Draft

Imnaha
Subbasin Summary

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Prepared for the Northwest Power Planning Council

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DRAFT: **This document has not yet been reviewed or approved by the Northwest Power Planning Council**

Imnaha Subbasin Summary

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Introduction

The Imnaha Subbasin Summary has been developed as part of the rolling provincial review process developed by the Northwest Power Planning Council (NWPPC) in February 2000 in response to recommendations by the Independent Scientific Review Panel (ISRP) and the Columbia Basin Fish and Wildlife Authority (CBFWA).

This summary is an interim document that provides context for project proposals during the provincial reviews while a more extensive subbasin plan is developed. The Imnaha subbasin is one of 56 subbasins included within the Columbia basin (Figure 1). The process of developing a subbasin summary for the Imnaha subbasin was initiated as part of the provincial review process at a March 28, 2001 meeting in La Grande, Oregon. The short timeline for this project precluded the possibility of collecting new data. Instead this document summarizes existing documents, data not yet published in previous documents, and best professional opinion when reliable data was unavailable.

This document has been reviewed at several stages in its development by professionals familiar with the subbasin, and by state and federal agency personnel responsible for fish and wildlife in the region. A technical working group met several times in April and early May to review and contribute to the document. Without their help, this document could not have been written in such a short time.

This document forms a foundation for future assessment and planning efforts in the subbasin. It is our hope that this summary will enable those working to protect and restore fish and wildlife in the subbasin to move forward to fill data gaps and more effectively implement projects without needing to intensively research and integrate past data.

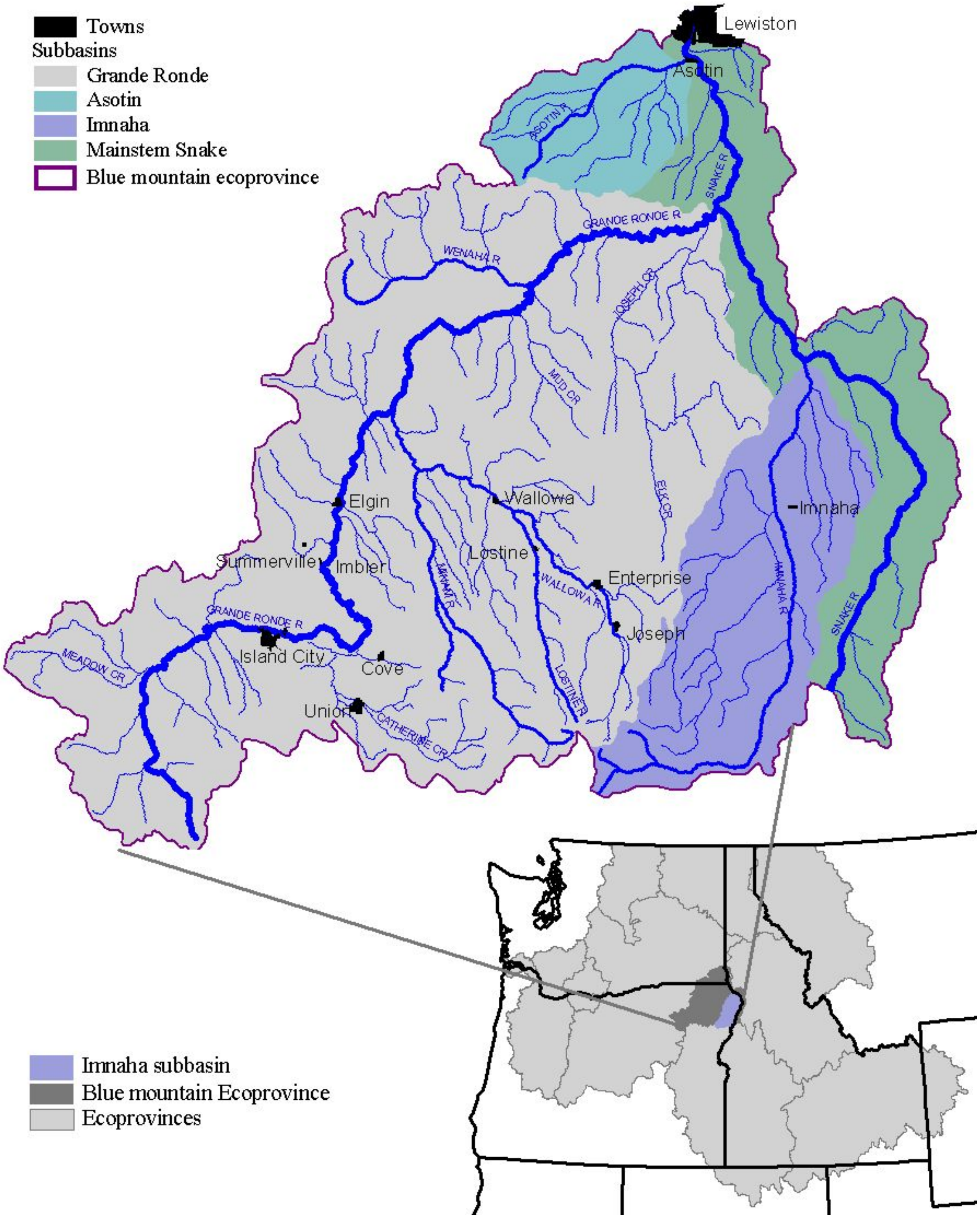

Figure 1. Location of Imnaha subbasin in the Blue Mountain Ecoprovince

Subbasin Description

General Description

Subbasin Location

The Imnaha River subbasin is located in the extreme northeast corner of Oregon and drains an area of 980 square miles (Figure 2). The mainstem is formed by the juncture of the North and South Forks at an elevation of 5,300 feet and flows in a northerly direction for approximately 63.5 miles to its confluence with the Snake River at river mile (RM) 191.7. Although several spring-fed tributaries occur in the subbasin, the Imnaha hydrology is primarily snow-melt dominated. The entire drainage is contained in EPA Reach 17060102.

