Asotin Subbasin Plan

May 2004 Version

Submitted by: **Asotin County Conservation District**

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Prepared for

Northwest Power and Conservation Council

Submitted by

Asotin County Conservation District

CONTRUBITORS

Subbasin Lead

Asotin County Conservation District

Subbasin Co-Lead

Nez Perce Tribe

Contributors

John Andrews, Washington Department of Fish and Wildlife
Becky Ashe, Nez Perce Tribe
Paul Ashley, Washington Department of Fish and Wildlife
Chad Atkins, Washington Department of Ecology
Paul Bedoin, Landowner/Pomeroy Conservation District
Keith Berglund, Garfield County Wheat Growers
William Dowdy, U.S. Forest Service, Umatillia National Forest
Jason Flory, U.S. Fish and Wildlife Service
Pat Fowler, Washington Department of Fish and Wildlife
Del Groat, U.S. Forest Service, Umatilla National Forest
Bradley Johnson, Asotin County Conservation District
Paul Kraynak, Nez Perce Tribe
Victoria Leuba, Washington Department of Ecology
Les Marois, Nez Perce Tribe
Steve Martin, Snake River Salmon Recovery Board
Glen Mendel, Washington Department of Fish and Wildlife
Ron Scheibe, Landowner, Asotin County Conservation District
Jim Schroeder, Natural Resource Conservation Service, Clarkston Field Office
Courtney Smith, Natural Resource Conservation Service, Clarkston Field Office
Mark Schuck, Washington Department of Fish and Wildlife
Angela Sondenaa, Nez Perce Tribe
Cheryl Sonnen, Asotin County Conservation District
Barry Southerland, Natural Resource Conservation Service, Spokane State Office
Megan Stewart, Asotin County Conservation District
Stacey Stovall, Washington Department of Fish and Wildlife
Emmit Taylor, Nez Perce Tribe
Mark Wachtel, Washington Department of Fish and Wildlife

Editors

Parametrix
Economic and Engineering Services, Inc.

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.

PREFACE (Continued)

Asotin Subbasin Addendum

The Asotin Subbasin has had considerable public input and buy-in for habitat restoration and enhancement projects for aquatic species since the early 1990's. The *Asotin Creek Model Watershed Plan (Model Watershed Plan)* was completed and printed in 1995 and it serves as a guide for ridge-top-to-ridge-top restoration for fish habitat and was the First Plan of its kind completed in Washington State with Bonneville funding. It is important to remember that Plans that are completed by locals can be implement without the need for regulatory hammers. The *Model Watershed Plan* and the associated 550 completed projects serve as an indication of what can be accomplished in prioritized watersheds on private lands with public support. The Asotin Subbasin Plan is consistent with and builds on the provisions of and success of the *Model Watershed Program*.

Local stakeholders, including the Asotin County Conservation District, recognize the importance of developing comprehensive, accurate plans to guide resource management efforts. However, these efforts must eventually begin to bear fruit through implementation to maintain the forward momentum that has been generated through the Model Watershed, Subbasin Planning, and similar processes. A significant amount of effort has gone into this plan, which represents the subbasin's best effort to balance a wide variety of interests. Participants in this process desire for this plan to be adopted by the Northwest Power and Conservation Council and implemented with the priorities, objectives, and strategies that were developed at the local level.

Given the number of on-going planning efforts in southeast Washington that are addressing salmon habitat (e.g. Model Watershed, Subbasin Planning, Water Resource Inventory Area Planning), it is essential that all efforts ultimately be merged into the Snake River Salmon Recovery Plan that will provide guidance for management of ESA-listed fish species and consistency on a regional scale. In addition to supporting implementation of related planning efforts, the Snake River Salmon Recovery Plan will provide the regional coordination that is necessary to appropriately manage fish and wildlife resources.

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 that 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 planning efforts, including the Asotin Model Watershed Plan, affect and are affected by the subbasin plans. The Asotin Creek Model Watershed Plan was completed in 1995 with local support and is currently in its implementation phase. This plan addressed issues of habitat and has served as the catalyst for a wide variety of habitat improvements throughout the subbasin. The Asotin Subbasin Plan is intended to build upon the successes of the *Model Watershed Plan* through development of an interactive relationship that is expected to be developed between subbasin planning, watershed plans, and State of Washington salmon recovery plans.

Asotin Subbasin Plan

This plan concerns the Asotin Subbasin in southeastern Washington. The Asotin Creek Subbasin is composed of 325 square miles located in Asotin and Garfield Counties drained by Asotin Creek, Couse Creek, Tenmile Creek and their tributaries. Asotin Creek originates in the Blue Mountains and is a tributary to the Snake River, draining an area of 208,000 acres. Rainfall ranges from more than 45 inches in the higher elevations to 12 inches in the lower elevations. Melting snow from the Blue Mountains provides much of the annual runoff to the streams and rivers in the subbasin; the water level in many streams diminishes greatly during the summer months. Vegetation in the subbasin is characterized by grasslands and agricultural lands at lower elevations and evergreen forests at higher elevations.

Pasture/rangeland (43 percent), cropland (26 percent), and forestland (30 percent) are the primary land uses in the subbasin. Approximately 67 percent of the Asotin Subbasin is in private ownership; most of this land is in the lower portion of the watershed.

The planning process in the Asotin Subbasin involved a number of organizations, agencies, and interested parties including the Asotin County Conservation District (ACCD), US Forest Service Pomeroy Ranger District, Nez Perce Tribe, Washington Department of Fish and Wildlife, private landowners and others. The lead entity for the planning effort was the ACCD 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 Tucannon 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 Asotin 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.

Aquatic Focal Species and Species of Interest

To guide the assessment and management plan, focal species were selected for aquatic and terrestrial habitats within the Asotin Subbasin. Aquatic focal species are steelhead/rainbow trout, spring Chinook salmon, and bull trout. These species were chosen based on the following considerations:

- Selection of species with life histories representative of the Asotin Subbasin
- ESA status

- Cultural importance of the species
- Level of information available about species' life histories allowing an effective assessment

In addition, Pacific lamprey and coho salmon were designated as aquatic "species of interest" for this planning effort. These species are of cultural and ecological significance to stakeholders, but not enough information was available to warrant their 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, bighorn sheep 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 Asotin Subbasin, four priority terrestrial 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. Aquatic focal species were 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 and salmon within the Asotin subbasin was accomplished with the Ecosystem Diagnostic and Treatment (EDT) model. Bull trout were not assessed using EDT as its methodology does not yet include information pertinent to that species. Further, insufficient data was available to run the EDT model on Couse Creek. The results from EDT on Tenmile were generally applied to Couse Creek.

EDT is a system for analyzing 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 Asotin Creek summer steelhead and spring/fall Chinook salmon, 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, Asotin Subbasin Summary, Asotin Model Watershed Plan, etc.); 2) the necessary trade-offs between the biological benefits provided by enhancement potential of one geographic area versus another to achieve geographic prioritization; 3) balancing the needs of all aquatic focal species; 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.

The areas with the highest restoration value in the Asotin Subbasin are: Upper Asotin (Headgate Dam to Forks), Lower George Creek, Lower NF Asotin, Charley Creek, and Lower SF Asotin. Within these priority areas, the most negatively impacted life stages were identified for steelhead and spring Chinook. In each of these areas, the key environmental factors that contribute to losses in focal species performance, i.e. limiting factors, were also identified. Key limiting factors for steelhead and spring Chinook included the following: sediment, large woody debris, key habitat (pools), riparian function, stream confinement, summer water temperature, bedscour and flow. Flow was identified as a primary limiting factor only in the Lower George geographic area. Decreasing the effect of these limiting factors through habitat enhancement is expected to benefit all aquatic focal species.

Priority protection geographic areas for aquatic focal species include all geographic areas identified for restoration plus the Upper North Fork Asotin Creek, Upper South Fork Asotin Creek, Upper George Creek, North Fork Asotin Tributaries, and the Headwater (upper ends of George Creek, Charley Creek, North Fork Asotin Creek, and South Fork Asotin Creek). Protecting current habitat conditions in these geographic areas is expected to achieve no loss of function, and to allow for natural attenuation of limiting factors over time to benefit aquatic habitat.

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. Shrub-steppe habitats, though common on the Columbia Plateau, do not occur in the Asotin Subbasin, nor is it considered to have occurred here historically. From historic to current times, there has been an estimated 73 percent decrease in riparian wetland habitat, 27 percent decrease in interior grassland habitat, and a 57 percent decrease in ponderosa pine habitat within 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, none of the subbasin is considered to be in high protection status, 2 precent is in medium protection status, 33 percent in low protection status, and 65 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 Asotin Subbasin, including the ACCD , Nez Perce Tribe, U.S. Fish and Wildlife Service (USFWS), NOAA-Fisheries, Washington Department of Fish and Wildlife (WDFW), Washington Department of Ecology (DOE), USDA NRCS and FSA, US Forest Service, county, and others. Key aquatic and terrestrial programs include the following:

- USDA Programs (e.g. Conservation Reserve Enhancement Program, Conservation Reserve Program)
- ACCD Habitat Cost-Share Programs (BPA, SRFB, and DOE Grants)
- Harvest regulations (tribal and sport fishing)
- Blue Mountains Elk Management Plan (WDFW)
- Priority Habitats and Species Program (WDFW)

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

- upland issues (60%)
- riparian restoration (23.9%)
- instream (13.3%)
- monitoring (2.7%)

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. Although local stakeholders desired to achieve the greatest coordination possible among various planning efforts, the draft Bull Trout Recovery Plan being developed by the U.S. Fish and Wildlife Service was not directly incorporated because it is still in draft form. However, the draft strategies it contains were considered and incorporated in general form during development of aquatic management strategies in the subbasin plan. The subbasin intends to consider incorporation of selected Bull Trout Recovery Plan strategies into the subbasin plan once the recovery plan is finalized.

For each priority restoration 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 George priority restoration geographic area, Working Hypothesis 4 states that an increase in riparian function and a decrease in stream confinement will increase the survival of steelhead, spring Chinook, and bull trout in various life stages. Biological objectives in this geographic area are as follows:

- Sediment – achieve less than 20% mean embeddedness
- Large Woody Debris – at least 1 piece per channel width should be present

- Pools – 10% or more of the stream surface area should be pools
- Riparian Function – the riparian function should be at least 50% of maximum
- Confinement – no more than 40% of the stream bank length should be confined
- Summer Maximum Water Temperature – the water temperature should exceed 75°F on fewer than 4 days per year
- Bedscour – limit bedscour to less than 10 centimeters
- Instream Flow – maintain summer flow in 90% of years

Strategies were identified specific to each biological objective and include enhancing riparian buffers, upholding existing land use regulations, implementing conservation easements, and decommissioning/paving roads near the river. These and similar strategies were applicable across all priority restoration geographic areas. Achieving the biological objectives in the priority restoration areas is considered a priority within the subbasin.

Aquatic strategies were also developed for two additional categories: 1) priority protection areas and 2) imminent threats. Priority protection geographic areas are those areas that EDT analysis or empirical data suggest would have the most negative impacts on the focal species if they were allowed to degrade further. Because all priority restoration areas are also considered priority protection areas, these strategies would apply to both types of geographic areas. Priority protection area strategies include but are not limited to implementation of riparian buffers, upland enhancement, alternative water development, conservation easements, expanding participation in the Conservation Reserve Program and similar efforts, and water conservation.

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. Implementing the identified strategies in priority protection areas and addressing imminent threats throughout the subbasin are also considered priorities within this subbasin plan.

Workng 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 restoration biological objectives only, protection biological objectives only, versus achieving all of the proposed biological objectives.
- Preliminary numeric fish population goals from other planning efforts (Biological objectives in this plan are habitat-based. Objectives with specific fish population numbers were not established in this subbasin plan).
- 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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L Terrestrial RM&E Plan
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ACRONYM LIST

ACCD	Asotin County Conservation District
ACCDLSC	Asotin County Conservation District Landowner Steering Committee
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
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)

SaSI	Washington Department of Fish and Wildlife Salmonid Stock Inventory
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 active restoration for this subbasin plan, and may not be consistent with typical definitions of active 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 fish that could potentially be supported by a stream under a defined set of habitat conditions (e.g. historic or current).

Hard Stabilization: Hard stabilization includes the use of rip rap, concrete, and similar structures to stabilize streambanks. *Use of such structures has been and will continue to be discouraged throughout the subbasin*. Methods such as vegetation planting, fascines, instream structures (e.g. J-hook vanes, vortex rock weirs), and similar bio-engineered structures, are the preferred methods of instream and riparian streambank stabilization.

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 0.1 m 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.

Managed Grazing: A grazing regime that includes consideration of the appropriate number of livestock for a particular area, alternative water sources and conveyance systems, timing, intensity, limited stream access (water gaps) and other practices combined in a manner that helps maintain the health and vigor of livestock, range and riparian vegetation, and water resources.

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.

GLOSSARY (Continued)

Passive Restoration: Passive restoration takes advantage of natural processes and out-of-stream actions 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 this subbasin plan, and may not be consistent with typical definitions of passive restoration.

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 percent 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

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 provide 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 Asotin Subbasin Plan is a local response to this regional directive. Components of this plan at the subbasin level will be integrated with those of the Grande Ronde, Imnaha, and Snake Hells Canyon subbasins in the Blue Mountain 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. The following assumptions were used by technical staff and the public during the development of biological objectives in the Asotin Subbasin. Specific definitions of terms can be found in the glossary.

Following are the key elements of the Asotin 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 list Planning Participants.

1.1 Planning Context

1.1.1 Relationship to Applicable Federal and State Regulations

The Asotin 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). A significant portion of ESA requirements for aquatic species in the subbasin will be met through development and implementation of the Snake River Salmon Recovery Plan. As a mechanism to obtain funding for habitat enhancement projects, the Asotin 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 Asotin Subbasin three primary aquatic species are listed as threatened: Steelhead, bull trout, and spring Chinook. 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 Asotin Creek summer steelhead, was listed as threatened under the federal Endangered Species Act (ESA) by NOAA Fisheries in August, 1997 (62 FR 43937).
- The Snake River spring/summer Chinook evolutionarily significant unit (ESU), which includes Asotin Creek spring Chinook, was listed as threatened under the ESA in 1992 (57 FR 14653).
- Bull Trout in the Columbia Basin (including Asotin Creek) were listed as threatened under the ESA in 1998.

The objectives and strategies outlined in the plan (Chapter 7) provide direction for implementing projects on tributary streams that will contribute to the recovery of these listed species.

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, where watersheds are divided into Water Quality Management Areas (WQMAs). Asotin Creek, from the mouth at the Snake River to the confluence of the North and South Forks, is being considered for a TMDL in the Upper Snake WQMA. Specific strategies outlined in the management plan (Chapter 7) will provide direction for water quality enhancement (addressing primarily turbidity and temperature).

1.1.2 Integration with Related Planning Efforts

The Asotin Subbasin Summary was completed in 2001 (Stovall 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; and 3) attempted integration and agreement by diverse stakeholders on a common set of hypotheses, objectives, and strategies.

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.

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

Assessment/Plan	Sponsor
Limiting Factors Analysis, 2002	Washington Conservation Commission
Asotin Subbasin Summary, 2001	Northwest Power and Conservation Council
Asotin Creek Model Watershed Plan, 1995	Northwest Power and Conservation Council
Bull Trout Recovery Plan (draft), 2002	United States Fish and Wildlife Service
Spirit of Salmon; Wy-Dan-Ush-Mi-Wa_Kish-Wit, 1996	Columbia River Inter-tribal Fish Commission

In addition to integration with BPA 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 non-BPA funding.

One such planning effort completed in the past, and currently in its implementation phase, was the *Asotin Creek Model Watershed Plan* (Asotin County Conservation District Landowner Steering Committee 1995). This plan, finalized in 1995, addressed issues of salmonid habitat protection and restoration project goals and objectives. Specific goals included the following (ACCDLSC 1995):

1. Strive for substantially improved fish and wildlife habitat quality and quantity.
2. Involve community groups and volunteers outside of the farming and ranching industry to support the plan and help improve fish and wildlife habitat.
3. Prioritize habitat improvements to make cost effective and responsible use of public funds.
4. Focus project efforts on a watershed/ecosystem approach rather than just the riparian area.
5. Create pro-active management of private resources without increasing government regulations.
6. Promote cooperative efforts between landowners and agencies.
7. Strive to reduce instream sediment levels by improving upland management practices.
8. Promote the use of conservation practices on all confined livestock winter feeding and calving areas, adjacent to Asotin Creek and its tributaries, to protect water quality and the riparian area.

9. Develop a public information and education program to raise the natural resource awareness of county residents.

10. Develop a watershed management plan that meets Section 10 requirements under the Endangered Species Act for a "habitat conservation plan".

Implementation of the *Asotin Creek Model Watershed Plan* through BPA and other funding sources has resulted in significant improvements in aquatic and terrestrial habitats in the subbasin through the cooperative efforts of landowners, the Asotin County Conservation District, and others.

One additional planning activity is the Water Resource Inventory Area (WRIA) 35 watershed planning process. This process, currently in the assessment phase, will incorporate the management plans of the Asotin, Lower Snake, and Tucannon subbasins as its approach for assessing and managing fish habitat. WRIA 35 planners intend to incorporate the appropriate subbasin plans by reference.

The Snake River Salmon Recovery Plan is another local planning effort that will incorporate the information provided by several subbasin plans, including the Asotin. 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, the Nez Perce Tribe, and the Confederated Tribes of the Umatilla Indian Reservation are guiding the habitat 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 supporting implementation and progress evaluation of habitat improvement projects for the Asotin Subbasin Plan.

1.2 Planning Process and Participants

The planning process in the Asotin Subbasin involved numerous entities, including the Asotin County 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 Asotin Subbasin Plan was the Asotin County 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 and Economic and Engineering Services, Inc.

The key group involved in guiding the Asotin Subbasin Plan was the Asotin, Lower Snake, and Tucannon Subbasin Planning Team (SPT). The SPT was established in fall 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, the forum in which significant policy-level issues were discussed and addressed. Given that all major groups involved in Subbasin planning in the Asotin were involved on the SPT, it also served a key function coordinating the efforts of its members. The SPT operated by consensus. Decision memos were used to track approval of plan components and key decisions throughout plan development.

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 comprised primarily of Conservation District, Nez Perce Tribe, U.S. Forest Service (USFS), USFWS, Washington Department of Fish and Wildlife (WDFW), Washington Department of Ecology and consultant team staff. The primary purpose of the technical work group was to review and evaluate WDFW work products before presentation to the public in order to identify inconsistencies and address technical issues.

The Asotin 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 (see Figure 1-1).

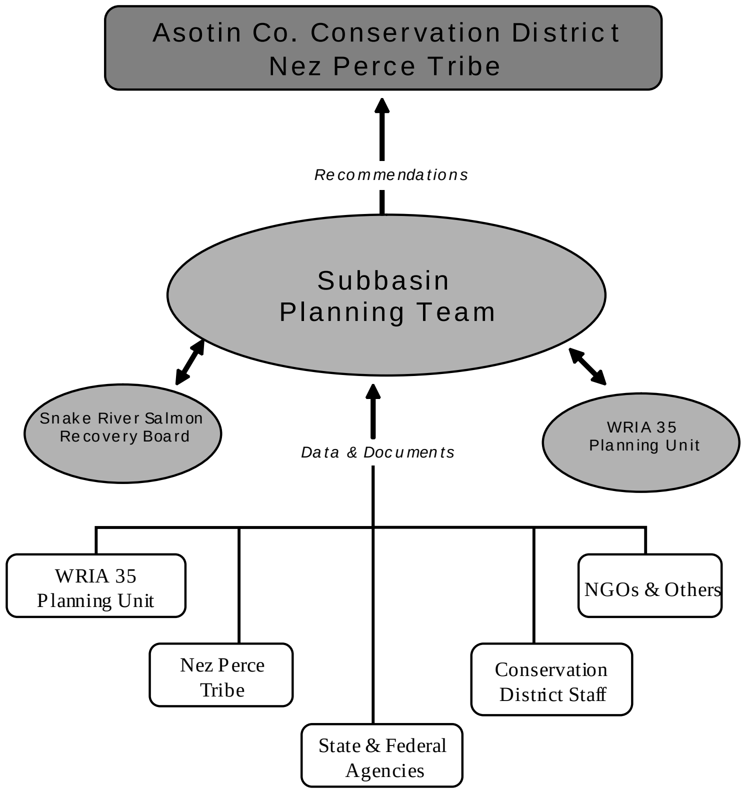

Figure 1-1 Asotin Subbasin Information Flow and Decision-Making Framework

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=1)
- 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 interface 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 Asotin County Conservation District, Nez Perce Tribe, state agencies, and others.

1.4 Plan Approval

On May 13, 2004, the Asotin County Conservation District Board of Directors approved submittal of the Asotin Subbasin Plan, May 2004 Version, to the Northwest Power and Conservation Council.

1.5 Plan Updates

The Asotin 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

This section contains the following:

- Description of the subbasin
    - Subbasin location
    - Climate
    - Physical factors
    - Water resources and hydrology
    - Fish and wildlife species
    - Vegetation
    - Current and historic land use
    - Political jurisdictions and land ownership
- Regional context for the subbasin plan
    - Relationship to ESA planning units
    - Out-of-subbasin environmental conditions, and
    - Long-term environmental trends.

2.1 Subbasin Description

2.1.1 Location and Climate

The Asotin Creek Subbasin is composed of 325 square miles located in Asotin and Garfield Counties in the southeast corner of Washington (Northwest Power Planning Council 2001; Figure 2-1). Asotin Creek originates in the Blue Mountains and is a tributary to the Snake River, draining an area of 208,000 acres (Northwest Power Planning Council 2001). The following description of the drainage area and climate in the Subbasin were excerpted from the Draft Asotin Creek Subbasin Summary completed by the Northwest Power Planning Council (NPPC 2001).

> "Asotin Creek has two major drainages, the mainstem and George Creek. The mainstem drains 119,000 acres and flows into the Snake River at the city of Asotin, Washington. Major tributaries to the mainstem include Charley Creek, North Fork of Asotin Creek, South Fork of Asotin Creek, and Lick Creek. George Creek drains 89,000 acres and its major tributaries include Pintler Creek, Nims Gulch, Ayers Gulch, Kelly Creek, Rockpile Creek, and Coombs Canyon.
>
> "The region's climate is influenced by the Cascade Mountains to the west, the Pacific Ocean, and the prevailing westerly winds. The subbasin receives a mean annual precipitation of 23 inches including a mean annual snowfall of 65 inches. Rainfall ranges from more than 45 inches in the higher elevations to 12 inches in the lower elevations. Ninety percent of the precipitation occurs between September and May with 30 percent of the winter's precipitation falling as snow. Snowfall at elevations less than 1,500 feet seldom lingers

beyond three or four weeks, occasionally melting quickly enough to produce severe erosion (Kelley et al. 1982; Fuller 1986). Temperatures can range from -20°F in the winter to 105°F in the summer. The growing season in the subbasin is 115 to 155 days."

The Tenmile and Couse Creek drainages are also located within the Asotin Subbasin, though they drain directly to the Snake River (see Figure 2-1).

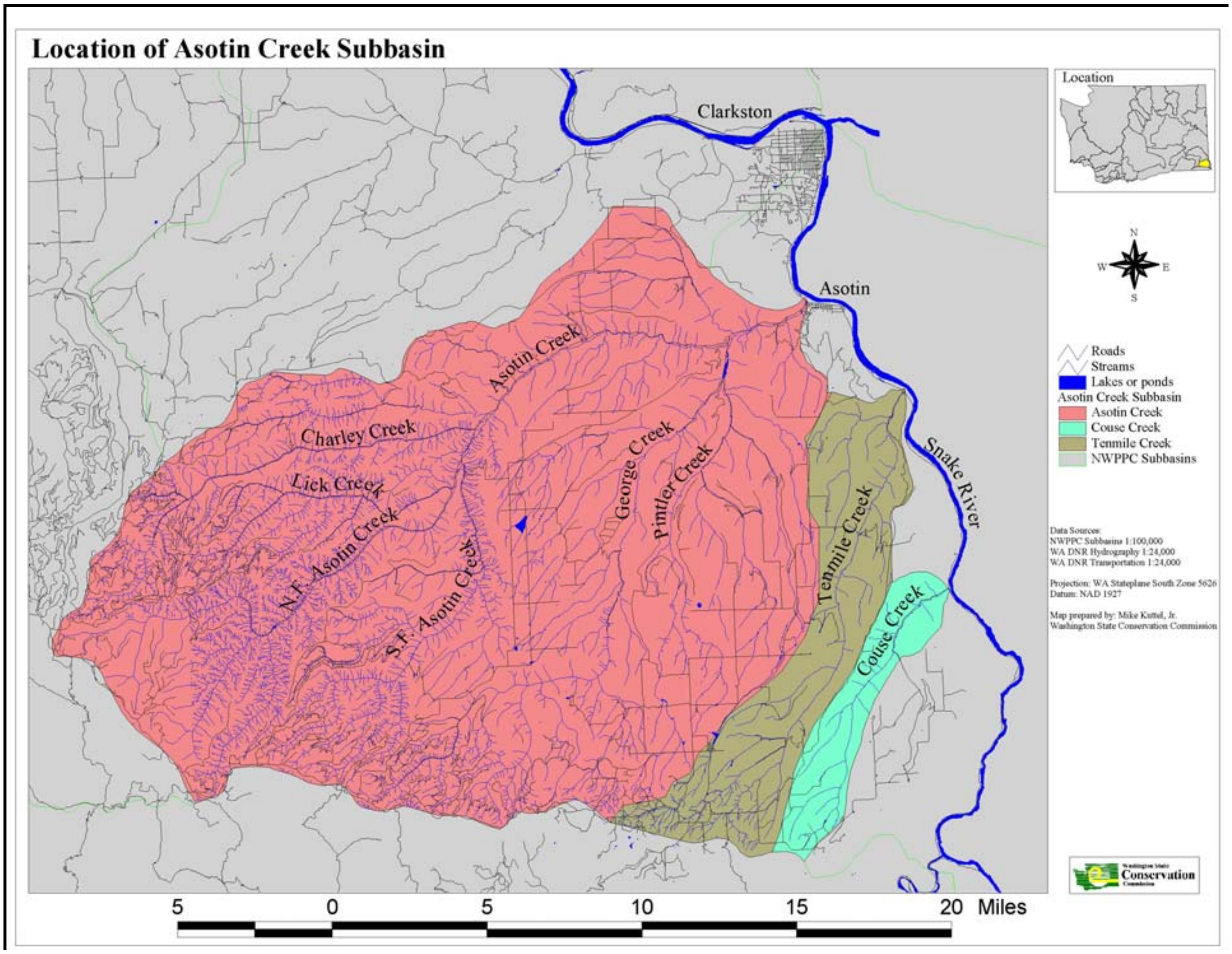

Figure 2-1 Location of Asotin Creek Subbasin (NPPC 2001, Figure 1)

2.1.2 Physical Environment

The following description of the topography and soil composition in the Subbasin was excerpted from the Draft Asotin Creek Subbasin Summary (NPPC 2001).

