ponderosa pine habitats, corridors and linkages within protected areas (GAP) and areas of private land that meet one or more of the following conditions: directly contribute to the restoration of aquatic focal species, have high ecological function, are adjacent to public land, contain rare or unique plant communities, have threatened, endangered, or sensitive species habitat or populations, or provide connectivity between high quality habitat areas.

Habitat Type	Objectives	Strategies **NOTE – Strategies are not prioritized and will be implemented based upon available opportunities.**
Grassland	G-A	Strategy G-A.1 Identify functioning interior grassland habitats, corridors, and linkages classified as ECA Class 1&2 for protection. Strategy G-A.2 Provide information, education, and outreach to protect habitats. Strategy G-A.3 Use easements, leases, cooperative agreements, and acquisitions to protect habitats (long-term protection strategies are preferred over short-term). Strategy G-A.4 Uphold existing land use and environmental regulations (e.g. critical area ordinances, etc.). Strategy G-A.5 Identify inadequate land use regulations. Work to strengthen existing regulations or pass new regulations to improve protection of habitats. Strategy G-A.6 Complete a more detailed assessment of focal species, focal species assemblages, and obligate species needs to determine their habitat requirements (quantity and quality). Assessment/research would ultimately determine what acreage and distribution of functional habitat is necessary to achieve habitat recovery in the context of focal species needs. Strategy G-A.7 Identify functioning interior grassland habitats, corridors, and linkages within protected areas (GAP) and areas of private land that meet one or more of the following conditions: directly contribute to the restoration of aquatic focal species, have high ecological function, are adjacent to public land, contain rare or unique plant communities, have threatened, endangered, or sensitive species habitat or populations, or provide connectivity between high quality habitat areas.

Habitat Type	Objectives	Strategies **NOTE – Strategies are not prioritized and will be implemented based upon available opportunities.**
Grassland	G-B	Strategy G-B.1 Identify non-functioning interior grassland habitats, corridors, and linkages within ECA Class 1 & 2 areas. Strategy G-B.2 Identify sites that are currently not in grassland habitat that have the potential to be of high ecological value, if restored. Strategy G-B.3 Provide information, outreach and-coordination with public and private land managers on management practices and the use of prescribed fire to restore and conserve habitat function. Strategy G-B.4 Enter into cooperative projects and management agreements with Federal, State, Tribal, and private landowners to restore and conserve habitat function. Strategy G-B.5 Assist in long-term development and implementation of a Southeast Washington Comprehensive Weed Control Management Plan in cooperation with local weed boards. Strategy G-B.6 Fund noxious weed control projects to improve habitat function. Strategy G-B.7 Work with county, state, and federal agencies and private landowners to develop livestock grazing programs on public and private lands that do not contribute to the invasion of noxious weeds or negatively alter habitats. Strategy G-B.8 Restore viable populations of obligate wildlife species where possible. Strategy G-B.9 Work with USDA programs (e.g. CRP) to maintain and enhance habitat quality. Strategy G-B.10Identify non functioning interior grassland habitats, corridors, and linkages within protected areas (GAP) and areas of private land that meet one or more of the following conditions: directly contribute to the restoration of aquatic focal species, have high ecological function, are adjacent to public land, contain rare or unique plant communities, have threatened, endangered, or sensitive species habitat or populations, or provide connectivity between high quality habitat areas.
Grassland	G-C	Strategy G-C.1 Increase landowner participation in federal, state, tribal, and local programs that enhance watershed health (e.g. CRP, CREP, Wetlands Reserve Program, EQIP, Partners for Fish & Wildlife, WDFW Landowner Incentive Program, Conservation Security Program, etc.) Strategy G-C.2 Seek additional funding sources consistent with current CRP and CREP guidelines to increase individual landowner enrollment in programs that achieve similar goals, including prioritization of landowners who have already reached their payment limitations. Strategy G-C.3 Seek funding sources to develop programs consistent with the goals of CRP, EQIP, and CREP in those areas where such programs are not available. Strategy G-C.4 During re-enrollment, convert CRP land to more functional plant communities. Strategy G-C.5 Enroll areas with documented wildlife damage and areas directly adjacent to high-quality wildlife habitat into CRP using cover practices 2, 3, and/or 4.