The Imnaha River subbasin lies entirely within the Wallowa-Snake physiographic province and is characterized by majestic peaks, high tablelands, and deeply incised valleys. Elevations range from nearly 10,000 feet in the Wallowa Mountains to 975 feet at the river's mouth, while the plateaus, such as Lord Flat Plateau, rise to nearly 7,000 feet. Plant associations and climate vary with the topography and geology of the region.

Geology

The Wallowa granite is part of the Cretaceous/Jurassic (160-120 ma) Idaho batholith system (Vallier and Brooks 1987) (Figure 3). The weather-resistant granite now forms the high peaks of the Wallowa Mountains with nine peaks over 9,000 feet in elevation (Weis et al. 1976). Here the headwaters of many intermittent creeks begin in the U shaped valleys cut by Pleistocene glaciers (Wallowa-Whitman National Forest 1998). The tributaries merge at terminal moraines of crushed rock and fine sediment to form the Imnaha River and the Big and Little Sheep Creeks. The moraine sediment is a possible source of sediment during spring runoff.

The Imnaha River flows east out of the Wallowa Mountains towards Idaho, cutting through the fossiliferous Martin Bridge limestone and the Hurwall siltstone formations. Big and Little Sheep Creeks flow due north near the town of Joseph, Oregon through these formations. Cobbles of lime rock line the river and creek beds through this section of the subbasin (Wallowa-Whitman National Forest 1998). The Imnaha River begins to turn north as it cuts through the Clovercreek Greenstone near the Coverdale Campground. This bedrock consists of metamorphosed sedimentary and volcanic rock (Vallier 1973).

As the river turns north near the Coverdale campground, it begins cutting through many layers of lava from the Imnaha and Grande Ronde members of the Miocene (17.5-15.6 ma) Columbia River basalt group (Hooper and Swanson 1990). Deep V-shaped valleys form as the Imnaha River and its tributaries begin incising through the overlying and more durable Grande Ronde basalt that makes up the many cliff-faced columnar exposures on steep slopes. Dry, Crazyman, Summit, and Freezeout Creeks begin in this basalt to the east along Summit Ridge before entering the upper Imnaha River.

The underlying Imnaha basalt is more easily weathered and is easily recognized by the shallower slopes that often are mantled with deeper soils with fewer columnar basalt outcrops (Art Kreger, USFS Soils Scientist, personal communication February 8, 2001). Big Sheep and Little Sheep Creek valleys have a similar geology and morphology through the Columbia River basalt lava layers and join together in the Imnaha basalt in the central part of the subbasin. Trail and Camp Creeks start in Grande Ronde basalt on Zumwalt Prairie in the northwestern part of the subbasin. They empty into Sheep Creek and together these tributaries drain the western part of the subbasin into the main river channel at the town of Imnaha.