"Topography in the Asotin Creek subbasin consists of basaltic rocks, which include ancient fractured and folded lava flows. The bedrock is overlain by fine-grained loess soils that are highly erodible when exposed to the elements. Folding of the underlying bedrock has resulted in a plateau tilted slightly to the north and east. The increase in elevation from this uplift caused streams to cut down and form very steep, and generally narrow, v-shaped canyons (Figure 2-2).

"Asotin Creek historically had a less severe gradient, a meandering flow pattern with point bars that formed pools and riffles, and well developed floodplain connections. The point bars provided habitat for an entire aquatic community of plants and animals. The stream channel had long, deep pools and a well-developed thalweg. Today, much of Asotin Creek and its tributaries have been straightened, diked, or relocated. The straight, wide and shallow channel continuously adjusts in order to compensate for alterations to channel shape and location, floodplain disconnections, and modifications to runoff patterns. Flood events in conjunction with these channel modifications have resulted in a braided channel lacking instream structure, pools, and woody riparian vegetation (NRCS 2001). The loss of well-developed thalwegs with naturally functioning point bars is responsible for much of the loss of fish habitat."

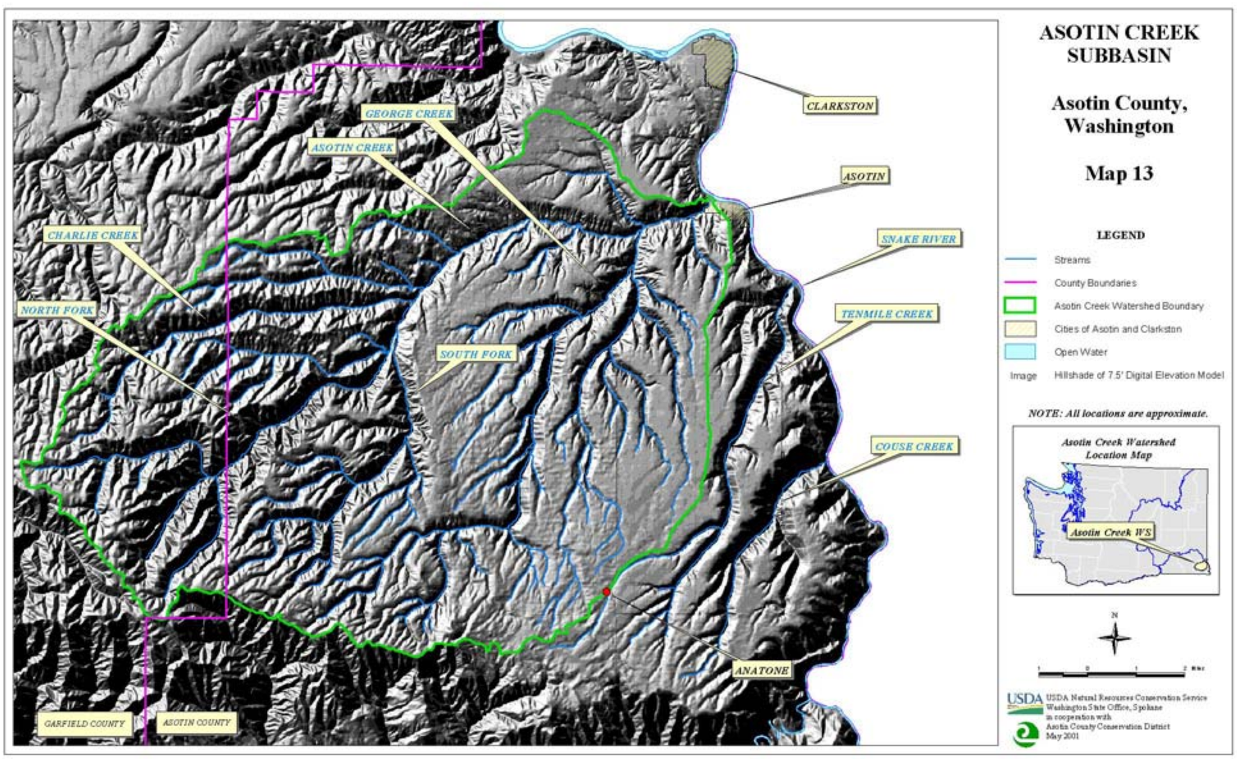

Figure 2-2 Topography of Asotin Creek Subbasin

NPPC 2001, Figure 2

2.1.3 Water Resources and Hydrology

The following description of hydrology in the Subbasin was excerpted from the Draft Asotin Creek Subbasin Summary (NPPC 2001).

> "Historic and current land use practices have altered the hydrologic cycle of Asotin Creek. Farming, timber harvesting, and urbanization have changed the water cycle, reducing water infiltration and accelerating runoff. To a lesser extent, modifications of the riparian zone, including tree removal, road building, grazing, soil compaction, and flood control projects also altered Asotin Creek hydrology… Asotin Creek is now wider and shallower than it was historically. Changes in the hydrologic cycle are demonstrated by excessive runoff, altered peak flow regimes, lack of ground water recharge, reduction in soil moisture storage, and low late-season flow (Figure 2-3). Stream channel straightening, an increase in slope, and flow velocity have caused a loss of instream fish habitat, especially pools."

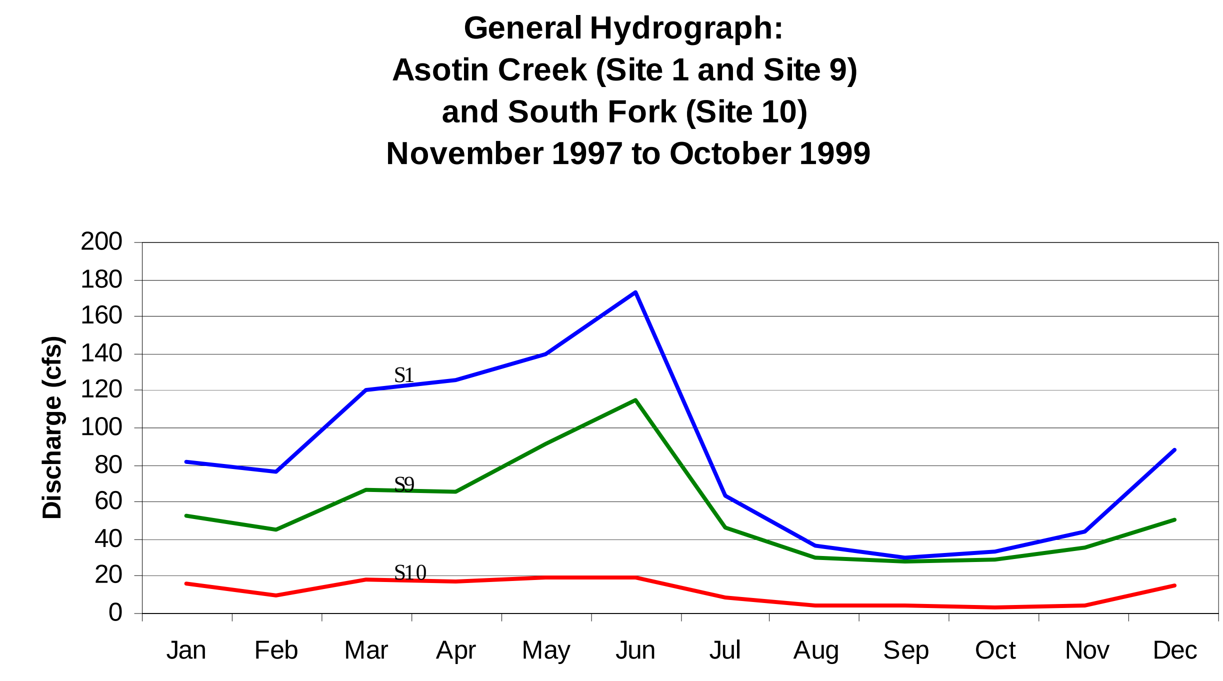

Figure 2-3 General Hydrograph: Asotin Creek/South Fork, November 1997- October 1999

ACCD 2000 as shown in NPPC 2001, Figure 5

Water quality assessments completed in the Subbasin have revealed several water quality problems in the creek and its tributaries. The Washington Department of Ecology classifies Asotin Creek and its tributaries that occur outside the Umatilla National Forest as Class A (excellent); waters occurring within the National Forest are classified as Class AA (extraordinary). Asotin Creek, from the mouth at the Snake River to the confluence of the North and South Forks, has been shown not to meet these standards for temperature and fecal coliform, and is being considered for a Total Maximum Daily Load (NPPC 2001).

2.1.4 Fish and Wildlife Species

Fish

The Asotin Creek subbasin supports a diverse collection of anadromous and resident fish species, some of which are on the ESA list, and is an important Snake River tributary for salmonid production (NPPC 2001; Table 2-1).

Table 2-1 Fish species present in Asotin Creek Subbasin

Species	Distribution
Bull trout (*Salvelinus confluentus*)	UW
Steelhead trout (*Oncorhynchus mykiss*)	WS
Spring Chinook salmon (*Oncorhynchus tshawytscha)*	E
Mountain whitefish (*Prosopium williamsoni)*	UNK
Northern pikeminnow (*Ptychocheilus oregonensis)*	UNK
Longnose dace (*Rhinichthys cataractae*)	UNK
Speckled dace (*Rhinichthys osculus)*	LW
Redside shiner (*Richardsonius balteatus*)	UNK
Chiselmouth (*Acrocheilus alutaceus*)	NM
Peamouth (*Mylocheilus caurinus*)	NM
Largescale sucker (*Catostomas macrocheilus*)	UNK
Bridgelip sucker (*Catostomas columbianus*)	WS
Pacific lamprey (*Lampetra tridentata*)	UNK
River lamprey (*Lampetra ayresi*)	UNK
Paiute sculpin (*Cottus beldingi*)	WS
Smallmouth bass (*Micropterus dolomieui*)	UNK
Bluegill (*Lepomis macrochirus*)	NM
Crappie (*Pomoxis spp.*)	NM
Channel catfish (*Ictaluris punctatus*)	UNK
Carp (Cyprinus carpio)	LW

E = extirpated, UW = upper watershed, LW = lower watershed, WS = wide spread, NM = near mouth of major drainages, UNK = unknown

Note: The Snake River ESU lists spring Chinook as threatened, however, there is debate as to whether or not remnant populations exist in the Asotin Subbasin.

Source: NPPC 2001, Table 3

The following discussion of fish species of concern occurring in the Subbasin was excerpted from the Draft Asotin Creek Subbasin Summary (NPPC 2001; See Chapter 3 for more detail).

> “Historical records indicate that Asotin Creek once harbored a moderate run (>100 adults) of spring chinook salmon. However, recent surveys indicate few or no adult spring chinook annually spawn in Asotin Creek (ACCD 1995).

"Washington Department of Fish and Wildlife personnel have conducted tagging studies of naturally produced Asotin Creek chinook each year since 1985. These studies indicate an overall return rate (egg to returning spawner) of 0.01-0.52 percent for Asotin Creek chinook (Mendel et al. 1993). Although no similar studies have been done for Asotin chinook, they probably have a lower return rate than the Asotin fish because they have two more dams to negotiate.

"Summer steelhead runs have faired much better in the Asotin Creek watershed than those of the salmon. Historical records indicate that Asotin Creek once harbored strong runs (>800 adults) of summer steelhead. However, recent surveys indicate steelhead spawner escapement has declined to about 200 (ACCD 1995).

"No adult Pacific lamprey have been documented in Asotin Creek since at least 1980. However, Mendel (1994) and others have noticed small lamprey, which could have been either river lamprey, which, like the Pacific lamprey, are also anadromous and parasitic on other fish as adults, or western brook lamprey, which are blind and never leave the stream.

"A 1993 USFS survey documented the presence of bull trout in the middle branch of the North Fork of Asotin Creek, the lower 1.5 miles of the South Fork of the North Fork of Asotin Creek, and in Charley Creek. Spawning surveys indicate this population has very limited distribution... The Salmonid Stock Inventory (WDFW 1998) indicates bull trout presence in Charley Creek, the North Fork, and its tributaries. The WDFW considers bull trout a "category 1" species on the state list of threatened and endangered species and lists the Asotin Creek race as "high risk." In general, bull trout in this watershed are thought to be resident populations, but WDFW suspects it historically may have also had fluvial or adfluvial connections with the Snake River as observed in the Asotin Creek (Underwood et al. 1995)."

Wildlife

The Asotin Creek subbasin contains approximately 277 species of wildlife (NPPC 2001). Table 2-2 (NPPC 2001) identifies Priority Habitat Species (PHS) within the subbasin. Population status varies by area and species; some species are doing well, while others are listed as state threatened, candidate, or species of concern (NPPC 2001). The peregrine falcon is the only state endangered species in the subbasin, while the ferruginous hawk, sharptail grouse, and bald eagle are listed as state threatened species (NPPC 2001). Mule deer populations are near WDFW management objective, while elk and bighorn sheep populations are below management objective within the subbasin.

Table 2-2 Status of Terrestrial Priority Habitat Species (PHS) within the Asotin Creek Subbasin

Species	State Status	Population
Ferruginous hawk (*Buteo regalis*)	T	unknown
Peregrine falcon (*Falco peregrinus*)	E	1 nesting pair
Sharptail grouse (*Tympanuchus phasianellus)*	T	extirpated
Loggerhead shrike (*Lanius ludovicianus*)	C	unknown
Goshawk *(Accipiter gentilis)*	C	unknown

Species	State Status	Population
Bald eagle (*Haliaeetus leucocephalus*)	T	wintering
Golden eagle (*Aquila chrysaetos*)	SC	declining
Chukar (*Aclectoris chukar*)	G	low
Wild turkey (*Meleagris gallopavo*)	G	stable
Sagebrush vole (*Lemmiscus curtatus*)	SM	unknown
Bighorn sheep (*Ovis canadensis*)	G -PHS	below MO
Mule deer (*Odocoileous hemionus)*	G-PHS	MO lowlands
Whitetail deer (*Odocoileous virginianus*)	G-PHS	MO
Elk (*Cervus elaphus*)	G-PHS	below MO

State Status: E = endangered, C = candidate, T = threatened, SC = species of concern, G = game species, PHS = Priority Habitat Species SM = state monitor, MO = management objective.

Source: NPPC 2001, Table 6

2.1.5 Vegetation

The following description of vegetation in the Subbasin was excerpted from the Draft Asotin Creek Subbasin Summary (NPPC 2001). More detail on vegetation cover types and classification can be found in Chapter 4.

> "Historical records of the condition of riparian vegetation within the subbasin are limited... Periodic flooding events have substantially altered the riparian vegetation. Aerial photographs dating from the 1950s and interviews with local residents (G. Caldwell, subbasin resident, personal communication, 1999) indicate that the predominance of alder (*Alnus* spp.) in the lower Asotin Creek watershed is a relatively recent occurrence.
>
> "Forested riparian vegetation along Asotin Creek and other subbasin streams remains in transition, modified by recent flooding events. In 1993, about 64 percent of the riparian vegetation along Asotin Creek consisted of mixed successional stands of alder and black cottonwood (ACCD 1995)… Flooding in 1996-97 substantially reduced the riparian forest overstory on Asotin Creek. By 2000, only 16 percent of the Creek contained more than 70 percent canopy closure considered desirable for stream shading (NRCS 2001). Damage to riparian cover in the upper portion of the watershed was evident, where canopy cover was reduced approximately in half compared to pre-flood (1993) surveys.
>
> "Understory shrubs typical of riparian forests include red-osier dogwood (*Cornus sericea*) and willows (*Salix* spp.), significant for their wildlife values (NRCS 2001). Herbaceous understory growth demonstrates disturbance in these communities. Cheatgrass (*Bromus tectorum*), Kentucky bluegrass (*Poa pratensis*), Reed canarygrass (*Phalaris arundinacea*), mullein (*Verbascum thapsus*), chicory (*Chicorium intybus*), and Scotch thistle (Onopordum *acanthium*) are among the most frequently encountered species…
>
> "The clearest indication of rangeland trends in the watershed is a decline in range condition due to the spread of noxious weeds, primarily yellow starthistle (*Centaurea solstitialis*). The Asotin County Weed Board (Weed Board) [actually called Asotin County Noxious Weed Control Board] estimates an increase in weed-infested acreage, from 2,000 acres in 1986 to

over 15,000 acres in 1993 (ACCD 1995). About 9,000 acres occur primarily in the lower portion of the watershed, but isolated populations are also found along the South Fork and in George Creek above Wormell Gulch. Yellow starthistle thrives on south-facing, degraded sites formerly occupied by cheatgrass, but also invades native rangeland and CRP seedings. In other rangeland areas, diffuse knapweed (*Centaurea diffusa*), chervil (*Anthriscus sylvestris*), and Scotch thistle are spreading. Between 1954 and 1993, the USFS Asotin allotment experienced an improved trend for range vegetation (ACCD 1995).

"Fire suppression has eliminated the mosaic pattern of stand age classes and created a more continuous stand, enabling stand replacement fires to attain larger size. Wildlife, big game in particular, derives some benefit from these undisturbed stands… However, fire suppression has also resulted in stagnant, over-stocked stands that contain trees with low vigor and unnaturally high downed-woody fuel loadings… Current conditions are ripe for disturbances of the same types as historic regimes. However, because of the conditions created by past management activities and/or lack of management activities, it is likely that the disturbances would occur with a higher intensity and over a larger percentage watershed area."

In 2004, the Asotin County Weed Board identified the following as noxious weed species of highest concern in the subbasin: rush skeletonweed, sulfur cinquefoil, orange hawkweed, Japanese knotweed, Dalmatian toadflax, perennial pepperweed, spotted knapweed, leafy spurge, whitetop, common bugloss, longspine sandbur, oxeye daisy, and pheasant's eye. These weeds currently have limited distribution in the subbasin, but the potential for ecosystem disturbance due to infestation by these weeds is high.

2.1.6 Current and Historic Land Use

The following description of major land uses was excerpted from the Draft Asotin Creek Subbasin Summary (NPPC 2001).

"Pasture and rangeland, cropland, and forestland are the predominant land uses within the Asotin Creek subbasin (Figure 2-4). Historic and current land uses have resulted in some portions of the subbasin undergoing stream channel instability (i.e., channel widening, down cutting, vertical cut banks, and excessive gully development)."

"Historically, livestock grazing in the Asotin Creek watershed began in the early 1800s. By the early 1900s, cattle, sheep, and wild horses grazed the watershed. The United States Forest Service (USFS) began regulating grazing on its lands and established the Asotin allotment in 1929 and the Peola-Pomeroy allotment in 1939.

"Pasture and rangelands occupy 43 percent (90,393 acres) of the Asotin Creek watershed. Livestock are wintered in the lower portions of the subbasin from December through March. After calving, most cattle graze lower canyon slopes until forest grazing is available in June or July. Fall/winter pastures include grain and canyonside pastures.

"Approximately 26 percent (54,956 acres) of the Asotin Creek watershed is comprised of cropland consisting of winter wheat and spring barley with summerfallow every two to three years…

"Forestland covers an estimated 62,621 acres (30 percent) of the Asotin Creek watershed, primarily in the north central portion of the subbasin. The primary timber type is Douglas fir (*Pseudotsuga menziesii*). Other timber types include ponderosa pine (*Pinus ponderosa*), lodgepole pine (*Pinus contorta Douglasii*), grand fir (*A. grandis*), Engelmann spruce (*Picea engelmannii*), and western larch (*Larix occidentalis*)."

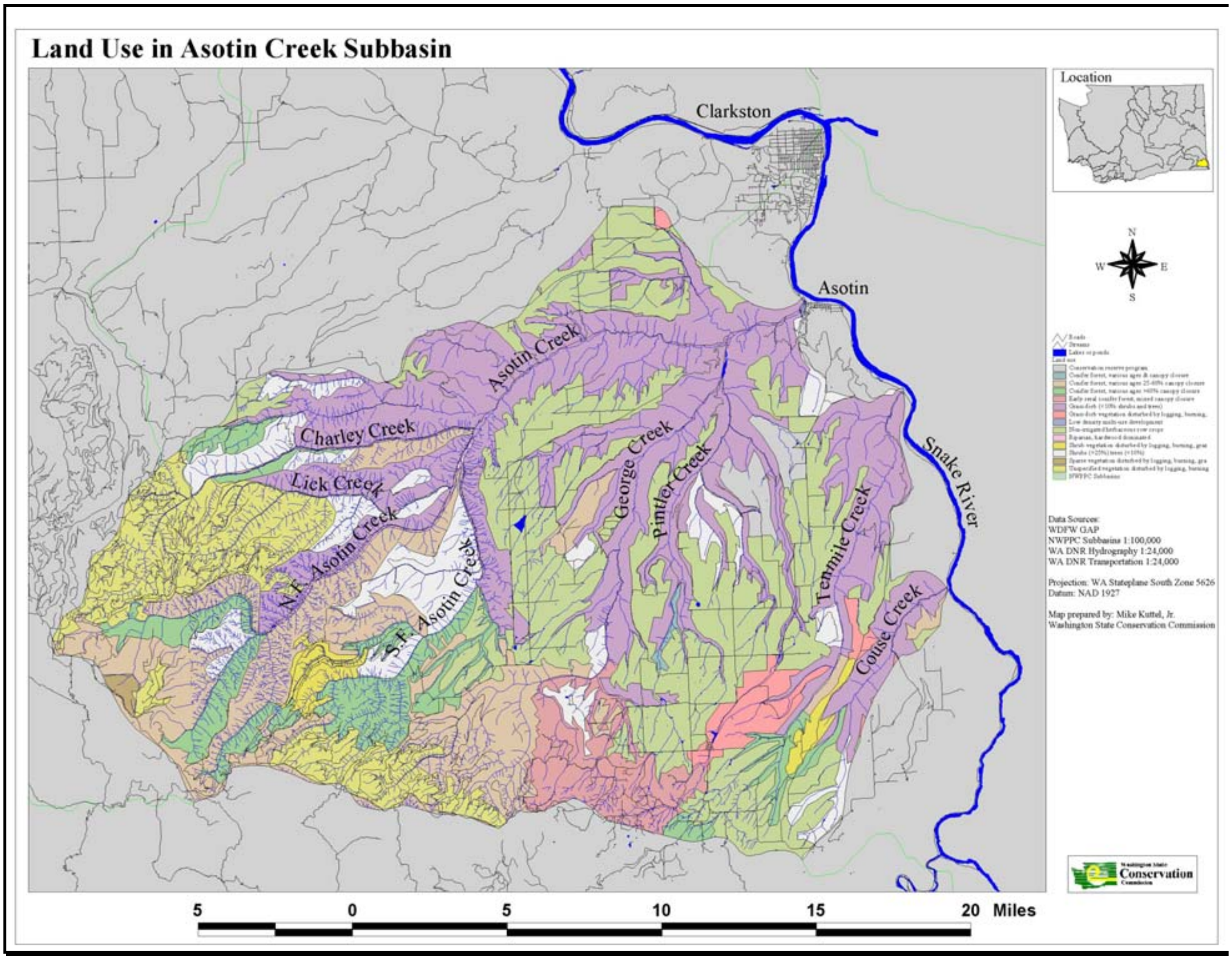

Figure 2-4 Land use in the Asotin Creek Subbasin
Source: NPPC 2001, Figure 3.

2.1.7 Political Jurisdictions and Land Ownership

The following discussion of land ownership and jurisdiction in the Subbasin was excerpted from the Draft Asotin Creek Subbasin Summary (NPPC 2001).

Primary jurisdictions in the Asotin Subbasin include Asotin County, Garfield County, City of Asotin, and the Nez Perce Tribe. With regard to subbasin planning, Cities and Counties work to uphold land use and other environmental regulations and to complete public works using the best management practices available. The Asotin County Conservation District also plays a key role in the Asotin Subbasin facilitating landowner participation in conservation programs and implementing habitat enhancement projects. The Nez Perce Tribe supports a wide variety of conservation and habitat enhancement projects within the subbasin.