Habitat Type	Objectives	Strategies **NOTE – Strategies are not prioritized and will be implemented based upon available opportunities.**
Shrubsteppe	S-A	Strategy S-A.1 Identify functioning interior grassland habitats, corridors, and linkages classified as ECA Class 1&2 for protection. Strategy S-A.2 Provide information, education, and outreach to protect habitats. Strategy S-A.3 Use easements, leases, cooperative agreements, and acquisitions to protect habitats (long-term protection strategies are preferred over short-term). Strategy S-A.4 Uphold existing land use and environmental regulations (e.g. critical area ordinances, etc.). Strategy S-A.5 Identify inadequate land use regulations. Work to strengthen existing regulations or pass new regulations to improve protection of habitats. Strategy S-A.6 Complete a more detailed assessment of focal species, focal species assemblages, and obligate species needs to determine their habitat requirements (quantity and quality). Assessment/research would ultimately determine what acreage and distribution of functional habitat is necessary to achieve habitat recovery in the context of focal species needs. Strategy S-A.7 Identify functioning shrubsteppe habitats, corridors, and linkages within protected areas (GAP) and areas of private land that meet one or more of the following conditions: directly contribute to the restoration of aquatic focal species, have high ecological function, are adjacent to public land, contain rare or unique plant communities, have threatened, endangered, or sensitive species habitat or populations, or provide connectivity between high quality habitat areas.

Habitat Type	Objectives	Strategies **NOTE – Strategies are not prioritized and will be implemented based upon available opportunities.**
Shrubsteppe	S-B	Strategy S-B.1 Identify non-functioning shrubsteppe habitats, corridors, and linkages within ECA Class 1 & 2 areas. Strategy S-B.2 Identify sites that are currently not in shrubsteppe habitat that have the potential to be of high ecological value, if restored. Strategy S-B.3 Provide information, outreach and-coordination with public and private land managers on management practices and the use of prescribed fire to restore and conserve habitat function. Strategy S-B.4 Enter into cooperative projects and management agreements with Federal, State, Tribal, and private landowners to restore and conserve habitat function. Strategy S-B.5 Assist in long-term development and implementation of a Southeast Washington Comprehensive Weed Control Management Plan in cooperation with local weed boards. Strategy S-B.6 Fund noxious weed control projects to improve habitat function. Strategy S-B.7 Work with county, state, and federal agencies and private landowners to develop livestock grazing programs on public and private lands that do not contribute to the invasion of noxious weeds or negatively alter habitats. Strategy S-B.8 Restore viable populations of obligate wildlife species where possible. Strategy S-B.9 Work with USDA programs (e.g. CRP) to maintain and enhance habitat quality. Strategy S-B.10 Identify non functioning shrubsteppe habitats, corridors, and linkages within protected areas (GAP) and areas of private land that meet one or more of the following conditions: directly contribute to the restoration of aquatic focal species, have high ecological function, are adjacent to public land, contain rare or unique plant communities, have threatened, endangered, or sensitive species habitat or populations, or provide connectivity between high quality habitat areas.

(Note-Strategies are not prioritized and will be implemented based upon available opportunities)

7.4.3 Agriculture – Cover Type of Interest

Given its predominance within the subbasin and its potential to positively and negatively impact terrestrial wildlife, agriculture is a cover type of special interest to stakeholders and subbasin planners. The primary concern regarding the interface between agriculture and wildlife was that of wildlife damage to agricultural crops. To remedy this concern, one objective was set for agricultural habitats: A1-Limit elk and deer damage on private agricultural lands.

Strategies to achieve this objective were developed as follows:

Strategy A1.1-Improve quality of focal habitats on public and private lands, e.g., prescribed burns, CRP, and other focal habitat strategies.

Strategy A1.2-Implement strategies in Washington elk and mule deer management plans (note-not all sub-strategies will apply in all areas), including the following:

- Salt in backcountry
- Manage recreation activities during calving season
- Limit road densities
- Quantify & fund mitigation for damages
- Maintain existing wildlife fences
- Build new wildlife fences
- Utilize radio collars to track herds for direct movement back to public land
- Develop forage plots

Strategy A1.3-Limit the impacts of urban, rural residential, and agricultural development in elk and deer habitat uses that result in increased conflicts.

Strategy A1.4-Implement additional strategies to attract and retain elk and deer on public lands.

7.5 Research, Monitoring, and Evaluation

This section provides an overview of the research, monitoring, and evaluation (RM&E) approach proposed for aquatic and terrestrial habitats and species in the Lower Snake Subbasin. The RM&E activities proposed herein will help fill existing data gaps and will facilitate implementation of an adaptive management approach in the subbasin. Although general in nature due to limitations of the Subbasin planning process, this RM&E plan is intended to be refined over time.