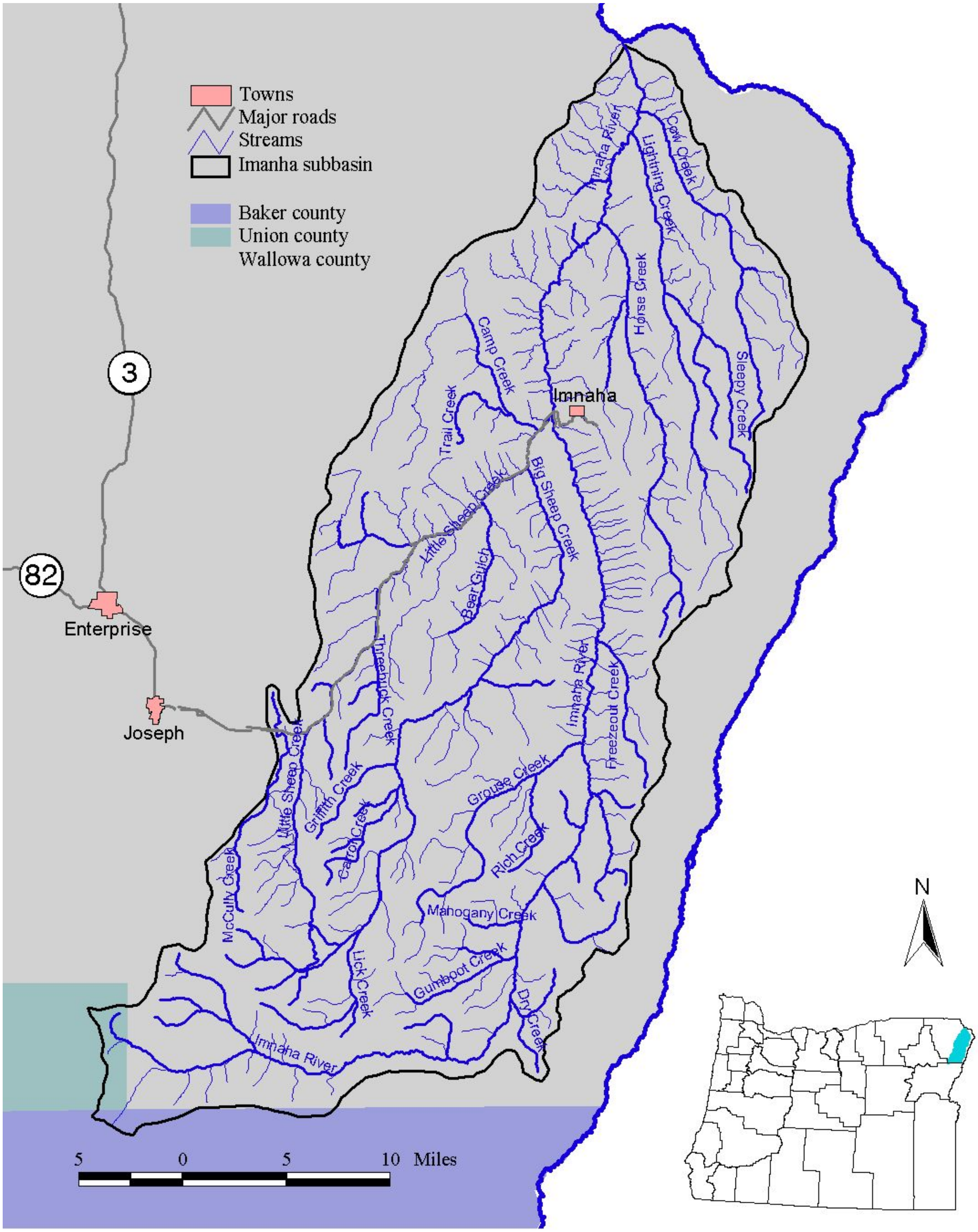

Figure 2. Location and major features of the Imnaha subbasin

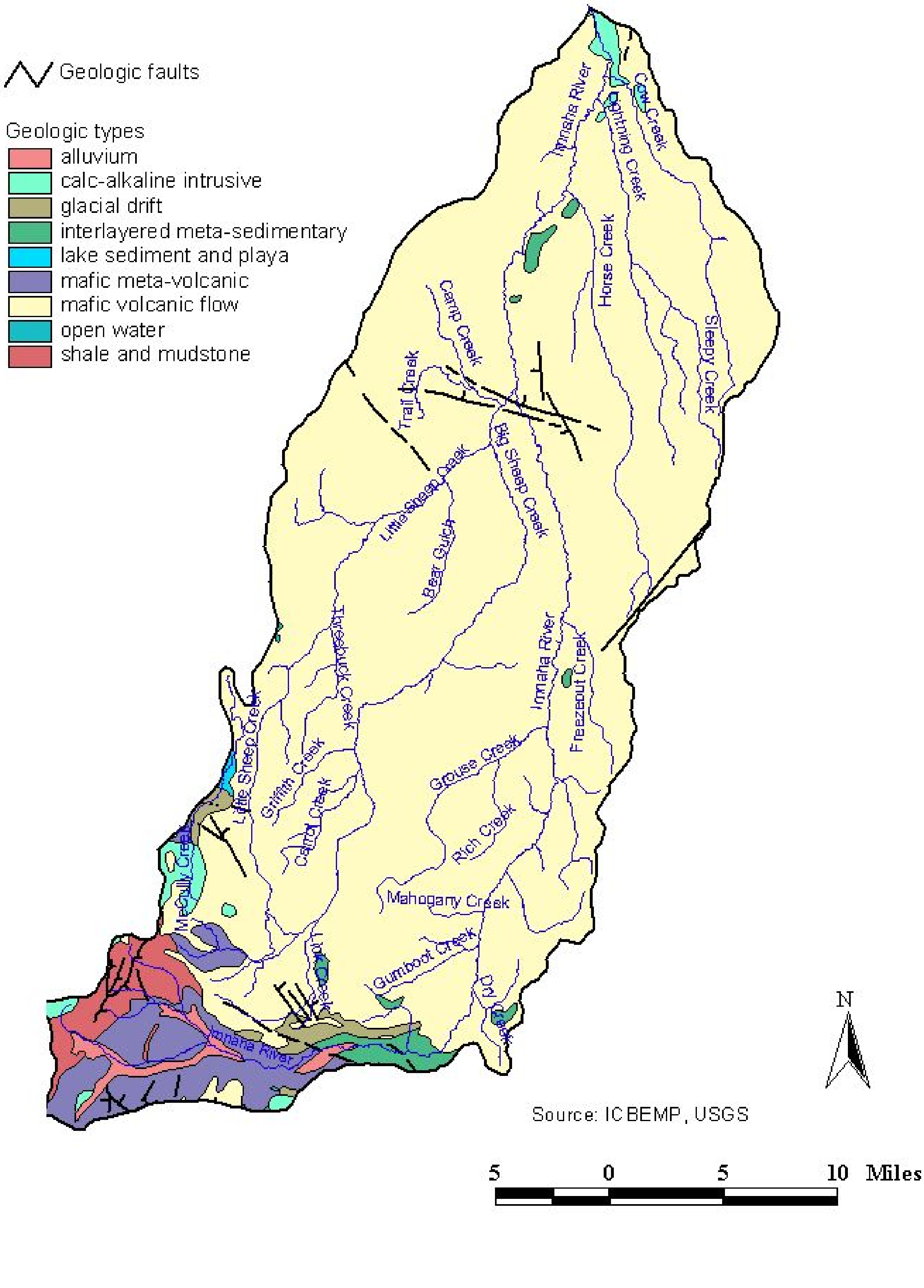

Figure 3. Geology of the Imnaha subbasin

Quaternary alluvial deposits form narrow river terraces along the banks of the Imnaha River and it's major tributaries. The alluvium contains river rock from upstream, colluvial basalt from the canyon side slopes, and Mazama ash and windblown silt mixed in with the soils that formed on the river terraces. These terraces are found in the central part of the Imnaha River and lower Big and Little Sheep creeks where the main channels have some ability to meander through the unconsolidated sediment. A recent study found that 84 percent of the riverbanks in the subbasin, including these terraces, are stable due mainly to vegetation and coarse sediment (Wallowa Whitman National Forest 1993).

North of Fence Creek down river from the town of Imnaha, the river begins to cut through older basement rock called the Wallowa Terrane (Vallier 1973). The Seven Devils Volcanic Group is a Permian-aged (290-240 ma) member of the Wallowa Terrane and is composed mostly of volcanic rock with sedimentary, and meta-sedimentary rock formations, and intrusive granites.

Horse, Cow, and Lightning creeks all start in the Grande Ronde basalt in the Lord Flat and Summit Ridge area along the eastern part of the subbasin. All three cut through the older Imnaha basalt and into the metamorphic rocks of the Wallowa terrene and experience similar river valley morphology before they enter into the lower Imnaha River's canyon. The river and creeks are heavily channeled by the crystalline Seven Devils formation.

The late Pleistocene (15 ka) Bonneville flood came down through Hell's Canyon past the mouth of the Imnaha River. This flood would have back-flooded the Imnaha River valley to some degree, but there is no sediment that can be accurately identified as having come from that one time flooding event (Mark Ferns, Geologist with DOGAMI, personal communication 2/8/01). As the Imnaha River enters into the Snake River through an alluvial fan of river-rock and sand, as well as tailings from early mining operations (Vallier 1998).