> "Approximately 33 percent of the lands in the Asotin Creek subbasin are in public ownership of which the Umatilla National Forest comprises 26 percent (Figure 2-5). There are 142 farm and ranch operators that own or lease agricultural lands in the subbasin. The size of agricultural holdings varies from 160 acres to 5,000 acres, with the average landowner owning or leasing 1,993 acres" (Cook and Jordan 1994).

> "The majority of forestland is in the Umatilla National Forest and is managed by the USFS for multiple uses including timber management, livestock grazing, outdoor recreation, mining, and water management. The state of Washington and non-industrial private forestland owners manage the remaining forestland."

The Asotin 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 Asotin Subbasin provides hunting, fishing and gathering opportunities for tribal members (refer to tribal harvest section).

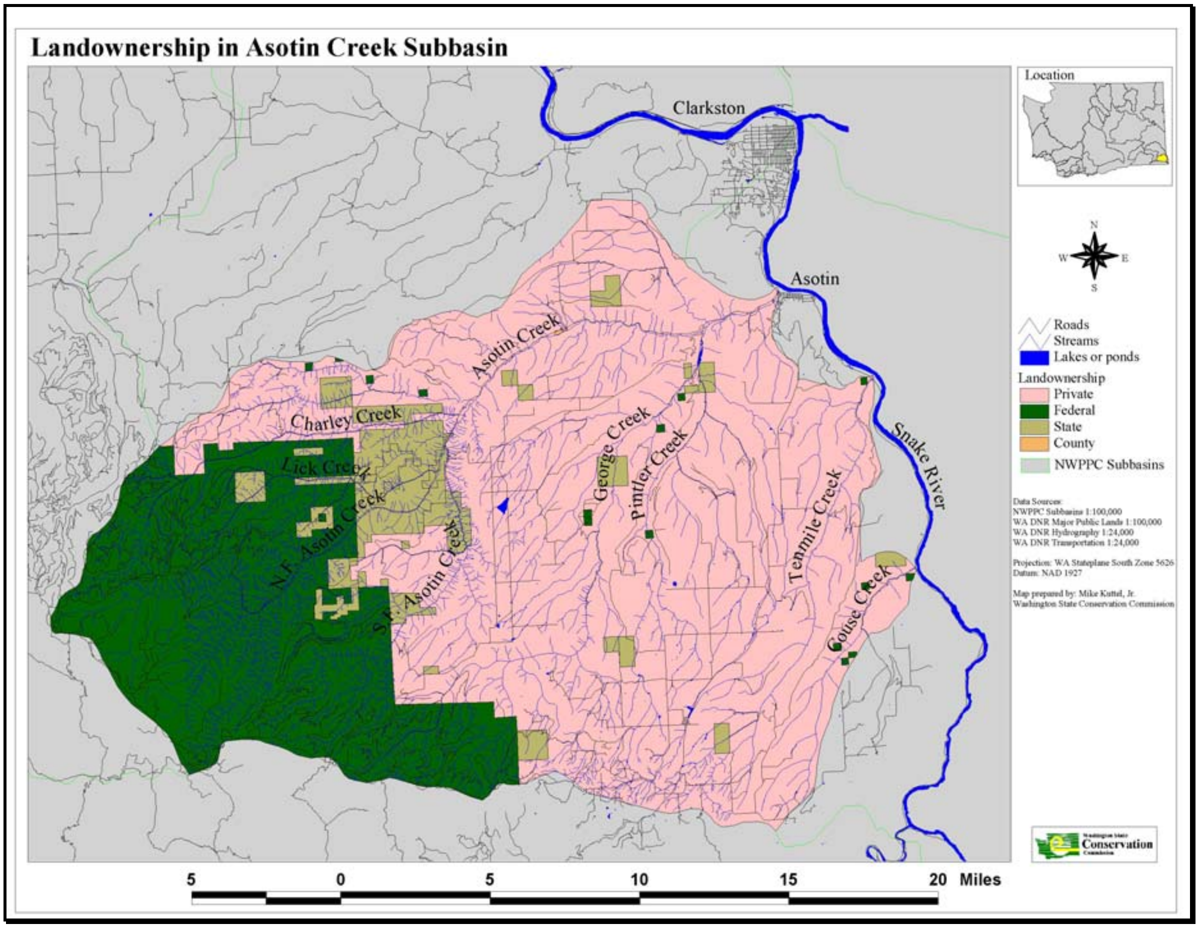

Figure 2-5 Land ownership in the Asotin Creek Subbasin
NPPC 2001, Figure 4

2.2 Regional Context for Subbasin Plan

2.2.1 Relation to ESA Planning Units

The Asotin Subbasin is only one portion of the larger Evolutionarily Significant Units (ESUs) that are the geographic basis for ESA listings. Given that it is only one subbasin within an ESU, if populations within the Asotin Subbasin were enhanced to become healthy and productive, the species could remain threatened at the ESU scale. As such, although efforts accomplished within the Asotin 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 2-6 shows the relationship of the Asotin Subbasin to the Snake River Basin Steelhead ESU. Figure 2-7 shows the relationship of the Asotin Subbasin to the Snake River Basin Fall Chinook ESU. Figure 2-8 shows the relationship of the Asotin Subbasin to the Snake River

Basin Spring/Summer Chinook ESU. Figure 2-9 shows the relationship of Asotin Creek bull trout to the Snake River Recovery unit. Steelhead, spring Chinook, and bull trout were selected as focal species in this subbasin. Although important at the regional scale, fall Chinook were considered by co-managers to be less of a priority and as such were not selected as a focal species.

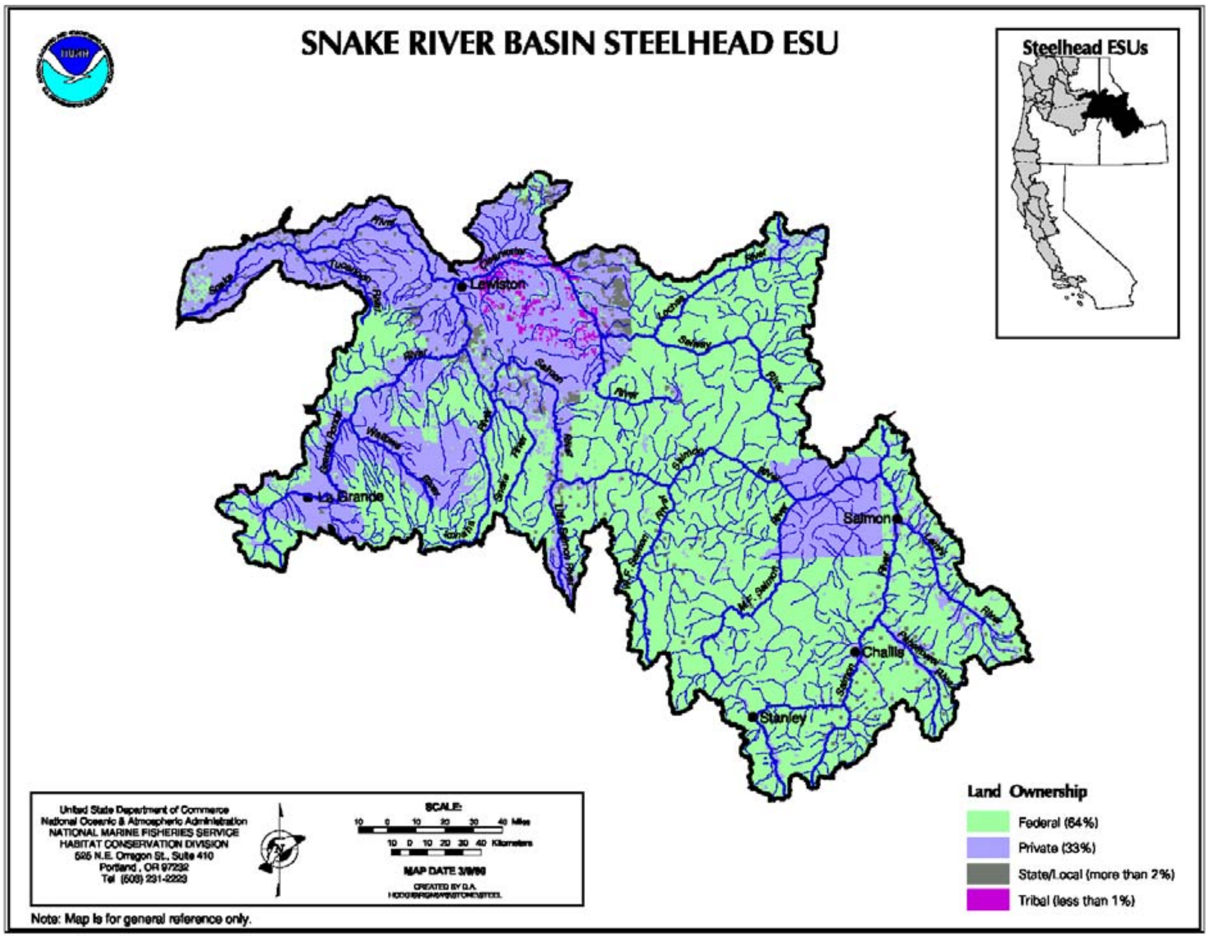

Figure 2-6 Relationship of Asotin Subbasin to the Snake River Basin Steelhead ESU

Source: NOAA-Fisheries 2004

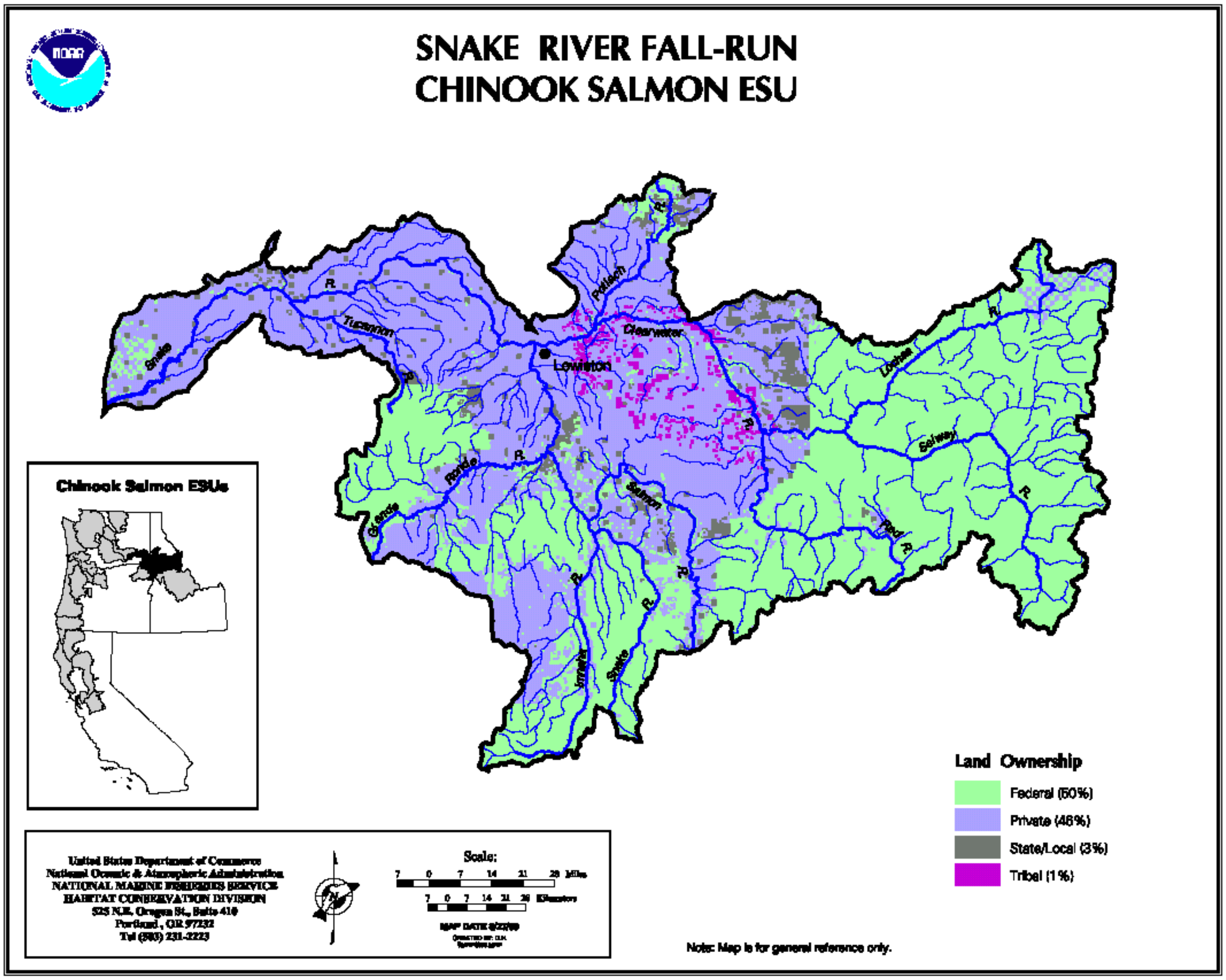

Figure 2-7 Relationship of Asotin Subbasin to the Snake River Basin Fall Chinook ESU

Source: NOAA-Fisheries 2004

Note: Fall Chinook were not selected as a focal species in the Asotin Subbasin (see Section 3.1)

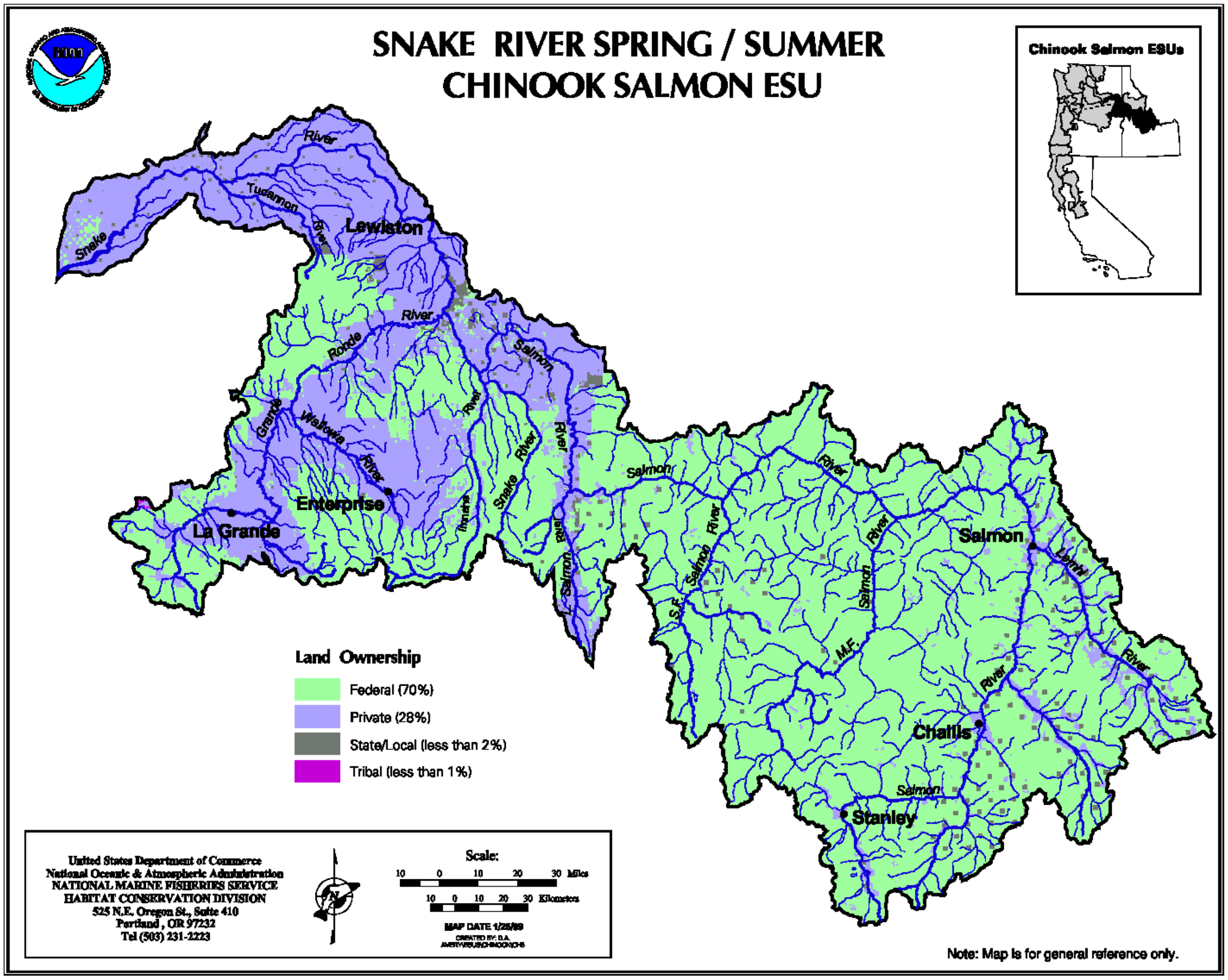

Figure 2-8 Relationship of Asotin Subbasin to the Snake River Basin Spring/Summer Chinook ESU

Source: NOAA-Fisheries 2004

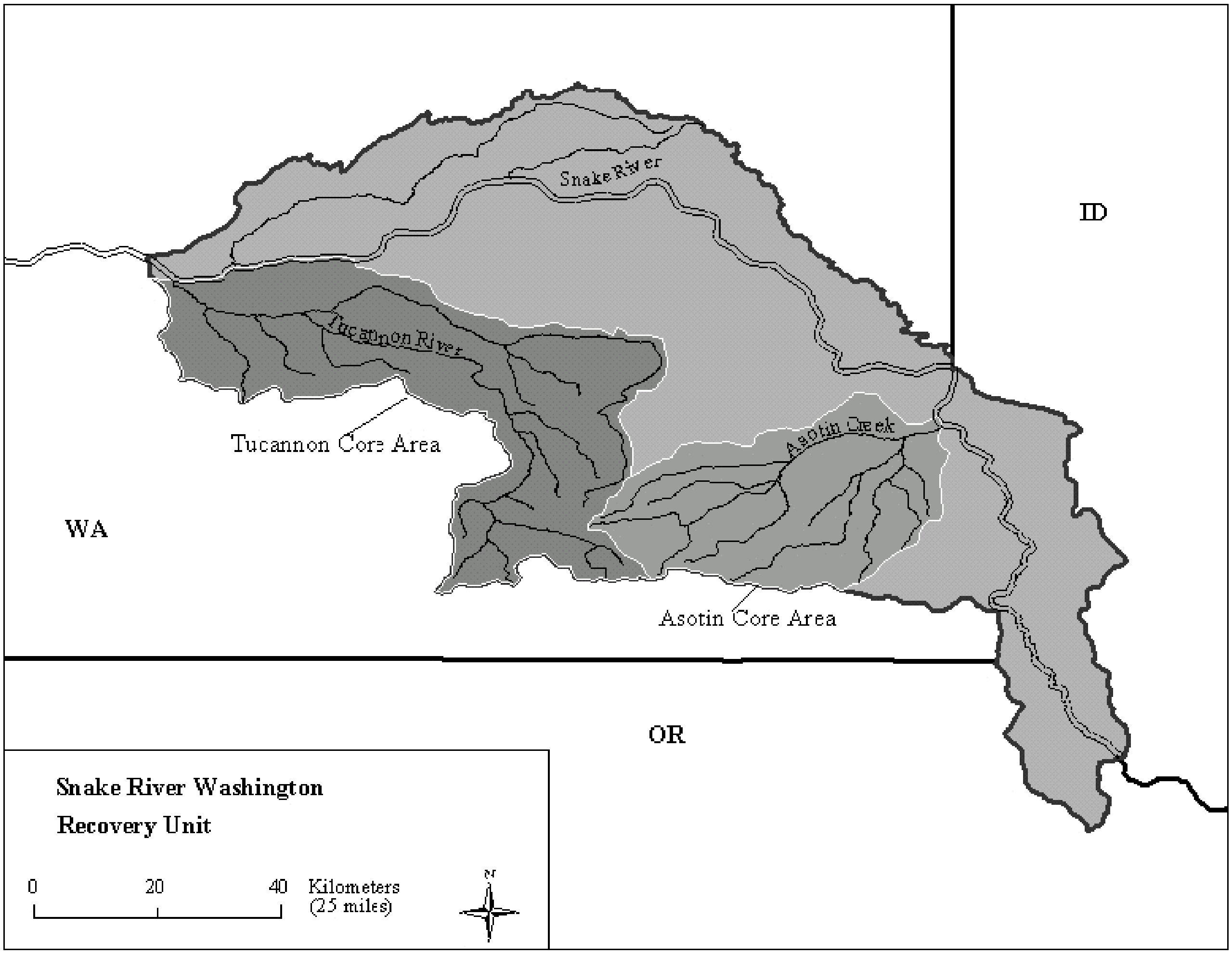

Figure 2-9 Relationship of Asotin Bull Trout Core Area to Snake River Recovery Unit
Source: Figure2, Chapter 24, USFWS 2002.

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 Asotin Subbasin 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 will serve to offset some of the anticipated climatic changes described above.

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 Pacific Lamprey as a "species of interest."

3.2 Selection of Focal Species

Three aquatic species were identified as focal species for Asotin Subbasin Planning: steelhead/rainbow trout *Oncorhynchus mykiss*, spring Chinook *Onchorynchus tshawytcha* and bull trout *Salvelinus confluentus* (see Figures 3-1, 3-2, and 3-3 respectively). The subbasin planning parties (WDFW, Nez Perce Tribe, private citizens, and other interested agencies and entities) selected these species based on the following considerations:

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

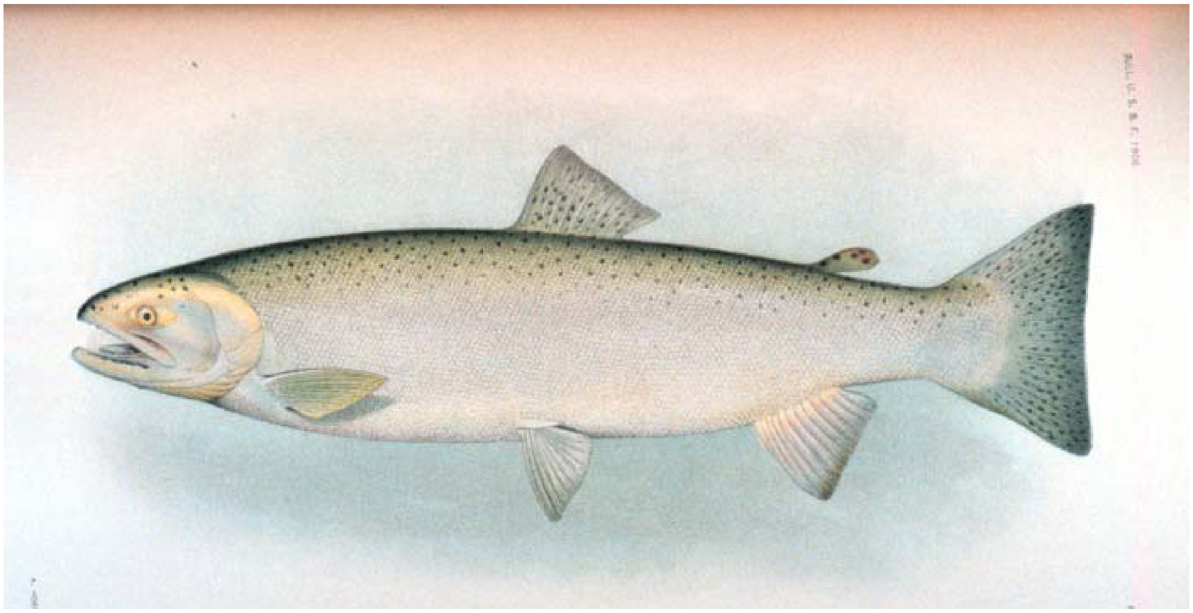

Figure 3-1 Steelhead Trout (*Oncorhynchus mykiss*)
Source: NOAA Photo Library (http://www.photolib.noaa.gov/fish/fish3016.htm).

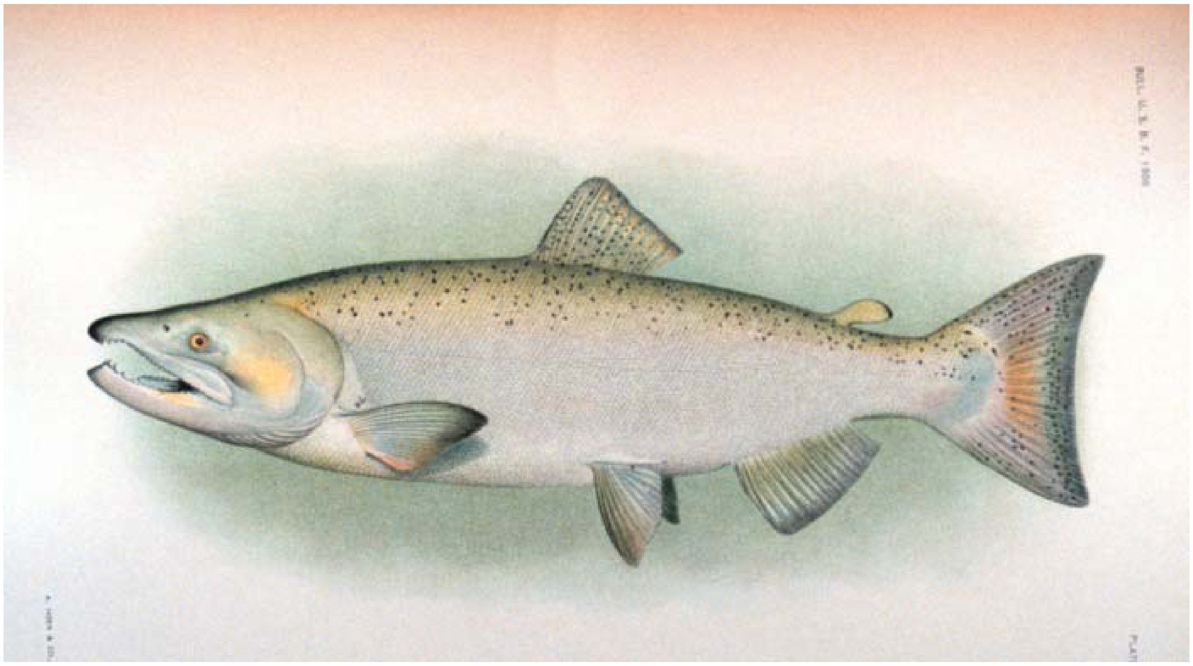

Figure 3-2 Chinook Salmon (*Oncorhynchus tshawytscha*)
Source: NOAA Photo Library (http://www.photolib.noaa.gov/fish/fish3007.htm).