- Research activities generally are intended to fill existing data gaps and establish baseline habitat conditions.

- Monitoring activities are intended to track individual project effectiveness, to document the extent to which strategies are being implemented, and to identify habitat and species responses to such actions.
- Evaluation activities enable subbasin planners to integrate research and monitoring data in a feedback loop to determine if strategies are contributing to achievement of the biological objectives, to assess the ability of objectives to address the working hypotheses, and to test accuracy of the working hypotheses.

The RM&E plan is split into two sections: aquatic (Section 7.7.1) and terrestrial (Section 7.7.2). Both the terrestrial and aquatics portion of the proposal describe high priority RM&E needs that will support achievement of the plan's vision. These needs are defined as programs that 1) gather data or conduct research that furthers our understanding of ecosystem function, 2) fill existing knowledge or data gaps, 3) answer questions critical to successful management of species or communities, 4) test or develop innovative restoration/management techniques, 5) identify the accuracy of assumptions, or 6) allow evaluation of the relative success of ongoing restoration/management activities, thereby facilitating adaptive management. Although they are discussed separately, each section follows the same general framework:

1. Identification of research needs to fill data gaps and establish baseline conditions
2. Identification of monitoring and evaluation needs to track progress on achievement of biological objectives and to support adaptive management in the subbasin.

The RM&E program is summarized below and is presented in full in Appendices L (terrestrial components) and M (aquatic components). Due to out of subbasin effects, habitat enhancement within the subbasin may not spur a direct increase in focal species populations. As such, the RM&E plan outlined below tracks improvements in both habitat quality and focal species populations. This plan is not intended to provide the full details needed for research and monitoring activities within the subbasin, but instead to provide direction and key areas in which such activities should focus. The intent is for this program to grow and develop as data gaps are filled, fed back into an adaptive management program to improve the information upon which this plan is based, and plan data needs change. However, cooperation among the various entities involved in aquatic and terrestrial species population and habitat enhancement is currently a high priority, and will likely continue as such well into the future.

7.5.1 Aquatic Habitats and Species

The full aquatic RM&E plan for the Lower Snake Subbasin is provided in Appendix M. Information regarding RM&E priorities for aquatic species of interest is provided in Appendix D. Note that this plan was reviewed by the Nez Perce Tribe and WDFW, but not by the public. Following are the guiding principles and priorities outlined in the plan:

- Fill EDT data gaps and establish baseline habitat conditions - focusing on filling data gaps that have the greatest leverage on EDT model outputs, those that are within priority protection or restoration stream reaches, attributes that have a broad effect on populations or habitat status, and data gaps that are identified specifically in the management plan). This includes gathering information on aquatic species of interest.

- Focus RM&E efforts on critical data needs for VSP attributes - improve understanding of abundance, diversity, spatial structure, and productivity.
- Implementation and effectiveness monitoring to document actions should be funded/undertaken within the basin – document the why, where, how much and whether of habitat recovery actions completed in the subbasin.
- Address critical uncertainties – critical uncertainties must be answered if populations are to be rebuilt and delisted. Such uncertainties may include habitat/life history stage relationships, causal relationships for degraded habitat and depressed or extirpated populations, and understanding the relationship between resident and anadromous *O. mykiss* subpopulations.
- Coordinate with regional efforts – as noted in Chapter 6, a wide variety of groups participate in habitat and species enhancement efforts within the subbasin. These efforts should be coordinated to the maximum extent possible both within the subbasin and at a regional scale.
- Data management and coordination are crucial to meet regional data accessibility needs.
- Methodologies should provided data of known quality (accuracy and precision).
- Validation of the EDT model as a reliable measure of habitat and population response to recovery actions taken in the Lower Snake Subbasin.
- A systematic approach to project selection and funding will be used that is consistent with and complementary to other RM&E efforts within the Columbia Basin.