Topography

The Imnaha subbasin is made up of a broad range of elevation and topographic relief (975 – 10,000 feet and 0 to > 90% slopes) (Figure 4). The granite peaks of the Wallowa Mountains are barren rock slopes and cliffs ranging from 90% to vertical. The Martin Bridge and Hurwall formations have soils forming on 30 to 90% slopes in the higher elevations in the Imnaha drainage where the South, Middle, and North Forks converge in U shaped valleys on the eastern side of the Wallowa Mountains (Weis et al. 1976).

As the river turns north near Coverdale campground it begins cutting through the Grande Ronde basalt, forming a deep V shaped valley with the typical columnar basalt cliff faces on the steeper slopes (30 to 90%). This is often referred to as bench type topography (Tom Smith, NRCS Soils Scientist, personal communication February 8, 2001). The Imnaha river channel erodes through the Grande Ronde basalt and into the more erodible Imnaha basalt near the intersection of North Pine Road and the Imnaha River Road. The river valley begins to widen, forming the shallow valley slopes that typify the central part of the Imnaha River valley corridor. The shallow slopes range from 5 to 15% near the river and 15 to 30% near the canyon walls (Art Kreger, USFS Soils Scientist, personal communication February 8, 2001).

As the Imnaha River carved its way into the more durable metamorphic rocks of the Wallowa terrane, it became incised in near vertical canyon walls, with only enough room at the bottom for the riverbed itself and the well known Ni-Mi-Puu foot trail (Wallowa-Whitman National Forest 1998).

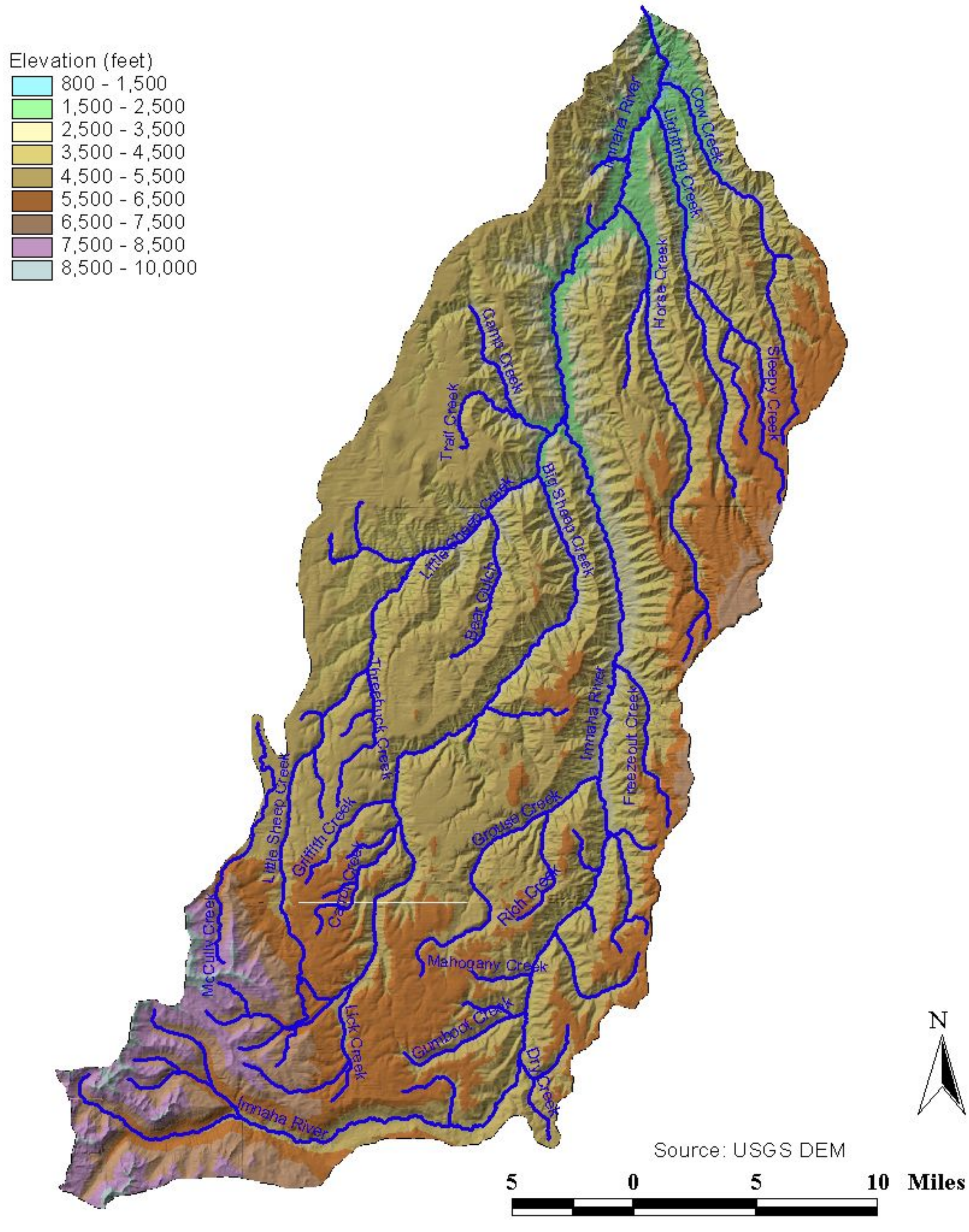

Figure 4. Topography and elevation in the Imnaha subbasin.

Climate

The climate may be described as temperate continental and dry, with the Cascade Mountains acting as a barrier to the coastal marine influence. Temperature and precipitation are greatly influenced by elevation. Mean summer temperatures below 3,000 feet are 80 degrees to 90 degrees Fahrenheit and mean winter temperatures are 30 F. Between 3,000 feet and 6,000 feet, the mean summer temperature is 61 F and the mean winter temperature is 20 F while above 6,000 feet the average temperature in July is 54 F and in January is 14 F. Precipitation below 2,000 feet averages less than 10 inches per year (mostly as rain) whereas above 8,000 feet the average is greater than 50 inches per year (mostly as snow). The variations in precipitation for the Imnaha subbasin are depicted in Figure 5. Because the data used in the figure is based upon neighboring climate station data and extrapolated to fit local topography and weather patterns, it may not be entirely accurate. Nevertheless, precipitation estimates range from nine inches per year at the confluence of the Imnaha with the Snake, to 75 inches annually at the headwaters (PRISM data).