Figure 3-3 Bull trout (*Salvelinus confluentus*)
Source: NOAA Photo Library (http://www.photolib.noaa.gov/fish/fish3007.htm).

Asotin summer steelhead, spring Chinook and bull trout life histories intersect a broad range of the aquatic ecosystem. Spatially, the life histories of these three species cover the entire subbasin from the mouth to the headwaters. These species also occupy all levels of the water column including slack water, swift water and the hyporheic zone. Not only are they present but also the ability of these species to thrive is dependent on being able to successfully occupy these areas. Temporally, these species 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 these species to be present at a particular time in a particular area is also key to the success of these species. Given the wide range of both the spatial and temporal aspects of these life histories it can be assumed that having habitat conditions that are appropriate for these three species will also produce conditions that allow for the prosperity of other aquatic life in the Asotin Subbasin.

The legal status of these species is important to the people of the Asotin Subbasin. All three species are listed as threatened under the ESA. Currently the citizens, governments, state and federal agencies and tribes are engaged in planning for the recovery of each of the salmonids through different processes. The intention of subbasin planning to address listed species within the subbasin supports the inclusion of the only three federally listed aquatic species within the subbasin as focal species." (Appendix B).

Information and knowledge on known and present distribution of these species, population status and other characteristics varies, with the most information being available for steelhead and the least information available on bull trout.

Additional species identified as "species of interest" are discussed briefly at the end of this chapter.

3.2.1 Steelhead Life History[1]

Asotin Creek

Asotin Creek summer steelhead are a typical Snake River "A"-run strain. A-run steelhead enter freshwater from June to August and generally pass Bonneville Dam before August 25. They begin passing Lower Granite Dam in early June and can continue through the following spring. Adult steelhead may enter Asotin Creek as early as September or October and continue through May. Peak entry is believed to occur in February through April (Glen Mendel, WDFW, personal communication). Spawning begins in late February or early March. Spawning peaks in early to mid-April and continues through mid-May.

There is little information on the adult age structure of Asotin Creek steelhead. Research completed on wild Asotin and Touchet River steelhead (Snake and Columbia River 'A-run' fish respectively) shows that 60 to 65 percent return to spawn after one year in saltwater, and 35 to 40 percent return to spawn after two years in saltwater (Bumgarner et al. 2003). Three-salt age fish are extremely rare. Until more empirical data on Asotin Creek steelhead are available, a similar age structure to the Touchet/Tucannon fish will be assumed. Fewer than 1 percent of Asotin Creek summer steelhead are believed to be repeat spawners (Glen Mendel, WDFW, personal communication).

Juveniles emerge from spawning gravels in late May or June. They typically rear for more than one year in Asotin Creek before migrating to the ocean. Migration occurs from October through June with a peak in April (Glen Mendel, WDFW, personal communication). Most juveniles migrate in their second year, but a small percentage migrate at age 1, 3 or 4 (Stovall 2001). A small group of 100 steelhead smolts sampled at Lower Granite Dam showed that most fish (62 percent) outmigrated in their second year, though 34 percent migrated in their third year, and 4 percent migrated in their first year (Hassemer 1992, cited in Busby et al. 1996). Smolt trapping conducted in the Asotin Creek between 1998 and 2001 (Bumgarner et al. 2003) showed that emigrating steelhead were about 40 percent age 1, 55 percent age 2, and 5 percent age 3 or 4. The actual makeup of steelhead smolts from Asotin Creek is unknown.

Tenmile and Couse Creeks

Tenmile and Couse Creek summer steelhead are a typical Snake River "A"-run strain. A-run steelhead enter freshwater from June to August and generally pass Bonneville Dam before August 25. They begin passing Lower Granite Dam in early June and can continue through the following spring. Adult steelhead may enter as early as March and continue through mid May. Peak entry is believed to occur in March or April (Glen Mendel, WDFW, personal communication). Spawning begins in late March or early April. Spawning peaks in early to mid-April and continues through mid to late May.

[1] Discussion in this section was taken from the WDFW Asotin Subbasin Aquatic Assessment, 2004.

Juveniles likely emerge from spawning gravels in May or June. Steelhead typically rear for more than one year in before migrating to the ocean. Juvenile migration possibly occurs from as early as late October, but because of limited water available in the fall, migration is more likely from March through May, with a peak in April (Glen Mendel, WDFW, personal communication). Most juveniles (estimated at 60 percent) migrate in their second year, but a percentage (~40 percent) probably migrate at age 1 because of high growth rates (high rearing temperatures) and limited carrying capacity (limited water). The actual makeup of steelhead smolts from Tenmile Creek is unknown.

Several assumptions needed to be made regarding steelhead life history for the purposes of this assessment. They are shown in Tables 3-1 and 3-2.

Table 3-1 Life History Assumptions Used to Model Summer Steelhead in Asotin Creek, Washington

Stock Name	Asotin Creek Summer Steelhead
Geographic Area (spawning reaches)	All Reaches
River Entry Timing (Lower Granite Dam)	August 13 - December 17; mean October 15
River Entry Timing (Asotin River)	January 29 – May 14; mean February 26
Adult Holding	Lower Granite Pool 68% Asotin River 32%
Spawn Timing	April 9 – May 28; mean April 30
Spawner Ages	63% 1-salt; 34% 2-salt; 3% 3-salt
Emergence Timing (dates)	May 28 – August 6; mean July 2
Smolt Ages	10% age 1; 85% age 2; 5% age 3
Juvenile Overwintering	Lower Granite and Little Goose Pools 21% Asotin River 79%
Stock Genetic Fitness	100%
Harvest (within Asotin Creek)	0%

Table 3-2 Life History Assumptions Used to Model Summer Steelhead in Tenmile Creek, Washington

Stock Name	Tenmile Creek Summer Steelhead
Geographic Area (spawning reaches)	Tenmile: All reaches
River Entry Timing (Columbia)	Bonneville Dam: mostly July-August, but as late as November
River Entry Timing (Tenmile)	Early January through mid-April; mean entry date in mid-February
Adult Holding	Adults begin holding in Lower Monumental Pool and between September and February
Spawn Timing	Begins week of March 1, ends 20th of May, with a peak in mid-April
Spawner Ages	60% 1-salt; 39% 2-salt; <1% 3-salt
Emergence Timing (dates)	Lasts 2 weeks beginning as early as mid-April and as late as early July, with an average period of May 25 to June 8
Smolt Ages	35% age 1; 60% age 2; 5% age 3; <0.5% age 4
Juvenile Overwintering	Snake River: 10% (late October to March) Tenmile Creek: 90% (late October to March)
Stock Genetic Fitness	90% wild
Harvest (in watershed)	No Harvest

3.2.2 Spring Chinook Life History[2]

Little is known about spring Chinook life history within Asotin Creek. Adult spawners probably enter Asotin Creek from late April through early June. They move upstream to areas with sufficiently cool summer water temperatures (mainly in the North Fork). Spawning begins in late August and continues through the end of September with a peak in early to mid-September. By early October, all spawners have died.

Age composition of spring Chinook spawners in Asotin Creek is unknown but is thought to be similar to that of Asotin spring Chinook. Most Asotin adults spawn at age 4 (72 percent) or age 5 (26 percent), but a small percentage may spawn at age 3 (2 percent).

Juveniles rear in Asotin Creek for at least one year prior to migrating to the ocean. They migrate from October through June, with peak migration from March through May.

Life history assumptions made to develop this assessment are summarized in Table 3-3.

Table 3-3 Life History Assumptions Used to Model Spring Chinook in Asotin Creek, Washington

Stock Name	Asotin Creek Spring Chinook
Geographic Area (spawning reaches)	Asotin: Mainstem Asotin, from mouth to forks; George Creek from mouth to Forest Service boundary line; Pintler Creek from mouth to Ayers Creek; Charley Creek from mouth to state ponds; NF Asotin Creek from mouth to SF of NF Asotin Creek; SF Asotin Creek from mouth to Redhill Gulch Creek.
River Entry Timing (Columbia)	Bonneville Dam: late March to late May
River Entry Timing (Asotin)	Late April to late June
Adult Holding	All inside Asotin Subbasin (between early May and mid-September
Spawn Timing	Between August 27 and October 7
Spawner Ages	2% jacks; 72% age-4; 26% age-5
Emergence Timing (dates)	Late March to mid-May
Smolt Ages	100% age-1
Juvenile Overwintering	Snake River: 27% (late October to March) Tenmile Creek: 73% (late October to March)
Stock Genetic Fitness	90% of wild fitness
Harvest (in watershed)	No Harvest

3.2.3 Bull Trout Life History

Bull trout are known to exist in the Asotin Basin, but very limited information exists regarding bull trout in this subbasin; bull trout are not known to exist currently or historically in Tenmile Creek. Bull trout have been documented periodically over many years by WDFW personnel conducting electrofishing, snorkeling or creel surveys, or while trapping for steelhead, in upper

[2] Discussion in this section was taken from the WDFW Asotin Subbasin Aquatic Assessment, 2004.

mainstem Asotin, Charley Creek, the North and lower South Fork of Asotin creeks. In 1993, the USFS documented the presence of bull trout in the middle branch of the North Fork, the lower 1.5 miles of the South Fork of the North Fork and in Charley Creek (Stovall2001). One additional bull trout was recently noted from the 1993 survey in upper George Creek by the USFS.

Bull trout are known to spawn in upper North Fork of Asotin and Cougar creeks (a tributary of the upper North Fork). Spawning should occur from late August through October, similar to bull trout in the Asotin Creek (USFWS 2002). Juvenile rearing is generally in the spawning areas, but subadult and adult bull trout may wander or migrate to other areas of the drainage during winter, spring and summer.

Migratory bull trout apparently existed as recently as the 1980's because bull trout were captured in the upper mainstem and lower North Fork of Asotin Creek in the springbut usually were not present in those locations in the summer and fall. Sub-adult and adult bull trout may migrate to the main stem Asotin Creek, or possibly to the Snake River to overwinter (similar to bull trout in the Tucannon or the Grande Ronde rivers). Presently, it is unclear whether both migratory and resident bull trout life histories remain, or whether only the resident form still exists.

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 the available empirical data for steelhead and spring Chinook. Figure 3-4 identifies steelhead distribution and use type. As can bee seen in Figure 3-5, detailed information regarding Chinook distribution and use type within the Asotin subbasin is not available.

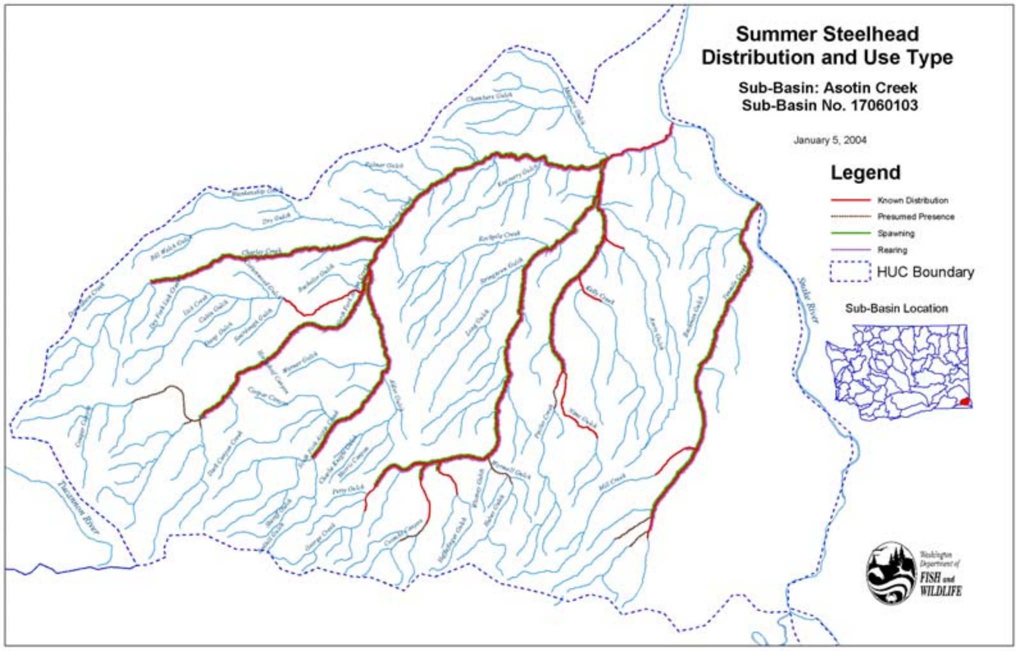

Figure 3-4 Current known and Presumed Distribution of Summer Steelhead in Asotin and Tenmile Creeks.

Source: Data from the WDFW Washington Lakes and Rivers Information System (WLRIS) database (figure taken from WDFW 2004).

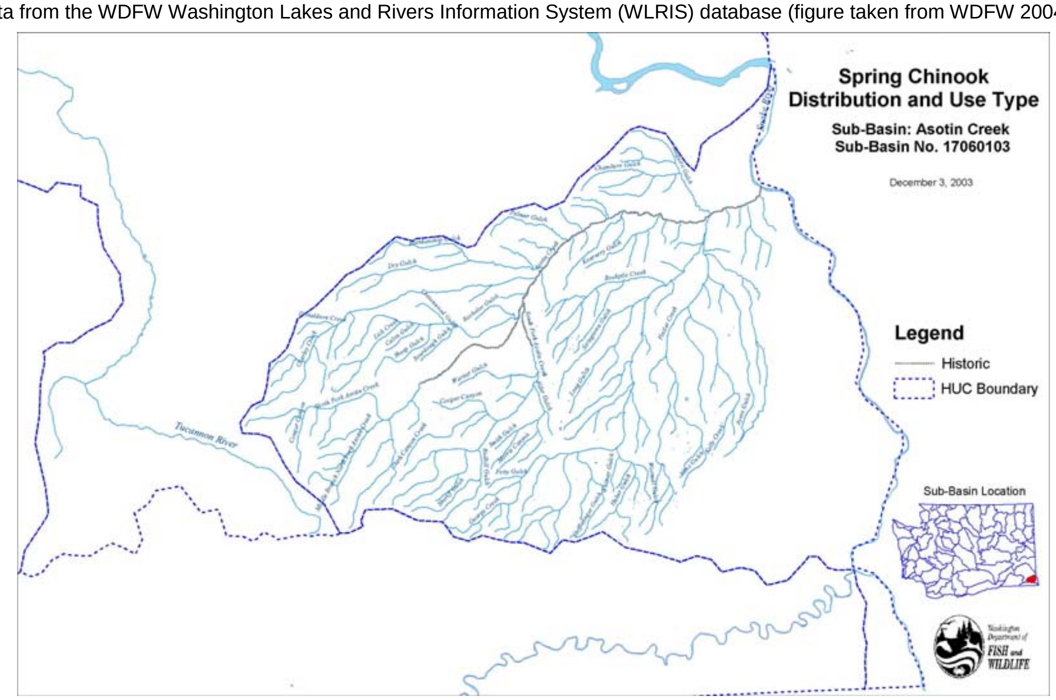

Figure 3-5 Current Known and Presumed Distribution of Spring Chinook in Asotin Creek

Source: Data from the WDFW Washington Lakes and Rivers Information System (WLRIS) database (figure taken from WDFW 2004)

3.4 Asotin Subbasin Habitat Assessment Methods

3.4.1 Introduction

Steelhead and spring Chinook in the Asotin subbasin were assessed by the Washington Department of Fish and Wildlife using the Ecosystem Diagnosis and Treatment (EDT) method. EDT modeling was not possible for bull trout, as EDT rules for bull trout were not available for this assessment (WDFW 2004). Additionally, a significant lack of knowledge exists regarding bull trout life history patterns specific to the Asotin subbasin (WDFW 2004). Even without the EDT analysis, however, it is clear that suitable bull trout habitat is significantly less prevalent than in pre-development times (WDFW 2004).

Habitat conditions for bull trout were generally assessed in the USFWS Draft Bull Trout Recovery Plan[3]. The USFWS Draft Bull Trout Recovery Plan (2002) identified temperature as the primary limiting factor in the Asotin subbasin (WDFW 2004). Bull trout have a narrower tolerance range for certain attributes (i.e. temperature) than do steelhead and Chinook (pers. comm. J. Flory, USFWS, 2004).

Most of the habitat improvements recommended for steelhead trout and Chinook salmon also would benefit bull trout, particularly those that would reduce instream temperatures and protect the upper reaches of the subbasin (WDFW 2004).

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 3-6). Levels 1 and 2 characterize the condition of the ecosystem/environment. Level 3 analyzes the performance of a focal species (e.g., Chinook salmon) 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).

[3] See the Recovery Plan and Chapter 7 of this document, the Asotin subbasin Management Plan, for additional information on bull trout.

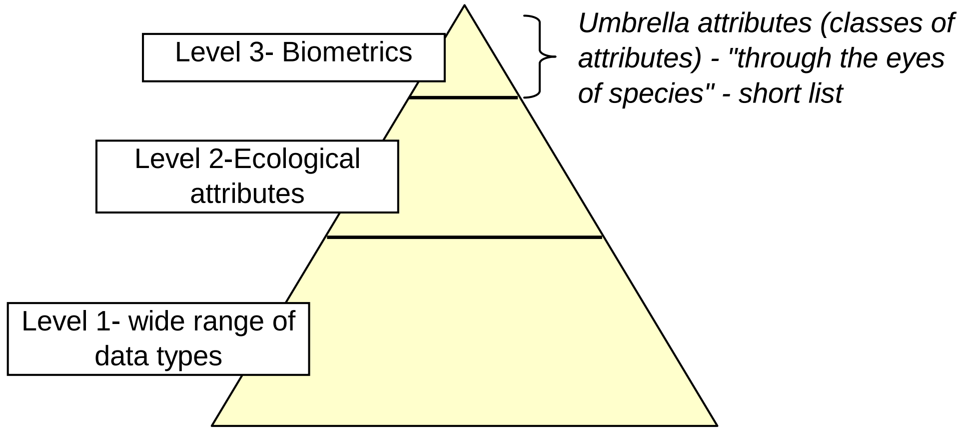

Figure 3-6 EDT Data/Information Pyramid
Source: WDFW 2004.

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[4]
2. current conditions
3. properly functioning conditions (PFC)[5]

The comparison of these scenarios formed the basis of the analysis, from which conclusions were drawn regarding the reduction in habitat quality in the Asotin 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

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[4] 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.

[5] 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).

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 and spring Chinook[6] (e.g., life history stages, timing of each stage, and 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 and spring Chinook 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, winter temperature or percent fines. The entire subbasin is lacking in bedscour, bankfull widths, flow and riparian function[7] data. Gradient measurements for individual reaches were also a concern. 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.

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[6] Information on bull trout life history was not available in a format usable in the EDT model.

[7] 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).

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 as discussed in Section 3.6.

3.5 EDT Analysis

3.5.1 Introduction

A technical work group was formed for the Asotin basin 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 were 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.

Three baseline reference scenarios were developed for the Asotin 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 Asotin 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 (Section 8.3.2).

Table 3-4 describes the Geographic Areas used for Asotin Creek Subbasin assessment 2003 (WDFW 2004).

Table 3-4 Geographic Areas used for Asotin Creek Subbasin

Geographic Area (Map Code)	Location	EDT Reaches included
Lower Asotin (LA)	Mouth to George Cr	Asotin1 and Asotin2
Lower George (LG)	Mouth to Wormell Cr	George1, 2 and 3
Pintler (PIN)	Mouth to Access Limit	Pintler1 and 2
Upper George (UG)	Wormell to Access Limit	George4 through George9
Upper George Tribs (UG-TRIB)	Wormell Cr, Hefflefinger Cr, Coombs Cr	Wormell, Hefflefinger, Coombs
Middle Asotin (MA)	George Cr to Headgate Dam	Asotin3A through Asotin4
Charley (CC)	Mouth to Access Limit	Charley1 through 4
Upper Asotin (UA)	Headgate Dam to Forks	Asotin5 and 6
Lick (LIC)	Mouth to Culvert	Lick
Lower NF Asotin (LA-NF)	Mouth to SF of NF Asotin	NF Asotin1 through 3
Upper NF Asotin (UA-NF)	SF of NF Asotin to Access Limit	NF Asotin4 and 5
NF Asotin Tribs (NF-ATRIB)	Middle Branch, SF of the NF Asotin	Middle Branch, SF of the NF Asotin
Lower SF Asotin (LA-SF)	Mouth to Alder Cr	SF Asotin1
Upper SF Asotin (UA-SF)	Alder Cr to Access Limit	SF Asotin2 and 3

Source: WDFW 2004.

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.

A Reach Analysis identifies the life stages most severely impacted (relative to historical performance) on a reach-by-reach basis, as well as the environmental conditions most responsible for the impacts. This three-part diagnosis can then be used to develop a plan designed to protect areas critical to current production, and to implement effective restoration actions in reaches with the greatest production potential.

3.5.3 Asotin Creek – Steelhead and Chinook EDT Assessment

Asotin Creek summer steelhead and spring Chinook 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")[8].

2. By identifying areas with the greatest potential for restoring a life stage that is critical to increasing production (i.e., high "Restoration Potential")[9].

Table 3-5 contains a ranked list of the priority geographic areas for restoration and a summary of potential performance increase for steelhead, spring Chinook, and fall Chinook by geographic area in the Asotin Subbasin. Table 3-6 contains a ranked list of the priority geographic areas for protection and a summary of potential performance increase for steelhead, spring Chinook, and fall Chinook by geographic area in the Asotin Subbasin. Potential performance increase was the sum of the model predicted increases in life history diversity, productivity, and abundance for the scaled (% benefit/ km) EDT output. Results are sorted by steelhead ranking and do not represent an integrated priority list for all species. Integration across focal species occurred during the integrated assessment analysis discussed below. Further detail regarding the restoration and protection potential performance increase for steelhead and spring Chinook can be found in Appendix B.

The "restoration potential" of a geographic area is the is the production benefit to a specific population if that area were to be restored to historical environmental conditions. Restoration potential is measured in tems of life history diversity, productivity, and average adult abundance, and is expressed as the percent increase in each of these variables relative to current values. In other words, restoration potential is a measure of the maximum fisheries benefit that could be achieved by restoring a particular geographic area. "Protection value" is essentially the inverse of restoration potential: a measure of the decrease in fish performance to be expected if a specific geographic area were to be degraded in a standardized way. Relative protection values over a number of geographic areas can be used to prioritize the areas in terms of their importance to preserving current production. Both restoration potential and protection value can be scaled to control for the impact of geographic areas that differ in size by dividing the absolute value by the length of the geographic area. Thus, scaled values represent, for instance, restoration potential per kilometer of stream.

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[8] 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.

[9] 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.

Table 3-5 Ranked List of Geographic Areas Based Upon EDT Restoration Priority Potential

Geographic area	EDT Restoration Priority Scaled Rank		Potential Performance Increase (%/km)	
	Steelhead	Spring Chinook	Steelhead	Spring Chinook
Lower Asotin (mouth to George)	1	1	7.5%	31.3%
Upper Asotin (above Headgate Dam to forks)	2	2	5.7%	13.1%
NF Tributaries (Lick, SF of NF, Middle Branch)	3	N/A	4.6%	N/A
Upper George Tributaries (Wormell, Heffelfinger, Coombs)	4	N/A	3.8%	N/A
Lower SF (mouth to Alder)	5	4	3.5%	10.4%
Lower NF (mouth to SF of NF)	6	5	3.1%	9.3%
Charley (mouth to access limit)	7	9	2.9%	1.9%
Upper George (Wormell to access limit)	8	8	2.8%	3.1%
Pintler (mouth to access limit)	9	10	2.6%	1.2%
Upper NF (SF of NF to access limit)	10	N/A	2.6%	N/A
Middle Asotin (George to Headgate Dam incl.)	11	3	2.5%	10.7%
Lower George (mouth to Wormell)	12	6	2.3%	7.1%
Upper SF (Alder to access limit)	13	7	1.9%	3.6%
Snake	14	12	1.8%	8.0%
Columbia	15	11	0.4%	1.4%

Source: Table 4-22 Appendix B (WDFW 2004),

Table 3-6 Ranked List of Geographic Areas Based Upon EDT Protection Priority Potential

Geographic area	EDT Restoration Priority Scaled Rank		Potential Performance Increase (%/km)	
	Steelhead	Spring Chinook	Steelhead	Spring Chinook
Lower NF (mouth to SF of NF)	1	1	-9.4%	-13.5%
Upper Asotin (above Headgate Dam to forks)	2	2	-6.5%	-6.1%
Charley (mouth to access limit)	3	10	-4.7%	-0.7%
Upper NF (SF of NF to access limit)	4	N/A	-4.6%	N/A
Upper SF (Alder to access limit)	5	3	-2.9%	-5.2%
Middle Asotin (George to Headgate Dam incl.)	6	4	-2.0%	-4.5%
Lower Asotin (mouth to George)	7	6	-1.6%	-3.7%
Lower SF (mouth to Alder)	8	7	-1.5%	-3.4%
Snake River	9	5	-0.6%	-3.8%
Lower George (mouth to Wormell)	10	8	-0.2%	-0.9%
Upper George (Wormell to access limit)	11	9	-0.2%	-0.7%

Geographic area	EDT Restoration Priority Scaled Rank		Potential Performance Increase (%/km)	
	Steelhead	Spring Chinook	Steelhead	Spring Chinook
Columbia River	12	11	-0.2%	-0.2%
Pintler (mouth to access limit)	13	12	0.0%	0.0%
Upper George Tributaries (Wormell, Heffelfinger, Coombs)	14	N/A	0.0%	N/A
NF Tributaries (Lick, SF of NF, Middle Branch)	15	N/A	0.0%	N/A

Source: Table 4-23 Appendix B (WDFW 2004).