The Lower Snake subbasin technical staff, managers, and stakeholders have initiated an effort to coordinate RM&E activities. Table 1 of Appendix M provides a detailed assessment of ongoing and needed RM&E activities. Following are broad RM&E recommendations based on principles and priorities and the items listed in Table 1 of Appendix M:

- Fund habitat inventories to collect data necessary to fill data gap for attributes with high EDT model leverage and evaluation of progress toward subbasin plan objectives. Specifically, appropriate data should be collected from Alpowa Creek, and possibly Penawawa Creek, to run the EDT within the next 3 years. The priority should be for Alpowa Creek. We currently do not have the data to attempt to run EDT on these two streams, and this does not allow for proper comparison of the enhancement potential between the four primary tributaries in the Lower Snake Subbasin (Almota, Deadman, Alpowa, & Penawawa).
- Continue to fund existing monitoring and evaluation actions within the subbasin that fulfill critical VSP data needs.
- Fund additional actions to complete basic population status monitoring needs for the subbasin
- Accountability for restoration actions needs to occur for each project. Basic documentation should be completed in a cost effective manner. A systematic approach to

documenting effectiveness is required that provides sufficient accountability without unnecessary redundancy.

- Fund research on critical uncertainties represented in the Lower Snake for a broader ESU relevance if not being funded or conducted in other subbasins (opportunity for a coordinated regional effort)
- Fund and implement RM&E that shows a clear link to resolving uncertainty regarding population abundance and management goals

7.5.2 Terrestrial Habitats and Species

The full aquatic RM&E plan for the Lower Snake Subbasin is provided in Appendix L. The intent of the terrestrial RM&E plan is to:

- evaluate success of focal habitat management strategies, via monitoring of focal wildlife species (The results of focal species monitoring and evaluation efforts are expected to function as potential performance measures to monitor and evaluate the results of implementing management strategies and actions on focal habitats).
- determine if management strategies undertaken are achieving recommended range of habitat management conditions, via monitoring and assessment of habitat conditions over time
- allow for evaluation of the assumptions and working hypotheses upon which the management plan is based, by determining if a correlation does indeed exist between focal habitat management conditions and focal species population trends

The terrestrial RM&E plan provided in Appendix L consists of two main components: 1) research; and 2) monitoring and evaluation. The research component identifies research needs, with their justification. Detailed research project design is not presented, however, being beyond the scope of the current planning effort. Existing data gaps, as identified through the subbasin planning process, are listed in this section, because many will require effort above routine monitoring and evaluation to address

Key research needs, a strategy to address the need, and the recommended agency/personnel to implement the strategy are identified by habitat type in Table 1 of Appendix L. General research needs that cross all habitat types include the following:

- Testing of the assumption that focal habitat are functional if a focal species assemblage's recommended management conditions are achieved.
- Testing of the assumption that selected species assemblages adequately represent focal habitats.
- Compilation of current, broad-scale habitat data through spatial data collection and GIS analysis.

All three of these general research needs would be a coordinated effort between federal, state, and local government agencies and NGOs.

The monitoring and evaluation component reviews focal habitat and focal species monitoring methodologies, and identifies monitoring needs for individual management strategies. Specifically, a monitoring and evaluation approach is provided for each terrestrial habitat enhancement strategy in Table 3 of Appendix L. Three key approaches regarding monitoring and evaluation are found throughout this table:

1. Identification of functional habitat. Current data provides a reasonable estimate of the extent of habitat types, but the functionality of those habitat types is unknown.
2. Track and report accomplishments of various entities.
3. Cooperative efforts among the various entities involved in species population and habitat enhancement work are encouraged wherever possible.

As mentioned above, this terrestrial RM&E program is intended to grow and develop as improvements are realized and strategies change. Tracking the results of project implementation and feeding those into an adaptive management program will facilitate more efficient use of project funds, and will help target such funds to those areas and projects that can provide the greatest benefit for terrestrial wildlife.

8. References

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APPENDIX A

Subbasin Planning Public Involvement Plan

APPENDIX B

Lower Snake Subbasin Aquatic Assessment

APPENDIX C

Out of Subbasin Survival Effects in EDT Analyses

APPENDIX D

Nez Perce Tribe Species of Interest Listings

APPENDIX E

Southeast Washington Wildlife Assessment

APPENDIX F

Level 2 Diagnosis and Project Inventory

APPENDIX G

Blue Mountains Elk Plan

APPENDIX H

Land Acquisition

APPENDIX I

Nez Perce Tribe Cultural Resource Study

APPENDIX J

Objectives Analysis

APPENDIX K

WDFW Lower Snake Subbasin Terrestrial Management Plan

APPENDIX L

Terrestrial RM&E Plan

APPENDIX M

Aquatic RM&E Plan