A SNOTEL site is located in the neighboring Grande Ronde subbasin on Mt. Howard (elevation 7,910 feet). Data collected at the site includes average monthly precipitation and snow water equivalence, both of which have been summarized by the Natural Resources Conservation Service. As shown in Table 1 average monthly precipitation at the site is greatest during the months of November (5.7 inches) and March (5.7 inches), while average snow water equivalence is highest during mid-April (17.0 inches).

Table 1. Mt. Howard SNOTEL averages: monthly precipitation and snow water equivalence (SWE) (downloaded April 19, 2001. http://www.wcc.nrcs.usda.gov/wcc.html).

Measure	Date	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Total
Avg. Precip.		2.5	5.7	4.7	4.8	4.9	5.7	4.2	5.4	3.1	1.2	1.9	2.5	46.6
Avg. SWE	1st	0.3	1.2	4.3	7.2	8.4	12.3	16.6	13.7	8.1	0.0	0.0	0.0	
	15th	0.6	2.4	6.1	8.5	9.8	15.8	17.0	13.6	3.7	0.0	0.0	0.0	

While the SNOTEL data provides a general idea of precipitation patterns in the subbasin, the climate regimes in the Imnaha are highly variable and are dominated by microclimates specific to aspect, location and region. North slopes tend to be wetter and cooler than south slopes. Stream bottoms provide a cooler damper climate than hillsides or ridge tops. Areas with good air drainage remain warmer in the winter than pockets with little or no air drainage.

Soils

The Imnaha River drainage provides a unique and diverse area for soil development due to its geological setting (Figure 3). Varying rock type, topography, and climatic conditions have a large impact on soil-forming processes over the length of the Imnaha River.

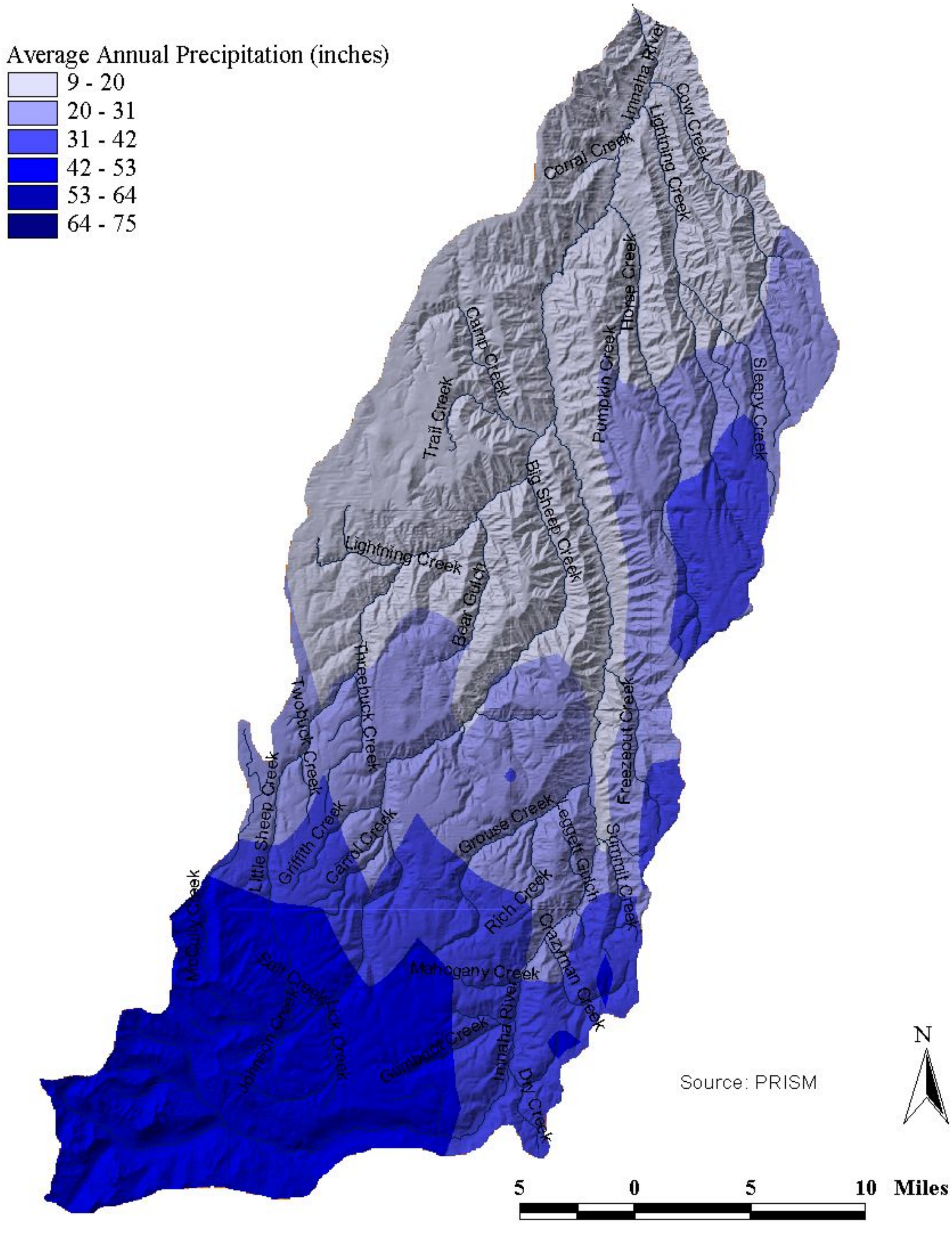

Figure 5. Precipitation patterns in the Imnaha subbasin

Soils are generally derived from the weathering of local bedrock or colluvial rock materials (called residual soils). Thus, granitic soils predominate above Indian Crossing (from weathering of the Wallowa batholith) while basaltic soils predominate below Indian Crossing. Residual soils tend to be deeper on north and east facing slopes (capable of supporting conifer stands) and shallower on south and west facing slopes (capable of supporting mainly grasslands). Forces other than weathering of bedrock, however, have also been active in the subbasin. Wind derived soils (loess) and ash deposits from the eruptions of Glacier Peak (12,000 years ago) and Mount Mazama (6,600 years ago) have added greatly to the productivity of the local soils. Ash deposits are very productive with low compactibility and high permeability and water holding capacity, but, because of their low density, are easily erodible. They are generally found on the plateaus where the densest conifer stands are located.