Steelhead Summary of limiting habitat attributes

Habitat diversity, sediment load, and key habitat quantity were the most common limiting factors for summer steelhead (WDFW 2004). For various life stages, the EDT analysis identified the following primary limiting factors (WDFW 2004):

- Fry and subyearling parr: habitat diversity (as influenced by gradient, confinement, hydromodifications [e.g., roads, dikes], degraded riparian function, and instream large wood)
- Juvenile rearing: lack of pool habitat
- Pre-spawning holding: lack of pool habitat
- Egg incubation and early life history stages: sediment load and channel stability

Spring Chinook Summary of limiting habitat attributes

Habitat diversity and key habitat quantity were the most common limiting factors for spring Chinook (WDFW 2004). The EDT analysis identified the following primary limiting factors (WDFW 2004):

- For fry and subyearling parr - habitat diversity (as influenced by gradient, confinement, hydromodifications [e.g., roads, dikes, dams], degraded riparian function, instream large wood, and icing)
- Quantity of key habitat (across various life stages in most geographic units).
    - Pools were reduced (29 percent) and riffles were increased (24 percent) as compared to reference conditions.
    - Pool tailouts (prime spawning areas) were reduced by up to 10 percent in some reaches.
    - Pools (prime pre-spawning holding and juvenile over-wintering habitat) were reduced up to 42 percent in some reaches.
- Warm summer water temperatures (for spawning, adult holding, and egg incubation).
- Sediment load (for egg incubation).
- Altered hydrologic regime (increased peak flows and in particular, reduced low flows during the critical summer months)

- Food availability (for fry colonization and juvenile rearing life stages).

Restoration efforts should focus on reducing the limiting factors identified for summer steelhead and spring Chinook. 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 Table 3-7 and Table 3-8. 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.

Table 3-7 Geographic Areas and Attribute Classes (Level 3s) from EDT Analysis on Asotin Creek 2003

Geographic area priority			Attribute class priority for restoration															
Geographic area	Protection benefit	Restoration benefit	Channel stability/landsc.1/	Chemicals	Competition (w/ hatch)	Competition (other sp)	Flow	Food	Habitat diversity	Harassment/poaching	Obstructions	Oxygen	Pathogens	Predation	Sediment load	Temperature	Withdrawals	Key habitat quantity
Lower Asotin (mouth to George)		◯	●				●	•	●	•					⬤			⬤
Lower George (mouth to Wormell)			●				•		●						⬤	⬤		●
Pintler (mouth to access limit)		◦	●				●		●						⬤	●		●
Upper George (Wormell to access limit)		◦	⬤				•		●						●	●		•
Upper George Tribs (Wormell Heffelfinger Coombs)		◦	⬤				•		●									●
Middle Asotin (George to Headgate Dam incl.)			•				•		●						●			●
Upper Asotin (above Headgate Dam to forks)	○	◯	•				•		•	•					●			●
Charley (mouth to access limit)	◦	○	•				•		•							●		●
Lower NF (mouth to SF of NF)	◯	○	•				•		•						•			●
Upper NF (SF of NF to access limit)	◦	◦	●				•		•									●
NF Tribs (Lick, SF of NF, Middle Branch)		○	⬤				•		•						•			⬤
Lower SF (mouth to Alder)		○	•				•		•						●	•		●
Upper SF (Alder to access limit)		◦	●				•		•									⬤
Snake		◦																
Columbia																		•

1/ "Channel stability" applies to freshwater areas; "channel landscape" applies to estuarine areas.

Key to strategic priority (corresponding Benefit Category letter also shown)

A	◯ / ⬤	High
B	○ / ●	Medium
C	◦ / •	Low
D & E	(blank)	Indirect or General

3.5.4 Tenmile and Couse Creeks – Steelhead EDT Assessment

Tenmile Creek was evaluated using EDT. Since Tenmile includes only 12 reaches, two of which are point reaches to designate obstructions, it was not grouped into geographic areas for the purpose of identifying protection and restoration reaches. For Tenmile Creek the unscaled version of the EDT output was used to rank priority restoration and protection reaches. This was determined to be the most effective way of identifying important reaches for this area. As opposed to the Asotin assessment where it was important to identify those areas with the greatest restorative and protective value per kilometer, focus was on singling out the reaches in Tenmile that could have the greatest impact on the subbasin population. The best way to accomplish this was to point out that reach(es) if restored or protected, would give the greatest contribution to the subbasin population.

In general the mainstem Tenmile reaches ranked higher for restoration than the Mill Creek Reaches. Within that area, the reaches from the end of the seasonally dewatered area to the mouth of the Middle Branch were considered highest in both restoration and protection value (Tenmile4 and 5)(Table 3-8). Potential performance increase was the sum of the model predicted increases in life history diversity, productivity, and abundance for the scaled (% benefit/ km) EDT output. Results are sorted by steelhead ranking and do not represent an integrated priority list for all species. In both reaches in this area, sediment load and channel stability were the most limiting factors on the most limited life stage, incubating eggs. Temperature impacts on incubating eggs and colonizing fry were also major factors affecting production but only in Tenmile4. Lack of key habitat and habitat diversity also were shown as problems according to EDT. Sediment load and habitat diversity (pools) are attributes that were also highlighted as problems by the Limiting Factors Analysis (Kuttle 2001). Tenmile in its entirety is flow limited. It is unknown and hard to estimate how much the change in land cover within this short, steep watershed has effected groundwater infusion during critical summer months. It is very possible that changes in land use practices throughout the basin could positively affect summer flows.

The relative contribution of Tenmile Creek to the overall population of steelhead in the Asotin Subbasin is small (see section 4.3.4). Thus, it was not considered with the geographic areas of Asotin Cr when identifying priority areas for restoration and protection. Though the relative contribution to the population is small, the importance that Tenmile steelhead has to the population in terms of diversity is unknown. This assessment clearly shows that Tenmile4, which is the top restoration and protection reach, is the most important for consideration of protection or restoration strategies.

Table 3-8 Priority Reaches for Restoration and Protection of Summer Steelhead in Tenmile Creek

	EDT Restoration Priority Unscaled		EDT Protection Priority Unscaled	
	Rank	Performance Increase	Rank	Performance Decrease
Tenmile4 (dewatered area to Mill Cr)	1	215%	1	124%
Tenmile5 (Mill Cr to mouth of Middle Branch)	2	117%	2	84%
Tenmile2 (Snake River road to Weissenfels Rd)	3	104%	6	8%
Tenmile6 (Middle Branch to Weissenfels Pond)	4	77%	3	33%
Tenmile3 (Weissenfels Rd to seasonal dewatered area)	5	68%	7	4%
Middle Branch (Mouth to end steelhead distribution)	6	47%	4	25%
Tenmile1 (Mouth to Snake River Rd)	7	33%	9	0
MillCreek3 (Mill Cr Rd culvert to irrigation diversion)	8	31%	8	1%
Millcreek1 (Mouth to Mill Cr Road culvert)	9	28%	5	14%
Tenmile8 (Weissenfels Pond to end steelhead distribution)	10	0%	9	0

Impacted Life Stages and Limiting Habitat Attributes

Within the Tenmile4 reach, the following life stages are the most impacted and the following habitat attributes are the most limiting to those life stages according to the EDT analysis:

- Tenmile 4 (dewatered area to Mill Cr)
  - i. Incubation (SH)
  - ii. Fry (SH)
  - iii. Overwintering (SH)
  - iv. Subyearling rearing (SH)
- Tenmile 4 (dewatered area to Mill Cr)
  - i. LWD
  - ii. Riparian Function
  - iii. Sediment (Turbidity, Fines and Embeddedness)
  - iv. Key Habitat (pools)
  - v. Flow

The results of EDT above are consistent with past assessments and the technical knowledge of the Tenmile basin.

The lack of resources available within the timetable provided did not allow for an EDT assessment of Couse Creek. Couse Creek has a known spawning steelhead population and thus has some importance to the subbasin population as a whole. The results from EDT on Tenmile can generally be applied to Couse Creek It is thought that sediment and lack of habitat diversity are limiting to steelhead production (Kuttle 2001).

3.5.5 Asotin Subbasin – 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.

For comparison within the EDT analysis, Mobrand Biometrics brought each of the EDT 46 habitat attributes in each reach up to a level that was no longer harmful to fish, but is not necessarily beneficial. This represents properly functioning conditions (PFC). PFC can be thought of as habitat conditions able to support populations sufficient for a self-sustaining population, but not necessarily populations that would be considered abundant. A comparison of the model results under current conditions, PFC conditions, and historic conditions can be found in Tables 3-9 and 3-10. Note that PFC as defined in this plan is based upon the definition provided by Mobrand Biometrics, and a wide variety of opinions exist regarding the proper definition of PFC.

Asotin and Tenmile Summer Steelhead

"The EDT model estimated the average spawning population size of the current Asotin Creek summer steelhead to be 206 fish, with a carrying capacity of 423 fish and a productivity of just 2 adult returns per spawner. The life history diversity value indicates only 18 percent of the historic life history pathways can be successfully used under current conditions. The analysis also suggests that the Asotin Subbasin has a much greater production potential for summer steelhead than it now displays, as historical abundance is estimated at 8,677 spawners, with a productivity of 21.6 returning adults per spawner and a life history diversity of 100 percent."

"The EDT model appears to underestimate the current population size and carrying capacity in Asotin Creek compared with the empirical data (206 adults, 423 capacity from EDT vs. 651 current adults from empirical data). However, EDT likely overestimates the historical abundance (8,677) and productivity (21.6 returning adults per spawner). In 2001, WDFW used a potential parr production estimator on data collected between 1981-2000 to assess steelhead production potential. That model estimated 1,662 as current potential carrying capacity with a parent to progeny ratio of 1.07."

EDT results for Asotin and Tenmile Creeks are presented in Table 3-9.

Table 3-9 EDT Summer Steelhead Spawner Population Performance Estimates.

Scenario	Diversity Index	Productivity	Capacity	Adult Abundance
Asotin				
Patient (Current)	18 %	2.0	423	206
PFC	57 %	2.3	636	356
Template (Reference/Historic)	100 %	21.6	9,099	8,677
Tenmile				
Patient (Current)	2% (49)	(2.5)	(291)	(175)
PFC	44% (72)	(5.7)	(449)	(370)
Template (Reference/Historic)	100%	18.1 (25.1)	1,740 (1744)	1,644 (1676)

EDT results also indicate that current abundance, productivity, and life history pathways are substantially less than in the past. This finding is consistent with the results of other analyses and is in-line with planning efforts in the basin (WDFW 2004).

Asotin Creek Spring Chinook

For the Asotin subbasin spring Chinook analysis, EDT estimates appear to be rather high for capacity and abundance when compared to available data. In particular, the EDT model estimates current Asotin Creek spring Chinook abundance at 158 fish, which is much higher than empirical data from WDFW's monitoring efforts over the past 20 years (average of two adults per year) (WDFW 2004). EDT capacity estimates also seem high when compared to historical population data.

"The EDT model estimated the average spawning population size of the current spring Chinook to be 158 fish, with a carrying capacity of 558 fish and a productivity of 1.4 adult returns per spawner (Table 3-10). The life history diversity value indicates only 29 percent of the historic life history pathways can be successfully used under current conditions. The analysis also suggests that the Asotin Subbasin has a much greater production potential for spring Chinook than it now displays, as historical abundance is estimated at 4,348 spawners, with a productivity of 14.9 returning adults per spawner and a life history diversity of 100 percent. Under PFCs, the EDT model predicted an abundance of 1,018 spawners with a capacity of 1,439 spawners, a productivity of 3.4 returning adults per spawner, and a life history diversity of 86 percent."

Table 3-10 EDT Spring Chinook Spawner Population Performance Estimates.

Scenario	Diversity Index	Productivity	Capacity	Adult Abundance
Patient (Current)	29 %	1.4	558	158
PFC	86 %	3.4	1,439	1,018
Template (Reference/Historic)	100 %	14.9	4,662	4,348

3.5.6 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 or spring Chinook; consequently, quantitative goals for the four parameters cannot be established at this time. However, the interim spawner abundance target for steelhead in Asotin Creek has been set at 400 adults. An interim spawner abundance target has not been set for Asotin Creek spring Chinook (Lohn 2002 as cited in WDFW 2004). The Asotin Creek Chinook population may be included with the Lower Mainstem Tributary spawning aggregation, which has an interim goal of 1,000 spawners (WDFW 2004).

A WDFW (2004) discussion of the four VSP parameters as they relate to the Asotin Creek EDT results for summer steelhead and spring Chinook is provided in Appendix B, Section 4.3.4.2 (steelhead) and 4.4.4.2 (spring chinook).

3.5.7 Out-of-Subbasin Effects

Out of Subbasin Effects – General

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."

Out of Subbasin Effects – Asotin Subbasin Empirical Data

Information in this section was provided by Becky Ashe, Nez Perce Tribe.

Anadromous fish focal species in the Asotin subbasin are limited primarily by out-of-subbasin factors involving hydropower development, ocean productivity, predation and harvest. Hydropower development and operation increases mortality in Snake River stocks of spring/summer and fall chinook. Fluctuations of ocean productivity in combination with the hydrosystem have caused severe declines in productivity and survival rates. Predation, especially within reservoirs, is also a potential limiting factor to salmonid smolts. Out of subbasin harvest is also a potential limiting factor for naturally produced chinook and steelhead stocks within the subbasin.

It is generally accepted that hydropower development on the lower Snake River and Columbia River is the primary cause of decline and continued suppression of Snake River salmon and steelhead (CBFWA 1991; NPPC 1992; NMFS 1995, 1997; NRC 1995; IDFG 1998; Williams et al. 1998). However, less agreement exists about whether the hydropower system is the primary factor limiting recovery (Mamorek et al. 1998).

Adult escapement of anadromous species to the Snake River basin remains relatively low despite significant hatchery production/reintroduction efforts. Smolt-to-adult return rates (SAR), from smolts at the uppermost dam to adults returning to the Columbia River mouth, averaged 5.2 percent in the 1960s before hydrosystem completion and only 1.2 percent from 1977 to 1994 (Petrosky et al. 2001) (Figure 3-7). This is below the 2 to 6 percent needed for recovery (Mamorek et al. 1998).

In contrast to the decline in SAR, numbers of smolts per spawner from Snake River tributaries did not decrease during this period, averaging 62 smolts per spawner before hydrosystem completion and 100 smolts per spawner afterward (Petrosky et al. 2001) (Figure 3-7). In this summary both spawner escapement and smolt yield are measured at the uppermost mainstem dam (currently Lower Granite). The increase in smolts per spawner was due to a reduction in density dependent mortality as spawner abundance declined. Accounting for density dependence, a modest decrease occurred in smolts per spawner from Snake River tributaries over this period, but not of a magnitude to explain the severe decline in life-cycle survival (Petrosky et al. 2001).

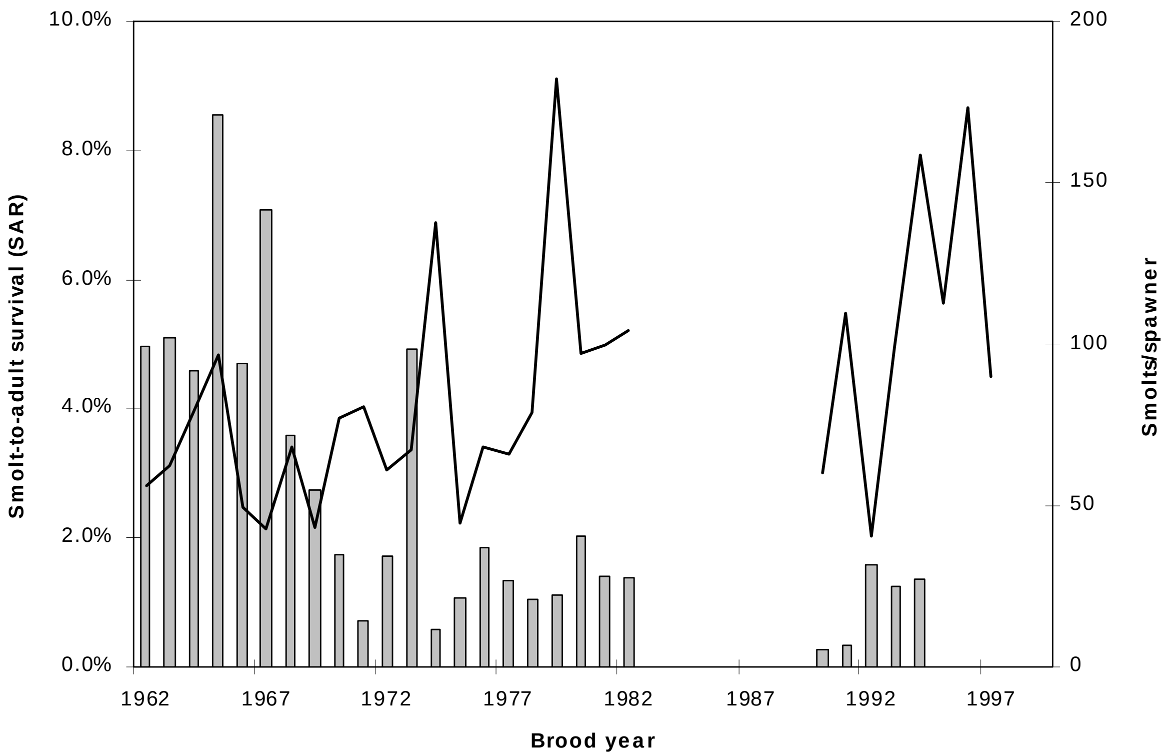

Figure 3-7 Smolt to Adult Survival Rates and Smolts/Spawners for Wild Snake River Spring and Summer Chinook

Key: Smolt to Adult Survival Rates = Bars; SAR; and Smolts/Spawner = solid line.

The SAR describes survival during mainstem downstream migration to adult returns whereas the number of smolts per spawner describes freshwater productivity in upstream freshwater spawning and rearing areas.

Source: Petrosky et al. 2001.

The dams cause direct, indirect, or delayed mortality, mainly to emigrating juveniles (IDFG 1998, Nemeth and Kiefer 1999). As a result of this increased mortality, Snake River spring and summer chinook declined at a greater rate than downriver stocks, coincident with completion of the federal hydropower system (Schaller et al. 1999). Schaller et al. (1999) concluded that factors other than hydropower development have not played a significant role in the differential decline in performance between upriver and downriver stocks. The Snake River stocks above eight dams survived one-third as well as downriver stocks migrating through 3 dams for this time period after taking into account factors common to both groups (Schaller et al. 1999; Deriso 2002). The additional decline in productivity of upriver stocks relative to downriver stocks indicates this portion of the mortality is related to factors unique to upriver stocks.

Patterns of Pacific Decadal Oscillation and salmon production would indicate that poor ocean conditions existed for Columbia River salmon after the late 1970s (Hare et al. 1999). However, the natural fluctuations of ocean productivity affecting all Columbia River stocks, in combination with mortality as a result of the hydrosystem, appear to have caused the severe declines in productivity and survival rates for the Snake River stocks. Temporal and spatial patterns of hatchery release numbers did not coincide with the differential changes in survival rates between upriver and downriver stocks (Schaller et al. 1999). Harvest rates were drastically reduced in the early 1970s, in response to declines in upriver stream-type chinook abundance. Given that changes in smolts per spawner cannot explain the decreases in SAR or overall survival rates for Snake River stocks, it appears the altered migration corridor has had a strong influence on the mortality that causes these differences in stock performance.

The SAR and smolt per spawner observations (Figure 3-7) indicate that the overall survival decline is consistent primarily with hydrosystem impacts and poorer ocean (out-of-subbasin factors), rather than large-scale impacts within the subbasins between the 1960s and present (Schaller et al. 1999; Petrosky et al. 2001). Because the smolt/spawner data represent aggregate populations from a mix of habitat qualities throughout the Snake River basin, and are from a period after hydropower development, they do not imply there is no room for survival improvement within the Snake River subbasins. However, because of limiting factors outside the subbasins, and critically reduced life-cycle survival for populations even in pristine watersheds, it is unlikely that potential survival improvements within the Snake River subbasins alone can increase survival to a level that ensures recovery of anadromous fish populations

TOAST (2004) provides a regional overview of out of subbasin factors impacting anadromous fish in the Columbia Basin, including the Snake River.

The TOAST (2004) utilized the most current studies and information reviewing mainstem passage effects on juvenile and adult salmonids to model hydrosystem effects on survival of anadromous fish. Juvenile survival through the mainstem Columbia and Snake rivers depends upon habitat quality and quantity, river flow, juvenile travel time, juvenile migration timing, dam survival, transportation survival, survival of naturally migrating fish, and competitive interactions with hatchery fish.

For example, survival of yearling chinook migrating in-river from above Lower Granite Dam (past eight hydroelectric projects) averages 36 percent (88 percent per project) and subyearling chinook in-river survival averages 29 percent (approximately 85 percent per project). For juveniles that are transported, TOAST (2004) assumed 98 percent of the juveniles survive to the point of release (NMFS 2000 White Paper Transportation). However, once transported Snake River yearling and subyearling chinook are released from the barges survival is 50 percent for yearlings (Bouwes et al. 1999) and 35 percent for subyearlings (PATH 1999 as cited by TOAST 2004) compared to that of juveniles migrating in-river, respectively.

Adult chinook survival past each mainstem dam under current conditions was assumed to average 93 percent (PATH 2000 as cited by TOAST 2004). Thus, total adult survival through mainstem river reaches is highly dependent on the number of dams each adult must pass. For example, adult chinook returning to the Asotin Creek would have to pass eight mainstem dams, and thus their overall survival rate would be 56 percent. Historically, adult chinook survival through the mainstem Columbia and Snake Rivers was assumed to average 92 percent (TOAST 2004).

TOAST (2004) also incorporated impacts to survival in the estuary and ocean and through mainstem fisheries.

Table 5 in TOAST (2004) contains Smolt-to-Adult (SAR) survival rates of juvenile fish from the mouth of the subbasin to their return to the subbasin as adults. They were calculated from intermediate EDT results. Results of SAR rates calculated for fish from Asotin Creek (those that originate above Lower Granite Dam) were:

- yearling chinook juveniles – 0.9% with a range of 0.3% to 2.97%.
- subyearling chinook – 0.4% with a range of 0.13% to 1.32%.
- steelhead juveniles – 1.69% with a range of 1.04% to 4.68%

TOAST (2004) compared the estimates of survival derived from EDT to actual smolt-to-adult survival estimates for spring chinook (yearling) populations above Lower Granite Dam (C. Petrosky, Idaho Department of Fish and Game January 9, 2004 e-mail), (Table 3-11). These data update the earlier run reconstruction data reported by Marmorek et al. (1998). Since 1992 (the period used for the Multi-Species Framework project), the SAR geometric mean has been 0.8 percent and with an SAR range of 0.19 to 3.0 percent. The SAR rates derived from EDT of 0.9 percent with a range of 0.3 to 2.97 percent is similar to the post 1992 geometric mean. Therefore, SAR rates derived from the EDT are probably a reasonable point estimate for yearling chinook SARs for those life history types entering each of the mainstem Columbia/Snake river reservoirs.

Table 3-11 Estimated Smolt to Adult Survival For Spring Chinook and Steelhead Smolt (Years 1964-2000)

Smolt Outmigration Year	Chinook SAR	Steelhead SAR
1964	2.35%	4.21%
1965	2.32%	3.68%
1966	2.31%	3.93%
1967	4.49%	4.01%
1968	2.58%	3.39%
1969	3.83%	3.66%
1970	1.92%	2.55%
1971	1.53%	2.27%
1972	1.02%	1.52%
1973	0.49%	0.63%
1974	1.39%	1.29%
1975	3.11%	1.84%
1976	0.92%	1.70%
1977	0.35%	0.90%
1978	0.98%	3.07%
1979	1.09%	3.18%
1980	0.55%	2.54%
1981	1.39%	1.11%

Smolt Outmigration Year	Chinook SAR	Steelhead SAR
1982	1.70%	3.37%
1983	1.83%	2.63%
1984	2.56%	3.66%
1985		3.07%
1986		3.05%
1987		3.63%
1988		2.01%
1989		1.02%
1990		2.33%
1991		1.55%
1992	0.19%	1.04%
1993	0.38%	1.07%
1994	1.02%	1.18%
1995	0.31%	1.40%
1996	0.36%	1.61%
1997	1.72%	1.39%
1998	1.15%	1.89%
1999	2.91%	3.16%
2000	3.00%	4.68%

Estimated Smolt to Adult Survival as measured at Lower Granite Dam for spring chinook and steelhead smolt outmigration years 1964-2000 based on run reconstruction.

Source: C. Petrosky, Idaho Department of Fish and Game January 9, 2004 e-mail as cited in TOAST 2004.

Out of Subbasin Effects and EDT

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 3-12 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”).

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 3-12 Steelhead and Chinook Restoration and Protection Potential

	Life history diversity		Productivity		Abundance	
Steelhead	Within Subbasin	Out of Subbasin*	Within Subbasin	Out of Subbasin*	Within Subbasin	Out of Subbasin*
Restoration Potential	61%	39%	52%	48%	28%	72%
Protection Potential	66%	34%	64%	36%	66%	34%
Chinook						
Restoration Potential	68%	32%	69%	31%	37%	63%
Protection Potential	59%	41%	61%	39%	64%	36%

* 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

These results show that for steelhead, 34 to 72 percent of potential improvements for the Asotin subbasin are tied to actions outside of the subbasin (i.e., restoration and protection in the mainstem Columbia and Snake rivers). For Chinook, 31 to 63 percent of potential improvements for the Asotin subbasin are tied to actions outside of the subbasin. These represent a significant impact of out-of-subbasin environmental conditions upon subbasin fish populations. Discussion of the need for activities outside of the subbasin in addition to those actions proposed in this plan is provided in Section 7.3.8.

3.6 Integrated Assessment Analysis and Conditions

3.6.1 Introduction

The information presented in this section was taken from Appendix B (WDFW 2004). It includes the results from integrating the steelhead and Chinook 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 Spring Chinook and Summer Steelhead EDT analysis limiting attributes

Within the Asotin subbasin the EDT analysis identified habitat diversity was the most common limiting habitat attribute for both steelhead and spring Chinook. For fry and subyearling parr, habitat diversity is a function of gradient, confinement, riparian function, LWD density and icing. Many of the Asotin reaches are thought to have gradients above 3 percent and a high degree of natural confinement that depresses habitat diversity. Icing was generally rated as moderate to high, depending on the elevation and location of the reach, with current conditions receiving the same values as historic conditions.

Sediment load, channel stability, and flow were common secondary limiting factors for egg incubation and early life history stages of summer steelhead and spring Chinook throughout the Asotin watershed.

Warm summer temperatures were a common problem for spawning (pre-spawn holding) and egg incubation for spring Chinook, but appeared to have little effect on steelhead, probably due to differences in spawn timing. Increased peak flows, reduced low flows, and food (salmon carcasses and benthic productivity) were consistently low to moderate limiting factors for fry colonization and juvenile rearing life stages. The cumulative impact of these low-level limiting attributes could be important to the overall reduced productivity in the Asotin Creek Subbasin.

Throughout the Asotin Creek subbasin key habitat quantity was also an important limiting factor for spring Chinook and steelhead. Key habitat quantity was limiting across various life stages in most geographic units. In general, for current conditions, pools were reduced (29 percent) and riffles were increased (24 percent) when compared to the reference condition. In some reaches, pool tailouts were reduced by up to 10 percent which affected spawning adults; in other reaches, primary pools were reduced up to 42 percent which affected pre-spawn holding, juveniles less than 1 year old, over-wintering and other life stages. Key habitat quantity will have to be evaluated on a reach-by-reach basis, based on the data that was entered into the Stream Reach Editor for EDT.

EDT analysis indicates that restoration efforts should focus on restoring riparian function (offchannel habitat, connection to the floodplain, and riparian vegetation), minimizing manmade confinement (roads and dikes), increasing large woody debris (LWD) density and reducing sediment load throughout the watershed. Addressing these habitat attributes will benefit both steelhead and spring Chinook.

3.6.3 EDT Limiting Attributes Compared with Other Assessments and Plans

The subbasin assessment has many findings that are comparable to other recent assessments and planning efforts. Habitat diversity, key habitat by lifestage, sediment and temperature were the most common limiting attribute identified with the assessment; this compared favorably with earlier assessments (Table 3-13).

Table 3-13 Assessments Performed in the Asotin Subbasin and the Key Limiting Factors Identified

Assessment	Key Limiting Factors Identified
EDT	Habitat Diversity (Includes: riparian function[1], confinement, gradient, LWD density for most life stages); Sediment Load (Including embeddedness; and percent fines); Temperature; Key Habitat (pools and pool tail-outs)
LFA	Sediment; Confinement; Pools; Temperature
Subbasin Summary	water quality; riparian function; sedimentation; instream habitat (inc. pools and LWD); passage; non native species
Model Watershed Plan	sediment; pools; LWD density; temperature
Bull Trout Recovery Plan (draft)	LWD; temperatures; sediment; bank stability; loss of riparian, passage

[1]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).

A more detailed discussion of these similarities as well as a few differences is provided in Appendix B, Section 4.6.

3.6.4 Divergences from EDT

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. Although EDT is the most comprehensive tool currently available for completing aquatic habitat assessments of the nature required for subbasin planning, significant data gaps remain that limited its accuracy in some cases. Thus, the Subbasin Planning Team reevaluated these EDT results in light of several additional considerations. Other plans were used to corroborate EDT. EDT is useful but not perfect. Where we noticed something was wrong, we looked at other information and fixed it.

- 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.
- The needs of all aquatic focal species needed to be balanced. This again required balancing between geographic areas that would provide significant benefit to one focal species, but lesser benefit to others.
- 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.
- Consistency with other planning efforts.

These factors were used to evaluate the results of the EDT model and identify areas where divergence from the EDT modeling results was needed. In areas where the EDT results appeared inconsistent with previous assessment efforts or with knowledge of the subbasin, the Subbasin Planning Team and technical staff reviewed the EDT results in light of the above factors and modified the final list of priority geographic areas accordingly. These areas are discussed as “divergences from EDT” in this section. Establishing priorities does not preclude projects from being implemented in 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. However, such a project would be a lower priority than projects proposed in a priority geographic area or a project that addresses imminent threats. The full EDT modeling results are provided in Appendix B.

In two cases, EDT results were questioned.

Lower Asotin ranked high for restoration when evaluated for both spring Chinook and steelhead. As noted in Appendix B, this is inconsistent with other assessments/planning efforts performed over the last 10 years on the Asotin Subbasin. Lower Asotin Creek and middle Asotin (George Creek to Headgate Dam) have not been listed as high priorities for steelhead restoration in previous planning efforts. EDT compares historic and current conditions, and the larger the difference between these conditions the higher the priority for restoration under EDT. These areas has probably diverged the furthest from historical conditions, and thus would benefit the population the greatest if completely restored. However, these stream reaches are currently marginal habitat for steelhead and the lowest reach has the most human disturbance and development in the subbasin.

Much of the lowest stream reach is diked for flood protection and development constrains options for fish habitat restoration. The opportunities for restoring this stream reach to approach historic conditions are very limited by the town of Asotin and rural development along the stream. Similar to the lower stream reach, the middle stream reach is likely far different than historic conditions. Roads and housing development in a very narrow valley have severely constrained Asotin Creek and will limit options for restoring this stream segment. It is very unlikely that historic conditions can be approached in either of these stream reaches and the empirical data suggests that steelhead production is limited in these areas. However it has not been included as a priority area for restoration because the stream reach has the most human disturbance and development in the subbasin, is diked in the lower section for flood protection, and opportunities for restoring this area to historic conditions are limited relative to other geographic areas that were selected as priorities.

It should be noted that during the other planning efforts the Lower Asotin was mentioned as being a low priority for these same reasons. However, none of the other planning documents actually identified specific areas as being higher priority for restoration than others in the final documents. Restoration efforts in Lower George and Charley Creek are likely to have only a moderate benefit to spring Chinook.

Lower George Creek was included as a priority for restoration due to steelhead empirical data summarized in Appendix B. Lower George had the highest densities and population estimates for >1+ steelhead. This clearly demonstrates its importance to the steelhead population. It is also clear that there is the need for active restoration. It is unclear why this portion of George Creek ranked as such a low priority for restoration; this could very well be a factor of the lack of hard data available for many key attributes as discussed previously.

The second divergence was that sediment was not identified in the EDT analysis as a limiting factor in Charley Creek, however, even casual observation of this creek proves that conclusion wrong. Other assessments clearly identified sediment as a limiting factor throughout the Asotin drainage, thus it was included as a limiting attribute.

3.7 Assessment Conclusions – Setting the Stage for the Management Plan

3.7.1 Introduction

EDT results and review of previous assessment and other planning documents referenced above were used to reach the following conclusions, and prepare the stage for the management plan (Section 7). These conclusions are organized consistent with the EDT framework for identifying priority restoration and protection areas. See Figure 3-8.

3.7.2 Asotin Creek - Restoration Priority Geographic Areas

The following geographic areas have the highest restoration value in Asotin Creek according to the EDT analysis of steelhead and spring Chinook and taking into account other factors, such as previous planning efforts and empirical data:

- Upper Asotin (Headgate Dam to Forks)
- Lower George Creek
- Lower NF Asotin
- Charley Creek
- Lower SF Asotin

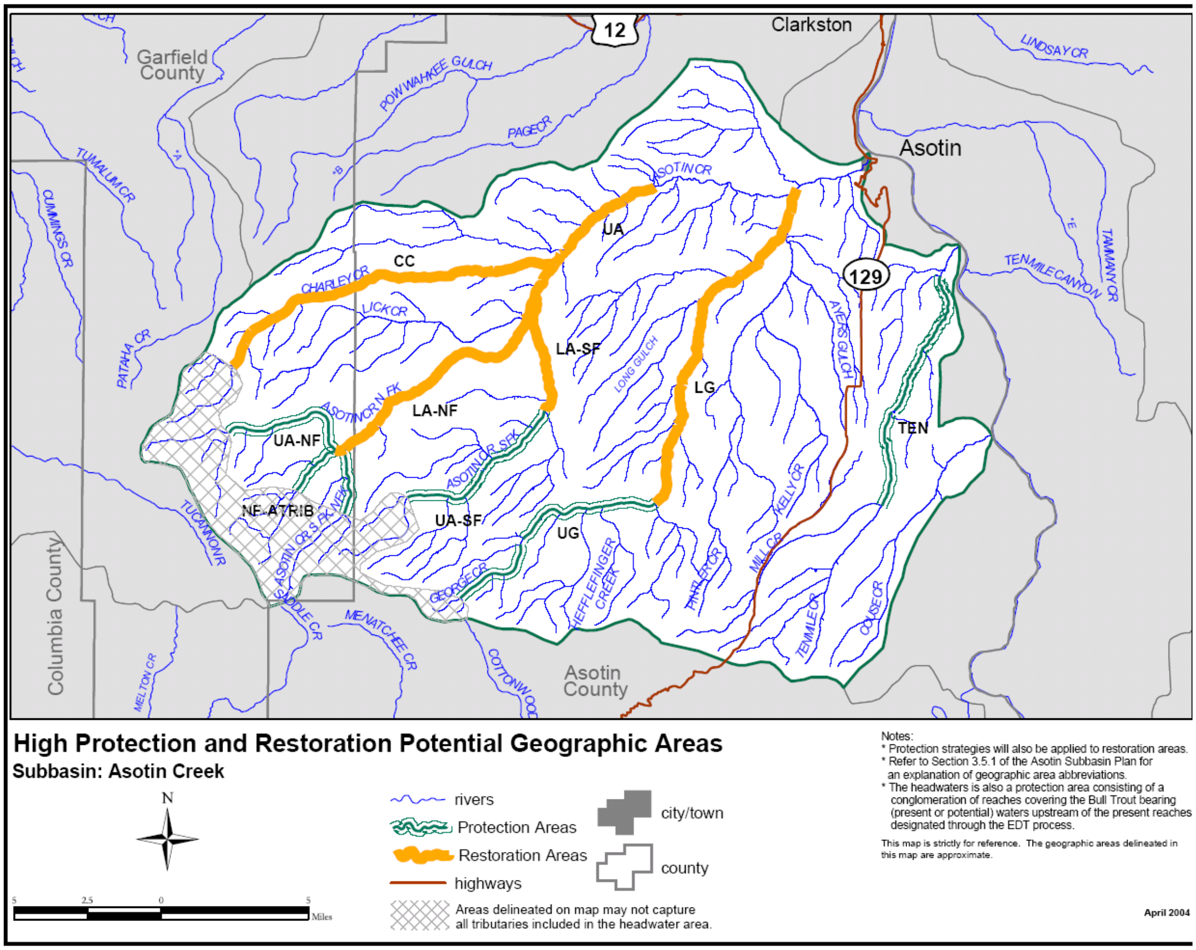

Figure 3-8 Priority Protection and Restoration Potential Geographic Areas

Key: NF-ATRIB=North Fork Asotin Creek Tributaries, UA-NF=Upper North Fork Asotin, UA-SF=Upper South Fork Asotin, LA-NF=Lower North Fork Asotin, LA-SF=Lower South Fork Asotin, CC=Charley Creek, UA=Upper Asotin, UG=Upper George, LG=Lower George

These are not in ranked order. Ranking of areas for restoration should be done by the management strategy planning team. The priority geographic areas were identified by considering first their rankings by the EDT analysis for restoration for both steelhead and spring Chinook from Tables 3-14 and 3-15. Then these were considered in the light of past planning efforts within the subbasin. NF Tributaries and Upper George Tributaries rate high according to EDT for restoration for steelhead. The areas, however, are not considered ever to have been spring Chinook habitat and thus were not included in the EDT analysis for spring Chinook. Since there would be no benefit to spring Chinook they were eliminated from consideration.

3.7.3 Impacted Life Stages

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

Table 3-14 Impacted Life Stages

Priority Restoration Geographic Area	Incubation	Fry	Sub-yearling rearing	Overwintering	Yearling Rearing	Pre-spawning
Upper Asotin	Steelhead Spring Chinook	Spring Chinook	Steelhead	Steelhead	Steelhead, Spring Chinook	Spring Chinook
Lower George	Steelhead Spring Chinook	Spring Chinook	Steelhead Spring Chinook	Steelhead Spring Chinook*	Steelhead	
Lower NF Asotin	Steelhead Spring Chinook	Steelhead Spring Chinook	Steelhead Spring Chinook	Spring Chinook	Steelhead	Spring Chinook
Charley	Steelhead Spring Chinook	Steelhead Spring Chinook	Steelhead	Spring Chinook	Steelhead	Spring Chinook
Lower SF Asotin	Steelhead Spring Chinook	Steelhead Spring Chinook	Steelhead Spring Chinook	Steelhead *		Spring Chinook

*Though overwintering for spring Chinook and steelhead in these two geographic areas were not in the top four when considering all three population performance measurements; it had an extremely high impact on productivity compared to pre-spawning and spawning which were in the top four.

The impacted life stages are strictly from the EDT analysis. Although EDT did not address bull trout, in certain areas bull trout life history stages are likely impacted as well by similar limiting factors (pers. comm., J. Flory, USFWS, 2004). These represent the top four by life stage rank for the geographic areas as determined from the reach analyses. Life stage ranks are determined through EDT for each reach by considering all three EDT population performance measures (life history diversity, abundance and production). The individual reach analysis that make up the geographic areas were then considered in determining the top four life stages. Those life stages that were ranked in the top four within the reaches most often were determined to be the four most impacted life stages for the geographic areas. 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 some degree. 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. These results are consistent with previous assessments, given that there appears to be general agreement on the limiting factors for the Asotin, particularly since the affected life stages are determined for the EDT analysis using the latest literature.

3.7.4 Limiting Habitat Attributes

The following habitat attributes are considered to have the most impact within the above Asotin Creek reaches and key life stages listed above:

Table 3-15 Key Limiting Habitat Attributes in Priority Restoration Geographic Areas

Geographic Area	LWD	Confinement	Riparian Function	Sediment	Key Habitat (pools)	Temperature	Flow	Bedscour
Upper Asotin	X	X	X	X	X	X		
Lower George	X	X	X	X	X	X	X	X
Lower NF Asotin	X	X	X	X	X			X
Charley	X	X	X	X	X			X
Lower SF Asotin	X	X	X	X	X	X		

These habitat attributes were taken directly from the EDT analysis. They were then modified given local knowledge and to be consistent with previous assessment and planning documents. Please note the commonality of compromised habitat attributes in the above reaches. While this does show pervasive problems within the system, it also can potentially make managing to these priority reaches simpler; meaning the same types of projects can benefit multiple reaches.

Although flow was identified as a limiting factor for all of the priority geographic areas to a certain degree, EDT results showed that it was a significant limiting factor for the Lower George geographic area only. Other limiting factors in the remaining geographic areas had a more significant impact upon fish populations than flow. As such, flow was identified by EDT as a key limiting factor in only the Lower George geographic area (Pers. comm., M. Wachtel, WDFW, May 2004).

3.7.5 Protection Priority Geographic Areas

The following geographic areas have the highest protection value in the Asotin Subbasin according to the EDT analysis and taking into account other assessment work:

- Upper NF Asotin
- Upper SF Asotin
- Lower NF Asotin
- Charley Creek
- Upper Asotin
- Upper George Creek
- Headwaters (upper ends of George Creek, Charley Creek, NF and SF Asotin)*
- NF Asotin Tributaries
- Lower SF Asotin
- Lower George Creek

*Headwaters is a assemblage of reaches covering the Bull Trout bearing (present or potential) waters upstream of the present reaches designated through the EDT process (see discussion in "E." below).

Standing out within this list is NF Asotin. Its upper and lower areas are high for protection. This, and the inclusion of the Lower NF in the list of streams highly rated for restoration accentuates, the current importance of this reach to salmonids in the subbasin. Upper Asotin, Charley Creek and Lower SF are all also present on both lists. It is important to note that the inclusion on one list does not exclude a reach from being on the other. This simply means that according to the EDT analysis it is important to preserve the habitat that is there while doing restorative work. Upper George was not ranked particularly high when analyzed for steelhead and spring Chinook by EDT. Its inclusion though is consistent with other assessments and is on the list of core streams in the *Draft Bull Trout Recovery Plan* (see comments below). It should be noted that many of the above protection reaches apply only to steelhead. It is unlikely that spring Chinook would benefit from protection in Upper SF, Charley Cr or George Cr because they use these areas very little, if at all.

The lower South Fork Asotin stream reach was added to the list of areas EDT results indicated have high protection value based on information and conclusion in past planning documents, the sporadic presence of bull trout, and the fact that the entire reach is now in public ownership.

3.7.6 Tenmile and Couse Creeks – Restoration and Protection Priority Geographic Areas

In general the mainstem Tenmile reaches ranked higher for restoration than the Mill Creek Reaches. Within that area, the reaches from the end of the seasonally dewatered area to the mouth of the Middle Branch were considered highest in both restoration and protection value (Tenmile4 and 5). In both reaches in this area sediment load and channel stability were the most limiting factor on the most limited life stage, incubating eggs. Temperature impacts on incubating eggs and colonizing fry were also major factors affecting production but only in Tenmile4. Lack of key habitat and habitat diversity also were shown as problems according to EDT. Sediment load and habitat diversity (pools) are attributes that were also highlighted as problems by the Limiting Factors Analysis (Kuttle 2001). Tenmile in its entirety is flow limited. It is unknown and hard to estimate how much the change in land cover within this short, steep watershed has effected groundwater infusion during critical summer months. It is very possible that changes in land use practices throughout the basin could positively affect summer flows.

The relative contribution of Tenmile Creek to the overall population of steelhead in the Asotin Subbasin is small (see Appendix B). Thus, it was not considered with the geographic areas of Asotin Creek when identifying priority areas for restoration and protection. Though the relative contribution to the population is small the importance that Tenmile steelhead has to the population in terms of diversity is unknown. This assessment clearly shows that Tenmile, which is the top restoration and protection reach, is the most important for consideration of protection or restoration strategies.

The lack of resources available within the timetable provided did not allow for an EDT assessment of Couse Creek. Couse Creek has a known spawning steelhead population and thus has some importance to the subbasin population as a whole. The results from EDT on Tenmile can generally be applied to Couse Creek. It is thought that sediment and lack of habitat diversity are limiting to steelhead production (Kuttle 2001).

3.7.7 Bull Trout

The assessment of bull trout and its habitat presented some difficulty in the Asotin Subbasin. Rules for bull trout in EDT had not been developed in time for this assessment. This coupled with a glaring lack of knowledge of even the basic life history of bull trout in the Asotin drainage put the fish at a distinct disadvantage when it came to naming priority habitats for protection and restoration. The *Draft Bull Trout Recovery Plan* identified temperature as being the most limiting factor in the subbasin. Protecting the upper reaches from degradation is the key to modifying or maintaining bull trout suitable temperatures in the Asotin. EDT reaches and the geographic areas described thus far in the document were developed based on the distribution of steelhead and spring Chinook, not bull trout. Given these two points, and to be consistent with other assessments such as the list of priority streams from the Recovery Plan, the upper reaches of George Creek, Charley Creek, NF Asotin and SF Asotin not covered within the geographic areas should be considered priority for protection. These areas quite probably represent the last good bull trout habitat in the Asotin Subbasin.

3.8 Aquatic Species of Interest

Species of Interest (SOI) were approved by the subbasin planning team for inclusion, because they may have ecological and/or cultural significance to the subbasin (WDFW 2004). In order to determine whether or not they should be classified as a focal species, more information is required regarding their subbasin specific life histories and conditions that may be limiting their productivity and abundance (WDFW 2004). WDFW (2004) has a established a 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 the future.

3.8.1 Pacific Lamprey (*Lampetra tridentata*)

Pacific lamprey (*Lampetra tridentata*) were suggested as a species of interest by the Nez Perce Tribe. The following write-up was provided by the Nez Perce Tribe (2004), (see Appendix D).

History

Pacific lamprey numbers have been in great decline since the installation of numerous dams and habitat degradation in the Columbia Basin. The Nez Perce Tribe regards Pacific lamprey as a highly valued resource harvested to this day as a subsistence food and is highly regarded for its cultural value. The Asotin Subbasin historically had a large run of anadromous Pacific Lamprey. There are numerous oral recollections of fishing for the lamprey as an alternative subsistence food source by Native Americans.

The town of Asotin is derived from the Nez Perce word Heustiin that means place of eels, (Allen Slickpoo Sr., Nez Perce, Salmon and His People, Landeen, Pinkham 1999).

Asotin County resident Frank Schiebe, who was the dam operator at Headgate Dam from 1954 – 1960, on main Asotin Creek, recalls numerous lampreys could be seen maneuvering over the headgate dam. He also recalled that lampreys were also taken out of Asotin Creek for use as sturgeon bait by local fishermen, (pers. comm. F. Scheibe, 2004).

Life History

The life cycle of the Pacific Lamprey is similar to that of salmonids. Pacific Lamprey reach the spawning grounds in mid-summer (Kan 1975; Beamish 1980) and generally spawn the following spring. Thus, adult lamprey spend approximately 1 year in freshwater. Spawning generally occurs in small tributary streams, where both sexes construct a crude redd (Scott and Crossman 1973), generally located in the center of the stream near the tailout of a pool, and immediately upstream of shoreline depositional areas (Beamish 1980). Mating is repeated several times in the redd, with each mating followed by actions that move substrate over newly laid eggs. Water temperatures of 10-15oC have been measured in Clear Creek, a tributary of the John Day River, during spawning (Kan 1975). Adults die soon afterward and provide valuable nutrients to small tributaries where salmon fry rear (Kan 1975).

Eggs typically hatch into ammocoetes in less than 2 weeks; these newly hatched larvae, which are filter feeders, then drift downstream and bury themselves in silt, mud, or fine gravel along the margins and backwaters of streams and rivers (Scott and Crossman 1973; Hammond 1979). Ammocoetes generally spend 5-6 years in freshwater (Scott and Crossman 1973). In the fall of their last year, they metamorphose into macrophthalmia, which resemble the adult form. This transformation process is generally completed by early winter.

Downstream migration of macrophthalmia appears to be stimulated by and dependent on late winter and early spring floods (Hammond 1979). Because they are not strong swimmers, lampreys appear to be dependent on spring flows to carry them to the ocean (Kan 1975; Beamish 1980). The upstream, spawning migration of adults generally begins in early spring. Adult lamprey use the mainstem in returning to their spawning grounds, but do not feed during this period. They were once an important food source for sturgeon in the mainstem (Kan 1975).

Pacific lampreys appear to travel directly into the open ocean, rather than feed in the estuary of nearby coastal waters (Kan 1975; Beamish 1980), as do some other lamprey species.

Pacific lampreys rear in the ocean habitat for up to 3.5 years (Beamish 1980), and range in excess of 100 km offshore, often in areas of considerable depth (up to 800 m) (Kan 1975; Beamish 1980;). Adult lampreys in the ocean are parasitic on many fish species, including salmon. They attach themselves to fish and other animals and feed on blood and body fluids through a hole rasped in the flesh of the host (Wy-Kan-Ush-Mi Wa-Kish-Wit, (Spirit of the Salmon): The Columbia River Anadromous Fish Restoration Plan of the Nez Perce, Umatilla, Warm Springs and Yakama Tribes, Volume I, CRITFC 1996).

Evidence suggests that Pacific Lamprey was well integrated into the native freshwater fish community, and as such had positive effects on the system. It was in all probability, a big contributor to the nutrient supply in oligotrophic streams of the basin as adults died after spawning (Beamish 1980). We suspect that it was an important buffer for upstream migrating adult salmon from predation by marine mammals. Juvenile lampreys migrating downstream may have buffered salmonid juveniles from predation by predacious fishes and sea gulls (Close et al. 1995).