An accelerated process of sedimentation in the upper portion of the subbasin occurs due to the instability of the barren granite mountain peaks. Primary mechanisms of sediment delivery to aquatic habitats in these areas include debris flows and other processes of mass wasting, which are most often triggered by thunderstorms or rain on snow events (Wallowa Whitman National Forest 1993). Low gradient areas and deep pools in the upper and middle portions of the subbasin effectively filter out much of the suspended sediment load delivered to headwater tributaries and mainstem reaches (Art Kreger, USFS Soils Scientist, personal communication February 8, 2001).

The soils that formed from Imnaha basalt along the central part of the valley have much higher clay and coarse sand content than typically found in similar soils throughout the region (Art Kreger, USFS soils scientist, personal communication February 8, 2001). This makes these soils more resistant to erosion along the riverbanks in the central part of the valley. These soils along with those formed on the river terraces have volcanic ash and wind blown silt (loess) content and are well-developed fertile soils that support modern agriculture. They can be a source of sedimentation into the river during flood stages (Tom Smith, NRCS Soils Scientist, personal communication 2/8/01).

Vegetation

The Imnaha subbasin contains vast expanses of relatively undisturbed land. The uppermost part of the subbasin is above the tree line and contains alpine communities (Rose et al. 1992). Below the tree line, the watershed contains a mixture of subalpine communities that grade into forested and grassland stands at lower elevations. Forested communities are more predominant in upstream and eastern portions of the subbasin, whereas grassland communities are more predominant in downstream and western portions of the subbasin (Figure 6). In areas with more intermediate environmental conditions, such as moisture regime and soil type, a mosaic of grassland and forested stands exists.

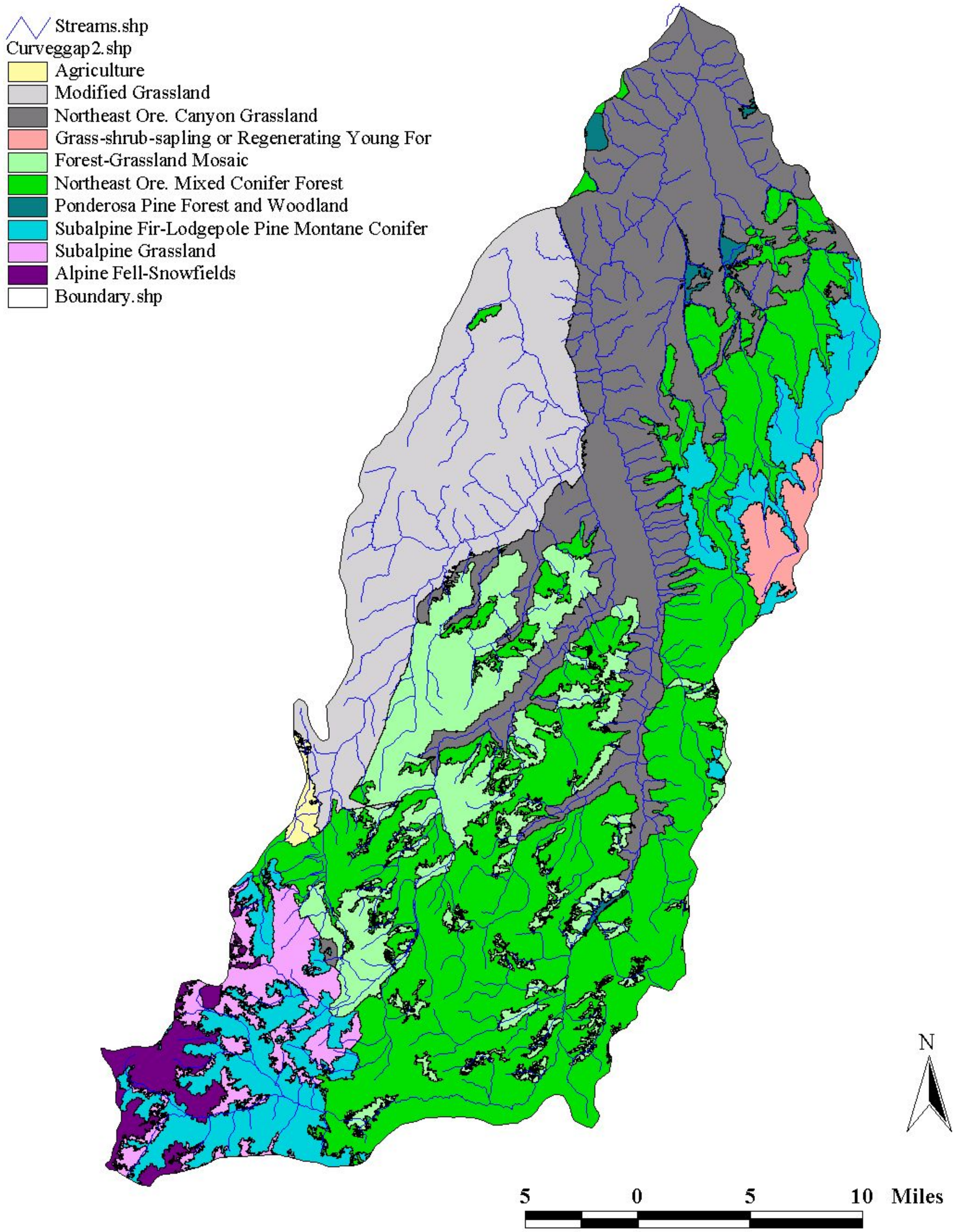

Figure 6 Current vegetation cover in the Imnaha subbasin.