Pacific Lamprey ammocoetes provide Snake River basin white sturgeon *Acispenser transmontanus* populations with an important food source (Galbreath 1979), which potentially contributed to Snake River white sturgeon historical productivity, (Cochnauer, Claire 2001). Pfeiffer and Pletcher (1964) found that coho fry ate emergent larval lamprey (Close et al. 1995).

Need

Since the completion of the hydropower system in the Columbia Basin, the numbers of Pacific lamprey have declined dramatically compared with historical levels of abundance and distribution.

Counts at Bonneville Dam have exceeded 300,000 lampreys in the past (Starke and Dalen 1995). These counts include only those fish that passed the counting station during the 18 hours of counting, i.e., they do not include lamprey that passed through navigation locks or at night. Counts of Pacific lamprey returning over lower Snake River dams were in the thousands in 1969, but declined to hundreds by 1978 (Hammond 1979) and numbered only 40 individuals total in 1993 (L. Basham, Fish Passage Center, Portland, personal communication 1994) (Wy-Kan-Ush-Mi Wa-Kish-Wit, (Spirit of the Salmon): The Columbia River Anadromous Fish Restoration Plan of the Nez Perce, Umatilla, Warm Springs and Yakama Tribes, Volume I, CRITFC 1996).

Currently there is no empirical data on the numbers of Pacific Lamprey that may still be returning to this watershed, they are considered functionally extirpated. Basic life history, distribution, and remaining population status are urgently needed to fully understand this species and to begin intensive management before populations decline to unrecoverable thresholds. Additional research is required to establish current numbers, limiting factors, available habitat and rehabilitation potential.

On going efforts to determine the current status of Pacific Lamprey have largely been focused from the mouth to the Lower and Mid Columbia regions with the exception of the Idaho Department of Fish and Game study in the Clearwater River Basin above the confluence of the Lower Snake River.

To enhance information sharing and to eliminate duplication of development of research methodology proposed efforts should adopt methods such as those that are currently being utilized by other Columbia River Intertribal Fish Commission tribes. The Nez Perce Tribe's goal relating to lamprey is to create a sustainable annual subsistence harvest and re-establish the lamprey's role in the Asotin subbasin.

3.8.2 Coho Salmon (*Oncorhynchus kisutch*)

Coho salmon (*Oncorhynchus kisutch*) were suggested as a species of interest by the Nez Perce Tribe. The following write-up was provided by the Nez Perce Tribe (2004) (see Appendix D).

The Nez Perce tribe regards coho salmon as a highly valued resource that was historically harvested as a subsistence food and is highly regarded for its cultural value.

Life History

Coho salmon spawn in small coastal streams and the tributaries of larger rivers. They prefer areas of mid-velocity water with small to medium sized gravels. Because they use small streams with limited space, they must use many such streams to successfully reproduce. Stream gradients of 3 percent or less provide conditions favorable for coho salmon (Reeves et a. 1989).

Historically, coho salmon in the Snake River Basin spawned from mid-October to mid-December, fry emerged from the gravel in late spring (April), juveniles reared for approximately 18 months and emigrated to the ocean (Cramer and Witty 1998). Smolt emigration from the Grande Ronde began in late April to early May. Passage over Ice Harbor Dam peaked in early June and smolts reached the Columbia River estuary in mid-May to early-June (Cramer and Witty 1998). The majority of adults coho salmon returning to the Grande Ronde River had spent 15 months rearing in the ocean and returned to spawn at age 3 (Cramer and Witty 1998).

Data

Coho salmon were considered to be extirpated in the Snake River basin in 1986 based on zero counts over the Snake River dams. There are no documented reports of coho salmon in Asotin Creek. However, historically, coho were abundant in the adjacent subbasins: the Clearwater and Grande Ronde. Nez Perce Tribal elders confirm the historical presence of coho salmon in the Clearwater River Subbasin (Paul Kucera, Director of Research, Nez Perce Tribe, Personal Communication) and Schoning (1940, 1947) and Fulton (1968) also document that residents of the area caught coho salmon in the Clearwater River Subbasin. In addition, the Grande Ronde subbasin was historically a major producer of coho salmon. Cramer and Witty (1998) estimated adult coho production exceeded 20,000 fish in the Grande Ronde subbasin (x miles upstream from Asotin Creek) prior to 1902.

Need

The Nez Perce Tribe has a mission to recover and restore all populations, all species of anadromous and resident fish within the traditional lands of the Nez Perce Tribe.

To support this mission, the Nez Perce Tribe has developed a plan for reintroduction and restoration of coho salmon to the Snake River Basin which includes the Grande Ronde Subbasin (Grassel et al. 2004 DRAFT) and the Clearwater River Subbasin (NPT and FPI 2004). The Nez Perce Tribe has an ongoing coho salmon reintroduction program in the Clearwater River Subbasin and recently has completed a master plan (NPT and FPI 2004) which identifies Asotin Creek as a stream for potential supplementation using a rotating schedule of juvenile coho salmon releases aimed at determining which tributaries have potential to support natural production.

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:

- 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 (Figure 3). 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 (Figure 4). 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 with categories 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. In the Asotin Subbasin, there are no high protection areas.

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. In the Asotin Subbasin, most the Asotin Creek Wildlife Area managed by WDFW would fall into this category.

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 intense 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. In the Asotin Subbasin, portions of the Asotin Creek Wildlife Area managed by WDFW would fall into this category as would land managed by the U.S. Forest Service and Washington Department of Natural Resources.

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	15,015	8,443	10,298	4,976	0	38,732
Status 3: Low Protection	159,032	61,194	77,157	80,690	124,645	502,718
Status 4: No Protection	195,164	982,905	224,938	160,334	993,342	2,556,683
Total(Subbasin)	**369,259**	**1,059,935**	**326,185**	**246,000**	**1,126,198**	**3,127,568**

Source: Table 6 of Appendix E

4.3 Terrestrial Priority Habitats

4.3.1 Selection of Terrestrial Priority Habitats

The Asotin subbasin consists of 11 wildlife habitat types. These habitat types are briefly described in Table 4-2. Their historic and current abundance in the Asotin 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.

Table 4-2 Wildlife Habitat Types Within the Asotin 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	Ponderosa pine dominated woodland or savannah, often with Douglas-fir; shrub, forb, or grass understory; lower elevation forest above steppe, shrub-steppe.
Eastside (interior) grasslands	Dominated by short to medium height native bunchgrass with forbs, cryptogam crust.
Shrub-steppe (not present)	Sagebrush and/or bitterbrush dominated; bunchgrass understory with forbs, cryptogam crust.
Interior canyon shrublands	Chokecherry, oceanspray, and Rocky Mtn. maple with shrubs and grasses dominated the understory.
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.
Herbaceous wetlands	Emergent herbaceous wetlands with grasses, sedges, bulrushes, or forbs; aquatic beds with pondweeds, pond lily, other aquatic plants
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 Asotin Subbasin Historic and Current Habitat Type Acres and Percent Change Changes in Wildlife Habitat Types in the Asotin Subbasin – circa 1850 (historic) to 1999 (current)

Status	Montane Mixed Conifer Forest	Interior Mixed Conifer Forest	Lodgepole Pine Forest and Woodlands	Ponderosa Pine	Eastside (Interior) Grasslands	Shrubsteppe	Interior Canyon Shrublands	Agriculture, Pasture, and Mixed Environs	Urban and Mixed Environs	Herbaceous Wetlands	Montane Coniferous Wetlands	Eastside (Interior) Riparian Wetlands
Historic	1,479	20,705	1,479	34,756	185,363	0	0	0	0	1,972	0	6,096
Current	6,093	27,921	2,902	14,997	134,789	0	311	57,040	86	28	137	1,687
Change (acres)	+4,614	+7,216	+1,423	-19,758	-50,575	0	+311	+57,040	+86	-1,944	+137	-4,409
Change (%)	+76	+26	+51	-57	-27	0	999	999	999	-99	999	-73

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

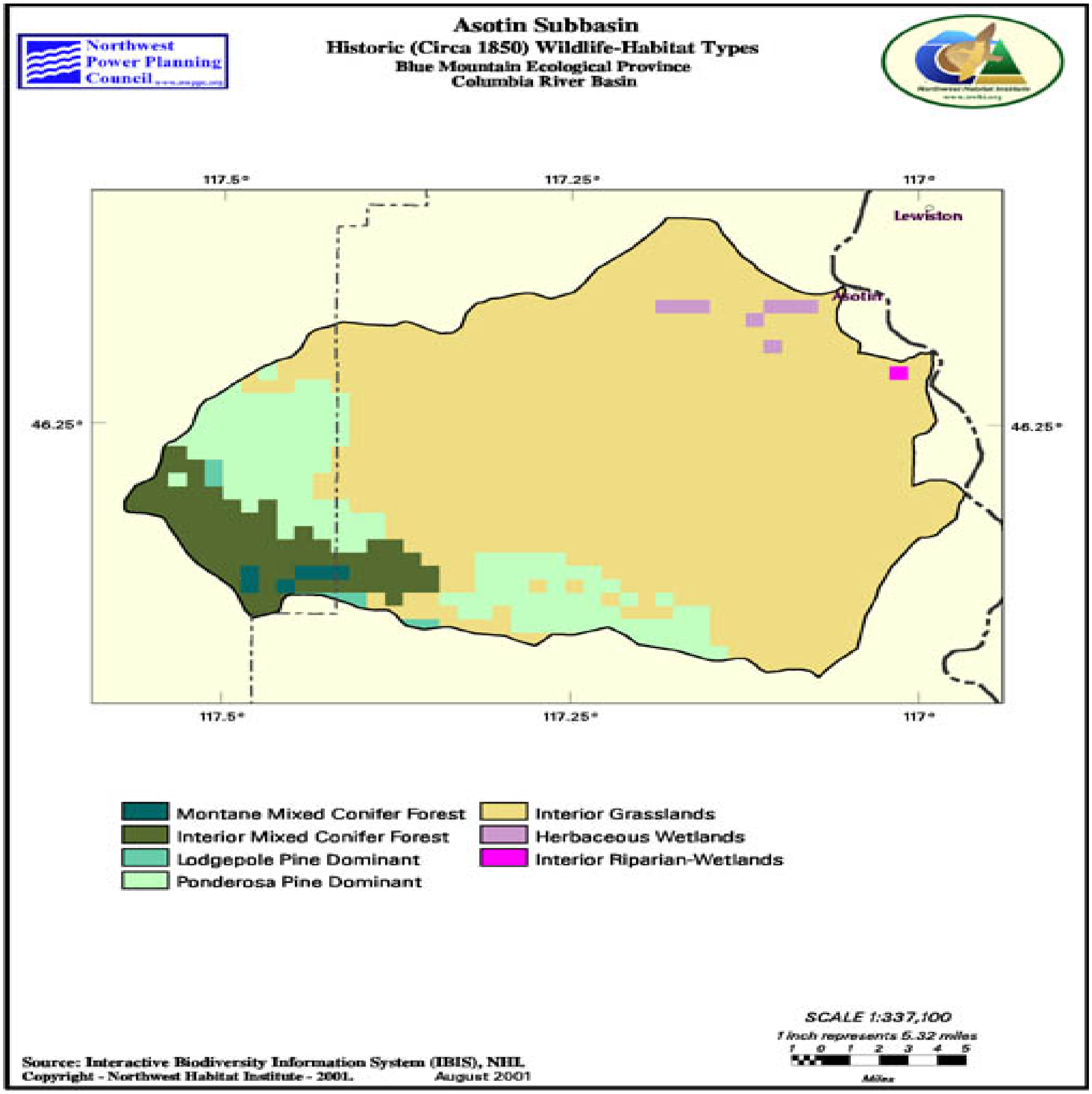

Figure 4-1 Asotin Subbasin Historic (Circa 1850) Wildlife Habitat Types

IBIS 2003, as cited in Ashley and Stovall 2004

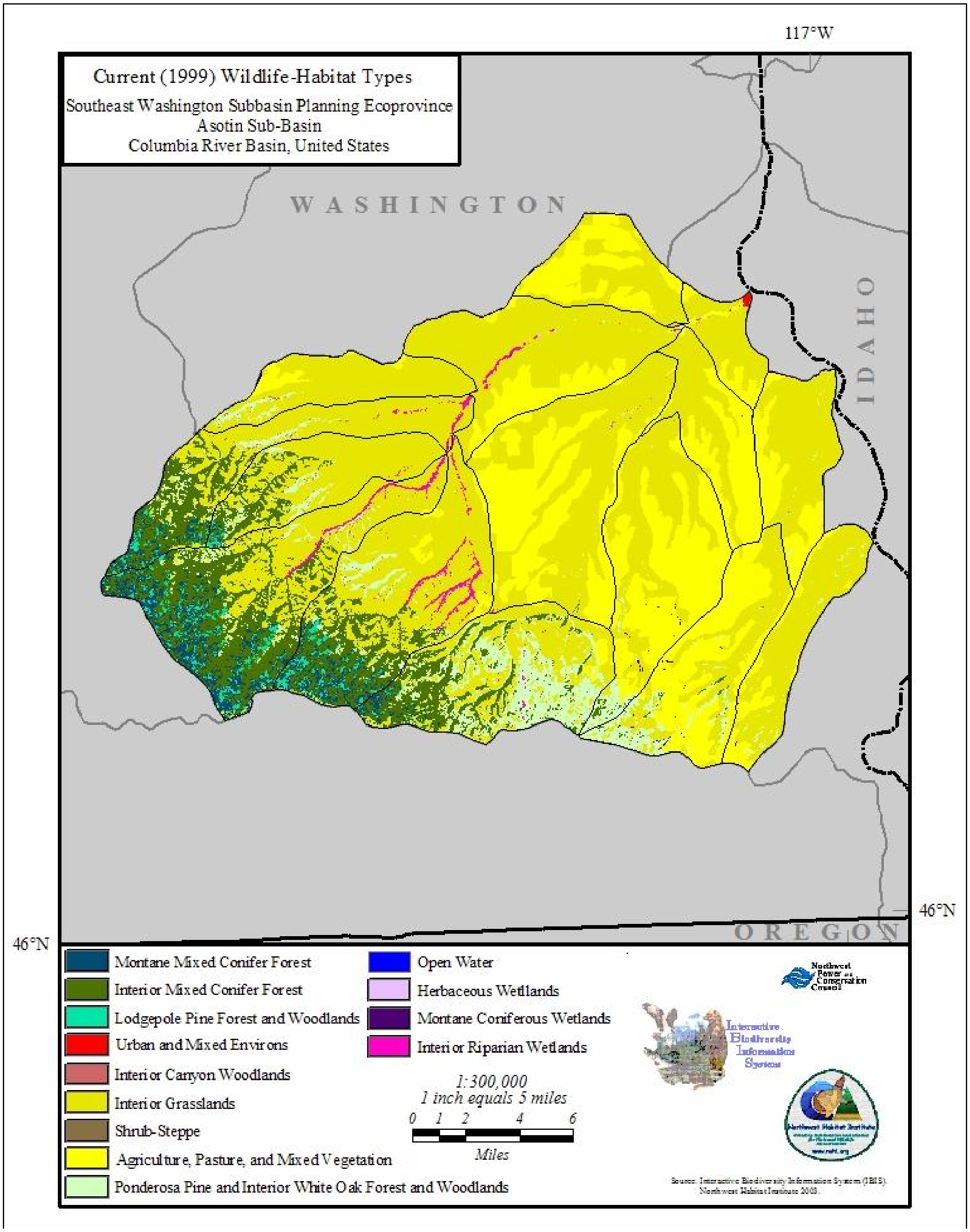

Figure 4-2 Current Wildlife Habitat Types of the Asotin Subbasin

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.
- Focal wildlife species/guilds can be used to represent focal habitats and to infer or measure response to changing habitat conditions at the subbasin 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 that are present within the subbasin, the following four were selected as focal habitats for 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
- eastside interior grasslands
- 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). Although there is little, if any, shrub-steppe habitat within the Asotin subbasin[10] (Table 4-4), it is included as a focal habitat for the Ecoregion and therefore will be discussed as a focal habitat in this assessment (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

Source: Ashley and Stovall 2004

[10] Additionally, both IBIS (2003) and Washington GAP data do not recognize it as a historical or current habitat type in the Asotin subbasin.

Ponderosa pine and eastside (interior) grassland focal habitat types are detailed graphically in Figure 4-3. Steppe vegetation zones are combined to form the grassland habitat type. Current and historic riparian wetland habitat information is a significant data gap, therefore, riparian wetland habitat is not included in the habitat distribution maps for the Asotin subbasin.

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

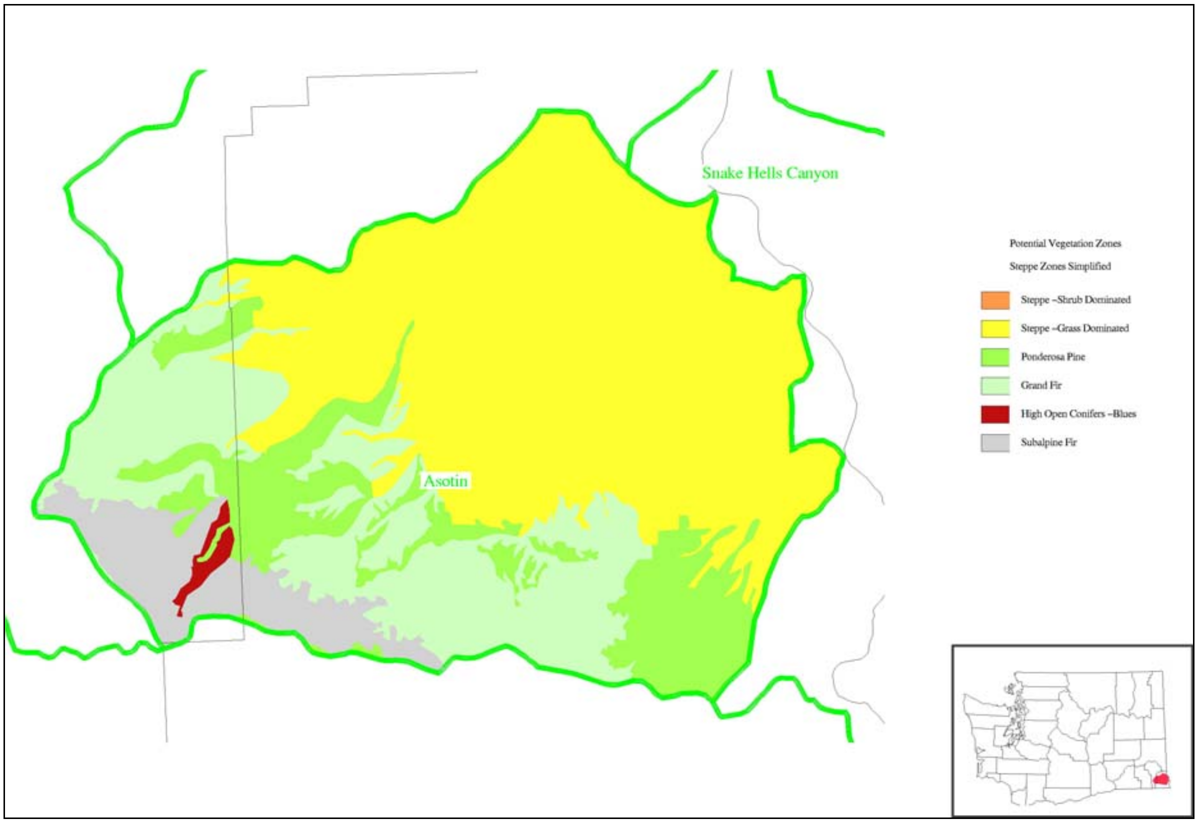

Figure 4-3 Ponderosa Pine and Eastside (Interior) Grassland Habitat Types in the Asotin Subbasin

Cassidy 1997; as cited in Ashley and Stovall 2004).

4.3.2 Description of Terrestrial Priority Habitats

Ponderosa Pine (*Pinus ponderosa*) Forest

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 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 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 genus *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).

Remaining ponderosa pine habitats in the Asotin subbasin fall primarily in the "low" to "no protection" categories. Consequently, this habitat type "will likely suffer further degradation, disturbance, and/or loss" in the subbasin. Table 4-5 details the protection status of remaining ponderosa pine habitat within the Asotin subbasin (Ashley and Stovall 2004).

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

GAP Protection Status	Acres
High Protection	0
Medium Protection	212
Low Protection	6,512
No Protection	8,332

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
Umatilla	4,501	3,989	777	1,219	3,276	385	N/A	14,147
Walla Walla	44,955	95,555	129	0	11,735	166	0	152,540
Whitman	25,616	62,594	36	19,781	15,932	11	24,791	148,761

Source: FSA 2003

Table 4-7 Number of Acres Protected Through the CREP/Continuous CRP Program By County (FSA CP-22 2003)

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

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).
Source: FSA 2003

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*). 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).

The Blue Mountain steppe vegetation zone comprises the grassland habitat within the Asotin subbasin (Ashley and Stovall 2004). In this ecoregion, the Blue Mountain steppe vegetation zone occurs only in the Asotin subbasin (Ashley and Stovall (2004); however, throughout most of the subbasin, native grasslands have been replaced by agricultural crops, or severely altered by introduction of, and subsequent competition from, introduced 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 Asotin 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; none 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 Asotin Subbasin

GAP Protection Status	Acres
High Protection	0
Medium Protection	4,464
Low Protection	35,195
No Protection	95,170

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 4-6 (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).

Eastside (Interior) Riparian Wetlands

Eastside (interior) riparian wetlands 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, altered stream channel morphology, and water withdrawal have played significant roles in changing the character of streams and associated riparian areas. Grazing in some areas has extensively suppressed woody vegetation. Herbaceous vegetation has also been highly altered with the introduction of Kentucky bluegrass and reed canarygrass, which has spread to many riparian areas."
>
> "Riparian zones along the Snake River and Asotin Creek have been lost and fragmented by agricultural development and subdivision. In 1993, an estimated 70 percent of the streambanks on private rangelands adjacent to Asotin Creek were either excluded from livestock grazing or used only during spring or early summer. Thirty percent of the streambanks are grazed year long or between mid-summer and winter (ACCD 1995 in NPPC 2001d). Some riparian reaches next to confined winter-feeding areas lack trees, shrubs and ground cover due to trampling by livestock. Portions of riparian areas also show signs of overgrazing, such as reduced ground cover, influxes of introduced vegetation, hedging of shrubs, decreased shrub vigor, low diversity of plant species and poor age class structure."
>
> "Forested riparian vegetation along Asotin Creek and other subbasin streams remains in transition, modified by recent flooding events. In 1993, about 64 percent of the riparian vegetation along Asotin Creek consisted of mixed successional stands of alder and black cottonwood (ACCD 1995 in NPPC 2001d). These stands of predominantly young age class provided from 37 percent canopy cover near the mouth of the creek to 79 percent canopy cover at Headgate Park. Flooding in 1996-97 substantially reduced the riparian forest overstory on Asotin Creek. By 2000, only 16 percent of the creek contained more than 70 percent canopy closure considered desirable for stream shading (NRCS 2001). Damage to riparian cover in the upper portion of the watershed was evident, where canopy cover was reduced approximately by half compared to pre-flood (1993) surveys. Douglas-fir and grand fir were the successional dominants in these older stands, with alder and ponderosa pine as notable components."

In conjunction with HEP surveys, Ashley (2003, as cited in Ashley and Stovall 2004) conducted vegetation transects along the upper reaches of South Fork Asotin Creek. Results indicate that mean tree canopy cover is 45 percent and mean shrub cover is 51 percent (Ashley and Stovall 2003). Black cottonwood (*Populus balsamifera*) and alder trees (*Alnus* spp.) are co-dominant with locusts (*Robinia* spp.), water birch (*Betula occidentalis*), ponderosa pine, and willows (*Salix* spp.) also present. Shrub species observed by Ashley (2003) include mock orange (*Philadelphus* spp.), snowberry (*Symphoricarpos albus*), and ninebark (*Physocarpus capitatus*). No indication is given as to how representative upper South Fork Asotin Creek's riparian wetland community is to riparian wetlands in other portions of the subbasin.

The protection status of remaining eastside (interior) riparian wetland habitat in the Asotin subbasin is presented in Table 4-9. The vast majority 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 Asotin Subbasin

GAP Protection Status	Acres
High Protection	0
Medium Protection	210
Low Protection	534
No Protection	950

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 4-7 (Ashley and Stovall 2004). 297 stream miles are eligible for CREP enrollment in Asotin County; however, only ~58 stream miles are currently registered (NRCS unpublished data, as cited in Ashley and Stovall 2004). The CREP program protects an average of ~23 acres of habitat per stream mile (1,339 acres ÷ 58 miles) on enrolled lands in Asotin County (FSA, unpublished data, as cited in Ashley and Stovall 2004).

Shrub-steppe

Description

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 not reported to occur currently or historically within the Asotin subbasin (Ashley and Stovall 2004).

4.3.3 Agriculture (Cover type of interest)

Asotin subbasin agriculture operations include dryland/irrigated crops and irrigated and non-irrigated pasture (alfalfa and hay). Cultivated crops include annuals and perennials (e.g., fruit trees, carrots, onions, wheat, and barley). Wheat and barley are the dominant crops; they typically are produced on upland, rolling terrain without irrigation on non-forested areas of the subbasin. Pastures adjacent to streams and riparian areas may be irrigated. 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 valley bottoms have significantly affected grasslands, shrublands, and riparian zones in those areas. Conversion of bottomland habitat into agriculture land uses results in the permanent fragmentation and destruction of functioning native habitats. 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 has also become an issue in the Asotin subbasin with most landowners desiring reductions in ungulate herds…."

IBIS (2003) reports that nearly all of the agriculture habitat type in the Asotin 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 Asotin subbasin is illustrated in Table 4-10.