Forested communities cover approximately 42% of the subbasin (Table 2). At high elevations, subalpine fir (*Abies lasiocarpa*), lodgepole pine (*Pinus contorta*), and Engelmann spruce (*Picea engelmannii*) dominate forested stands (Wallowa-Whitman National Forest 1998; Wallowa-Whitman National Forest 1995; Mays 1992). These high elevation forest communities are found in the headwater areas at the southern end of the subbasin and along parts of the eastern boundary of the subbasin (Figure 6). Grand fir (*Abies grandis*), Douglas fir (*Pseudotsuga menziesii*), and ponderosa pine (*Pinus ponderosa*) dominate low elevation forest communities (Wallowa-Whitman National Forest 1998; Wallowa-Whitman National Forest 1995; Rose et al. 1992). The low-elevation forest communities belong to the northeastern Oregon mixed conifer vegetation type and are found in the eastern and upper elevation portions of the subbasin (Figure 6).

Grasslands cover approximately 43% of the subbasin (Table 2). Most high elevation grasslands in the subbasin belong to the green fescue/Hood's sedge (*Festuca viridula/Carex hoodii*) association (Wallowa-Whitman National Forest 1998; Wallowa-Whitman National Forest 1995). These grassland communities occur in the headwaters region of the subbasin. Grasslands at lower elevations belong to a variety of bunchgrass associations with dominants including bluebunch wheatgrass (*Agropyron spicatum),* Idaho fescue (*Festuca idahoensis*), Sandberg's bluegrass (*Poa sandbergii*), and Kentucky bluegrass (*Poa pratensis*) (Wallowa-Whitman National Forest 1998; Reid et al. 1991; Nez Perce Tribe et al. 1990). These grasslands belong to the northeastern Oregon canyon grasslands vegetation type. They are found along the steep canyons of the subbasin and generally throughout the northern and western sections of the subbasin (Figure 6).

Table 2. Vegetation cover types in the Imnaha subbasin

Landscape-Level Vegetation Type	Area km^2	Area mi^2	% of Subbasin
Northeast Ore. Mixed Conifer Forest	727.9	281.0	32.7%
Northeast Ore. Canyon Grassland	521.4	201.3	23.4%
Modified Grassland	349.8	135.1	15.7%
Forest-Grassland Mosaic	258.5	99.8	11.6%
Subalpine Fir-Lodgepole Pine Montane Conifer	197.0	76.1	8.9%
Subalpine Grassland	74.6	28.8	3.4%
Alpine Fell-Snowfields	43.6	16.8	2.0%
Grass-shrub-sapling or Regenerating Young Forest	31.4	12.1	1.4%
Ponderosa Pine Forest and Woodland	12.2	4.7	0.5%
Agriculture	8.0	3.1	0.4%
TOTAL	2224.4	858.8	100.0%

Some plant communities in the subbasin cover little area but have great significance because of high species diversity, importance to wildlife, or their function in the larger ecosystem. Riparian communities in the subbasin are diverse. Riparian communities along the Imnaha range from mixed conifer stands in upper reaches to low shrub and grass stands in lower reaches (Wallowa-Whitman National Forest 1998). In the Big Sheep Creek watershed alone, 80 plant associations have been found in riparian communities (Wallowa-Whitman National Forest 1995). The Zumwalt Prairie, in the northern portion of the subbasin, is one of the best remaining examples of Palouse bunchgrass prairie in North America (The Nature Conservancy 2000). The Zumwalt prairie is significant because of its large size, 220 square miles, and its high quality (The Nature Conservancy 2000). Managed grazing and little agricultural cultivation have allowed the ecological integrity of the Zumwalt prairie to remain high (The Nature Conservancy 2000). One federally listed threatened species, MacFarlane's four o'clock (*Mirabilis macfarlanei*), and one federally proposed threatened species, Spalding's catchfly (*Silene spaldingii*), have been documented in the Imnaha subbasin (USDA Forest Service Region 6 1999). Over 50 other rare or sensitive plant species have also been documented in the Wallowa-Whitman National Forest (Appendix A).

Introduced species and fewer low-intensity fires have altered the structure and composition of some parts of the subbasin from historical conditions. Some of the successful invaders of riparian communities are diffuse knapweed (*Centaurea diffusa*), yellow star thistle *(Centaurea solstitialis*), and leafy spurge (*Euphorba esula*) (Mason et al. 1993). Grasslands throughout the subbasin have been and are currently grazed. The rangelands are generally in good condition except where cheatgrass (*Bromus tectorum*), leafy spurge, and knapweeds (*Centaurea* spp.) have invaded (Wallowa-Whitman National Forest 1998; Mason et al. 1993). Disturbed areas and roadways in the subbasin host a variety of the introduced species listed above and additional species like Canada thistle (*Cirsium arvense*) (Wallowa-Whitman National Forest 1995). Less frequent wildfires have resulted in grand fir dominating some sites that historically would have been dominated by Douglas fir and ponderosa pine (Mason et al. 1993). Forested stands on many northern slopes lack seral species such as ponderosa pine and western larch (*Larix occidentalis*) that used to be favored by historical fire regimes (Wallowa-Whitman National Forest 1998). The present fire regime has led to overstocked stands and higher proportions of late seral stands which face insect and disease problems (Wallowa-Whitman National Forest 1998).

Hydrology

Water Quantity

The Imnaha River subbasin drains an area of 980 square miles. The Imnaha mainstem extends approximately 63.5 miles upstream from its confluence with the Snake River to the North and South Forks in the Eagle Cap Wilderness (Wallowa Whittman National Forest 1994). Primary tributaries, starting at the confluence with the Snake River, include Cow Creek, Lightning Creek, Horse Creek, Big Sheep Creek, Freezeout Creek, Grouse Creek, Summit Creek, Crazyman Creek, Gumboot Creek, Dry Creek, Skookum Creek, South Fork, Middle Fork, and North Fork Imnaha River.

Current flow data in the Imnaha has been collected from the USGS-maintained gage located near the town of Imnaha (gage #13292000) since 1928 (Table 3). The discharge measured at the gaging station represents 622 square miles, 72% of the entire subbasin (Wallowa Whitman National Forest 1994). Three other gages, two of which collected only peak flow data, were historically used in the subbasin, yet are no longer in service. These include the Mahogany Creek station (gage #13291200), the Gumboot station (gage #13291000) and the Deer Creek station (gage # 13291400) (Table 3).