Table 4-10 GAP Protection Status/Acres of Agriculture and Mixed Environments in the Asotin Subbasin

GAP Protection Status	Acres
High Protection	0
Medium Protection	28
Low Protection	3,172
No Protection	53,763

Source: Ashley and Stovall 2004

Distribution

Primarily due to steep topography and shallow soils, the Asotin subbasin has the lowest percentage of agriculture land within the ecoregion (Figure 4-4). Agricultural production generally occurs wherever it is not precluded by unsuitable soils or topography or public land ownership. (Ashley and Stovall 2004)

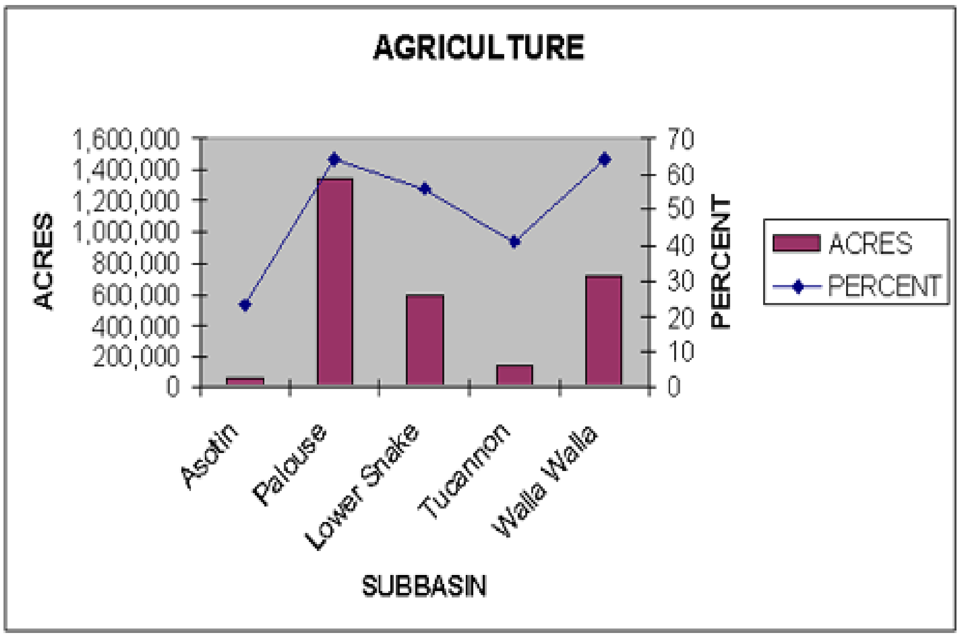

Figure 4-4 Agricultural land use within the Ecoregion
IBIS 2003

4.3.4 Terrestrial Habitat and Protection Status Summary

Table 4-11 summarizes changes in the extent of focal habitats within the Asotin subbasin (Ashley and Stovall 2004). All Asotin subbasin focal habitats have decreased substantially since 1850. Only agriculture (a cover type of interest) has increased.

Table4-11 Changes in Focal Wildlife Habitat Types in the Asotin Subbasin From Circa 1850 (Historic) to 1999 (Current)

Focal Habitat Type	Historic Acres	Current Acres	Acre Change	Percent Change
Ponderosa Pine	34,756	14,997	-19,758	-57
Shrub-steppe	0	0	0	0
Eastside (Interior) Grassland	185,363	134,789	-50,575	-27
Eastside (Interior) Riparian Wetlands	6,096	1,687	-4409	-73
Agriculture	0	57,040	+57,040	---

M. Hudson, WDFW, personal communication, 2003; IBIS 2003; both as cited in Ashley and Stovall 2004

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

> "Forest succession, logging, and development account for the 57 percent total change (loss) in ponderosa pine habitat (IBIS 2003). Similarly, conversion of grasslands to agriculture largely accounts for the entire change (loss) in eastside (interior) grasslands habitat (IBIS 2003)….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."

An estimated 2 percent (4,976 acres) of the Asotin subbasin is protected by GAP priority 2 status, 33 percent (80,689 acres) is under GAP priority 3 status, and the remainder (65 percent or 160,334 acres) has no degree of protection (GAP priority status 4) (Figure 4-5) (Ashley and Stovall 2004). The Asotin subbasin is the only subbasin in the Ecoregion that has no high protection status (priority 1) lands (Ashley and Stovall 2004). Definitions of various levels of GAP protection status can be found in the introduction of Section 4.

Subbasin ECA priorities and public land ownership are shown in Figure 4-6. There are no ECA Class 1 priority lands in this subbasin (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 enable 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".

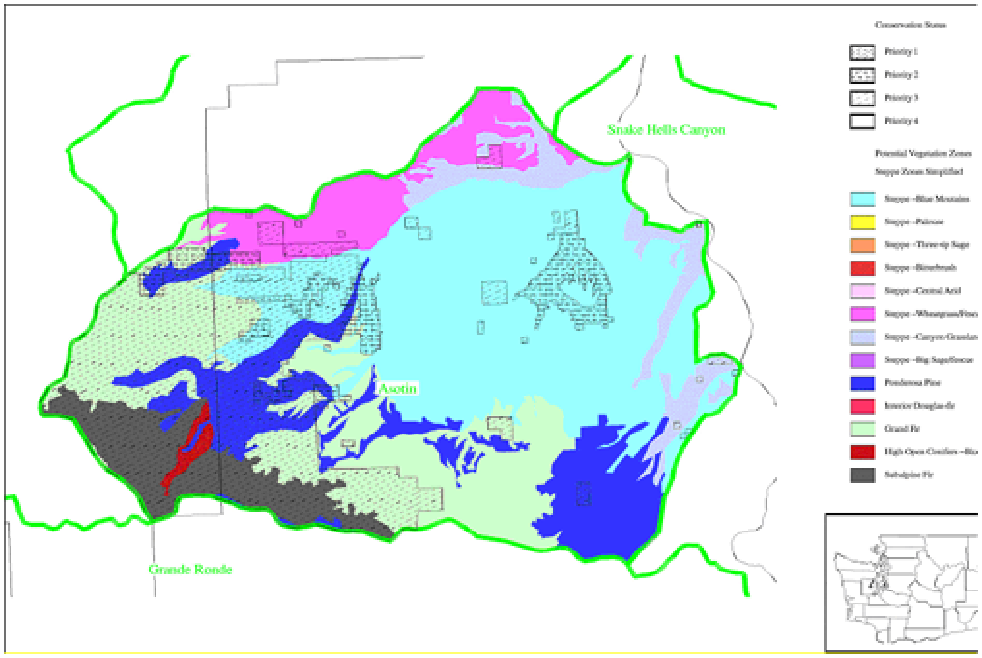

Figure 4-5 Protection Status and Vegetation Zones of the Asotin Subbasin

Cassidy 1997, as cited in Ashley and Stovall 2004.

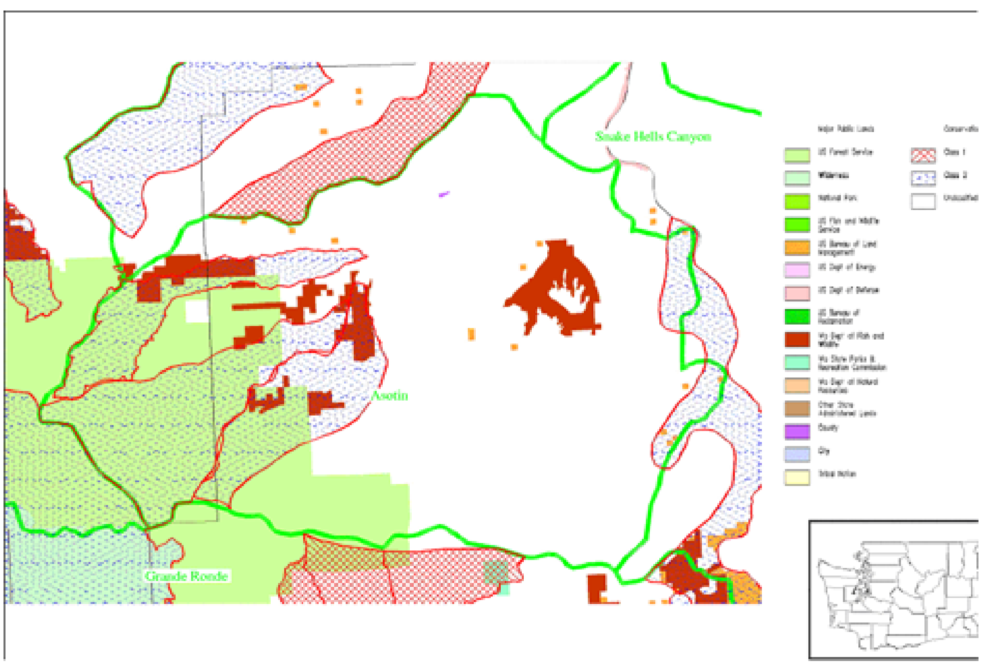

Figure 4-6 ECA and Publicly Owned Lands in the Asotin Subbasin

ECA 2003, as cited in Ashley and Stovall 2004).

4.4 Focal Species

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

4.4.1 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
- professional knowledge on species of local interest.

There are an estimated 246 wildlife species that occur in the Asotin subbasin (Appendix E). Of these species, 84 are closely associated with wetland habitat and 48 consume salmonids during some portion of their life cycle. Eleven species in the Asotin subbasin are non-native. Nine wildlife species that occur in the Subbasin are listed federally and 43 species are listed in Washington as Threatened, Endangered, or Candidate species, (Ashley and Stovall 2004)

A total of ten species were chosen as focal or indicator species to represent four priority habitats in the Asotin Subbasin (see Table 4-12). Focal species selection rationale and important habitat attributes are described in further detail in Table 31 of Appendix E.

Table 4-12 Focal Species Selection Matrix for the Asotin 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
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

Common Name	Focal Habitat[1]	Status[2] Federal	Status[2] State	Native Species	PHS	Partners in Flight	Game Species
Sharp-tailed grouse	Eastside (Interior) Grassland	SC	T	Yes	Yes	Yes	No
Bighorn Sheep*	Eastside (Interior) Grassland	n/a	n/a	n/a	n/a	n/a	No
Mule Deer *	Eastside (Interior) Grassland	n/a	n/a	n/a	n/a	n/a	Yes

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

* Bighorn sheep and mule deer were added at the subbasin-level.

Information regarding management of specific species, where applicable, can be found in Chapter 6. Figures 4-7 to 4-11 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 Appendix E.

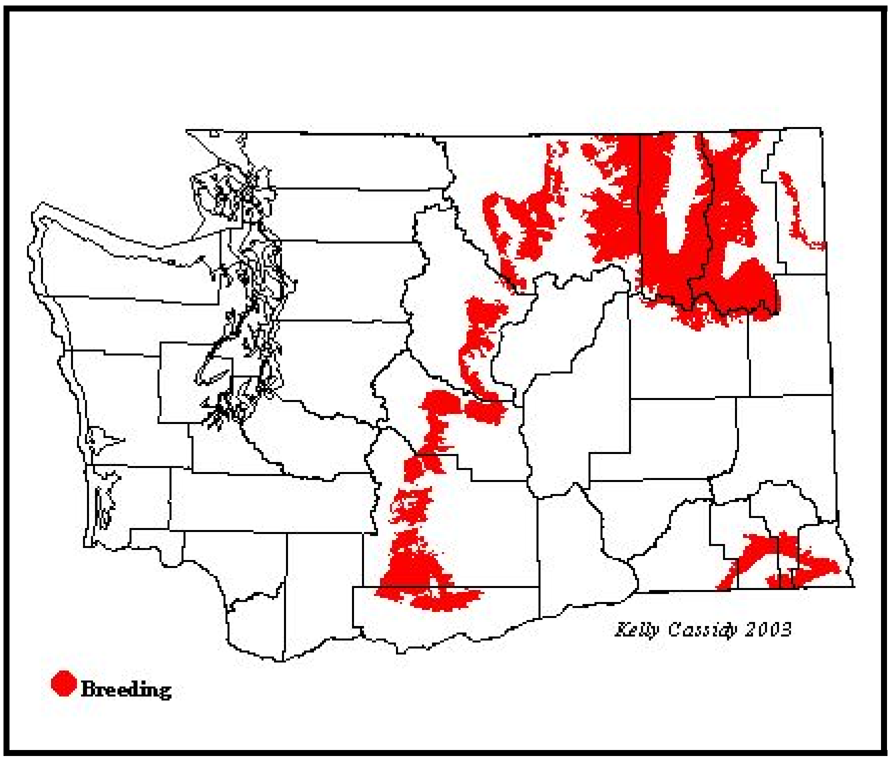

Figure 4-7 Flammulated Owl Distribution, Washington

Source: Kaufman 1996; as cited in Appendix E

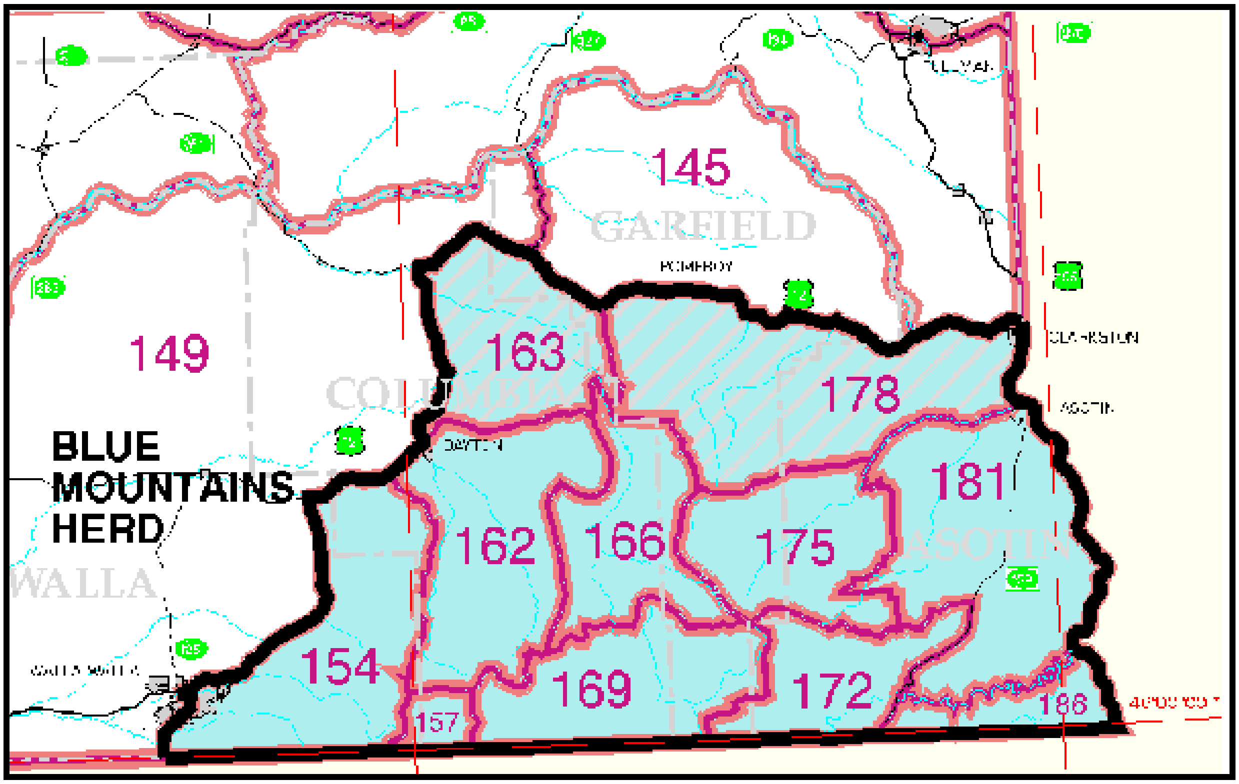

Figure 4-8 Elk Game Management Units in the Southeast Washington Subbasin Planning Ecoregion, Washington

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

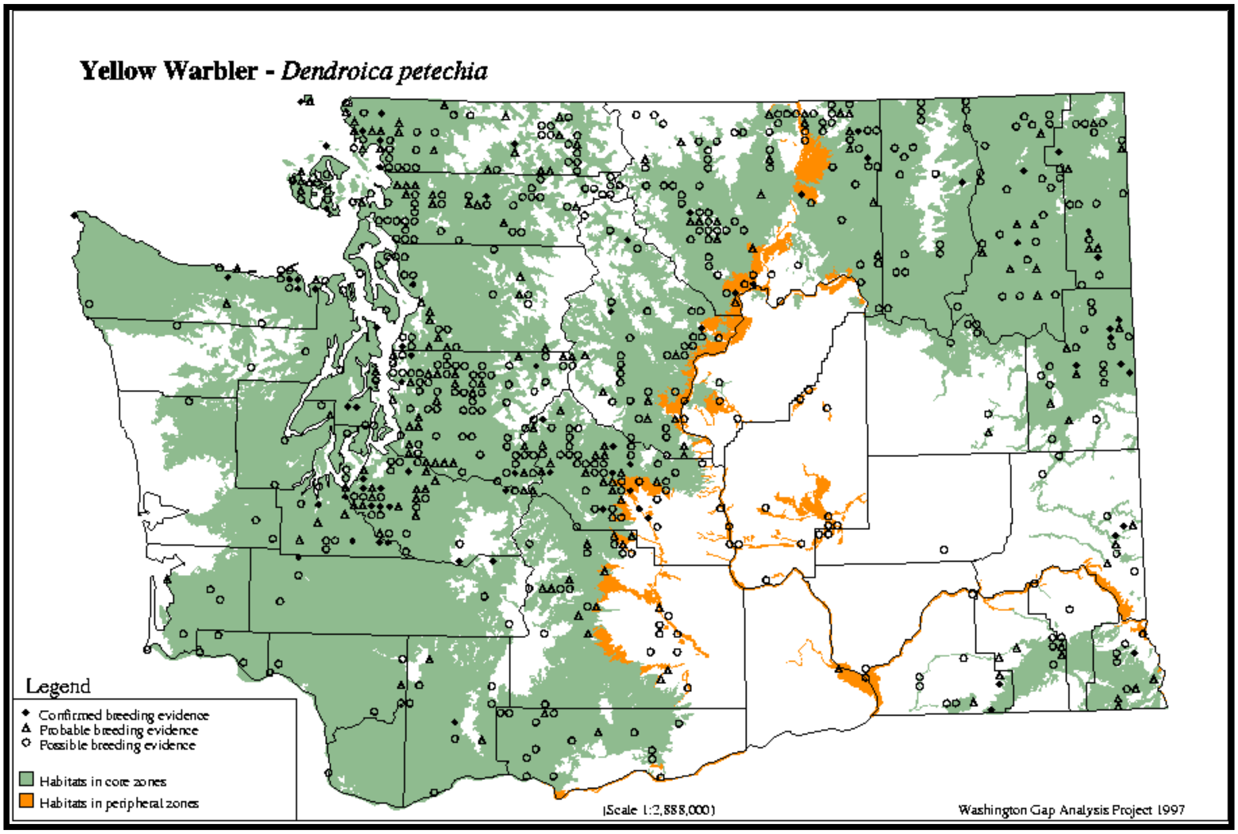

Figure 4-9 Breeding Bird Atlas Data (1987-1995) and Species Distribution for Yellow Warbler

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

Figure 4-10 Geographic Distribution of American Beaver

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

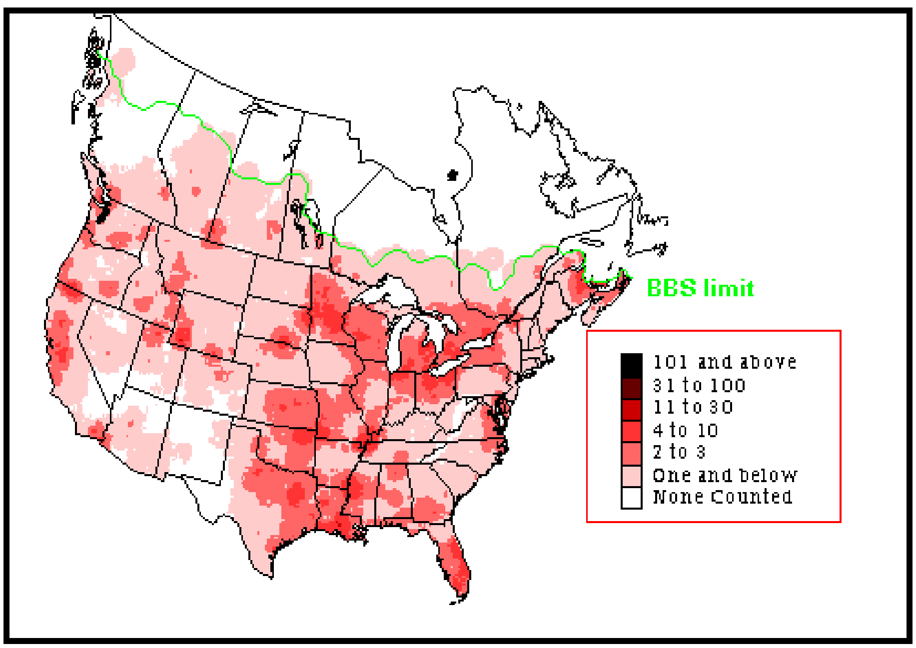

Figure 4-11 Great Blue Heron Summer Distribution

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.

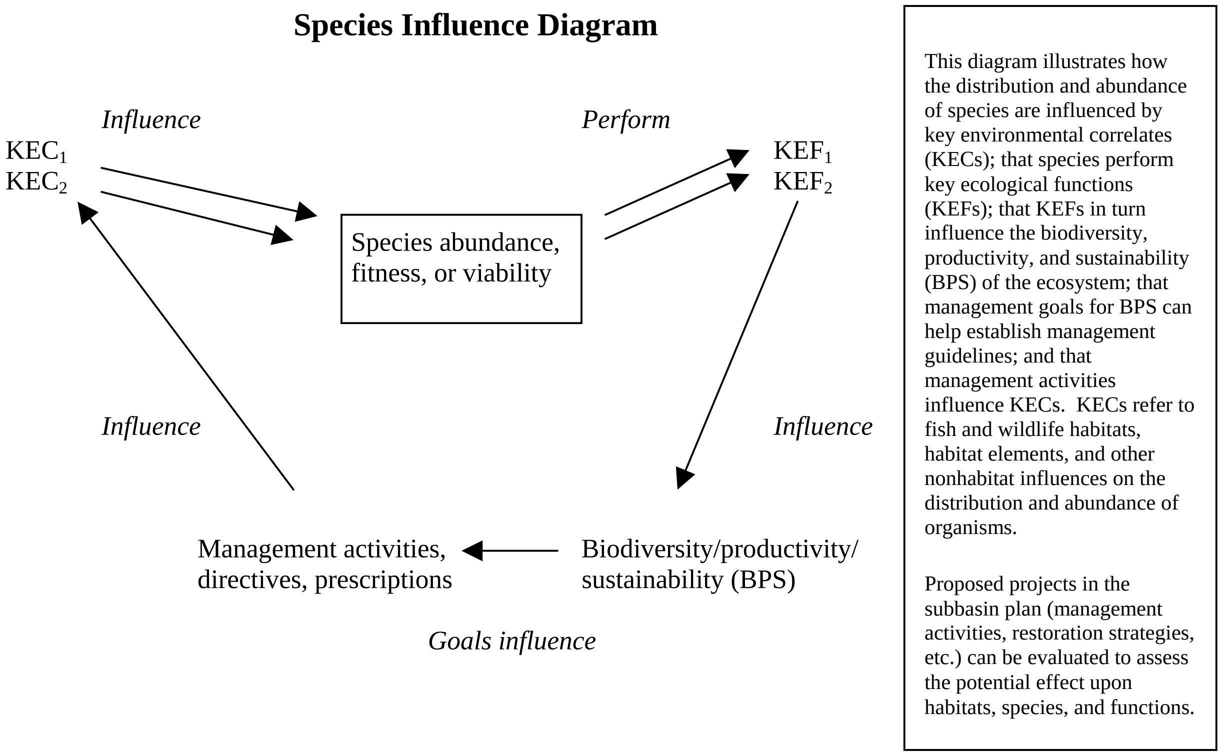

Figure 5-1 Species Influence Diagram

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)[11] 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.

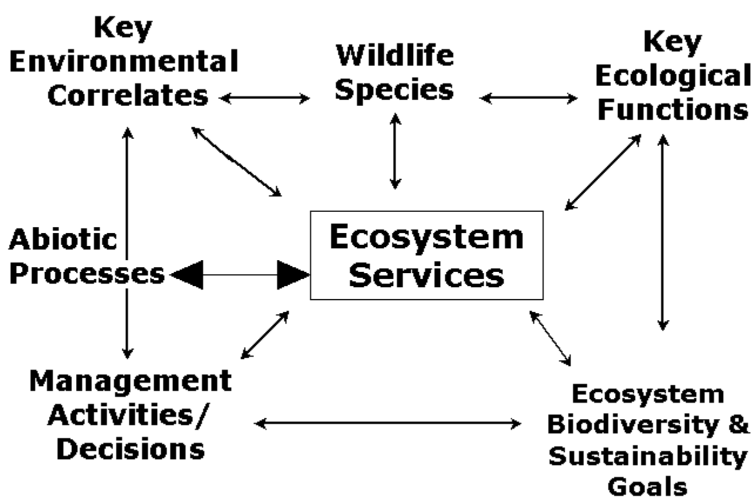

Figure 5-2 Integration of Abiotic Processes (Habitat Forming Processes)
Source: T.A. O'Neil and B. Marcot (2004).

[11] 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.