The river's annual mean discharge at the Imnaha gaging station is 517 cfs, based on 73 years of flow data (Figure 7). The highest mean annual discharge (≈12,500 cfs) occurred during 1996, compared to the lowest mean annual discharge of 184 cfs, which occurred during the 1977 drought year (US Geological Survey, Water Quality Report 1999). Monthly flow statistics are shown in Table 4.

Table 3. USGS gaging summary, Imnaha River Basin, Oregon

Gage No.	Gage Name	Latitude	Longitude	Area (mi^2)	Elevation (ft)	Period of Record
[1]13291400	Deer Cr nr Imnaha	45:33:00	116:47:30	2	3760	65,71-72,74-76,78-79
[1]13291200	Mahogany Cr nr Homestead	45:12:15	116:52:05	4	3740	65-72,75
13291000	Imnaha above Gumboot Cr	45:11:00	116:52:00	100	3813	45-53
13292000	Imnaha at Imnaha	45:33:45	116:50:00	622	1941	29-98

[1]/ PEAK FLOWS ONLY

Table 4. Average monthly flows in the Imnaha River at the town of Imnaha (1928-2000)

Flow **(cfs)**	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept
Mean	157	185	200	213	330	417	942	1575	1336	569	198	146

Flood frequency analysis, based on 73 years of data from the Imnaha gage is shown in Table 5. The Imnaha River reached a record high discharge of 20,200 cfs during a rain-on-snow flood event on January 1, 1997 (U. S. Geological Survey). The event triggered landslides, destroyed a house (Tom Smith, NRCS Soils Scientist, personal communication February 8, 2001), and significantly modified stream channel morphology, specifically mainstem tributaries, through mass movements of bedload material (USDA Forest Service 1998). The record low was 25 cfs on November 22-23 in 1931. Flow duration curves, as they relate to important salmonid life stages, are presented in Appendix B.

Table 5. Annual flood flow frequency summary for two gauges in the Imnaha subbasin.

Exceedance Probability (%)	Return Period (yrs)	Gage #13292000
0.99	1	974
0.50	2	2,607
0.20	5	4,284
0.10	10	5,739
0.05	20	7,435
0.02	50	10,145
0.01	100	12,625

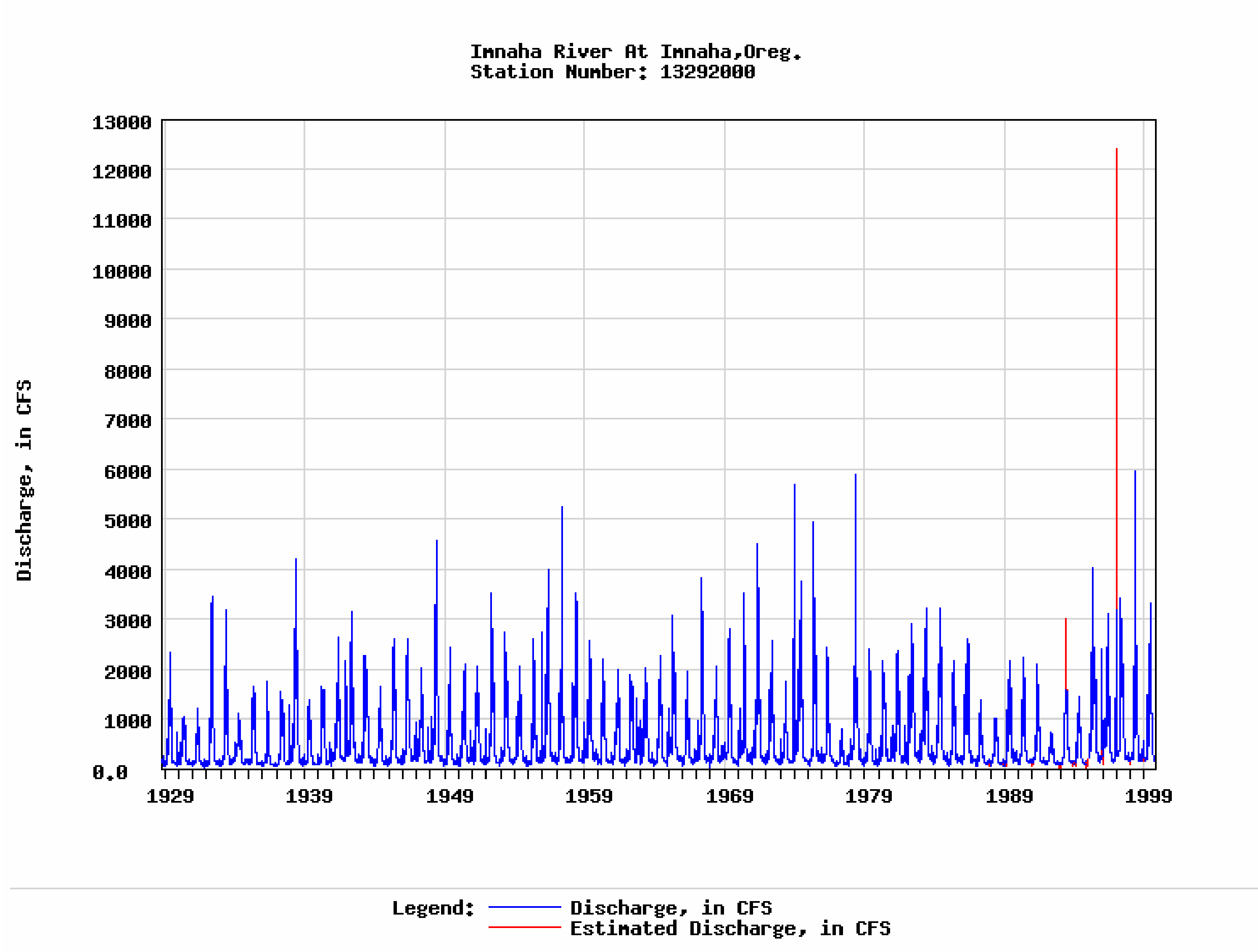

Figure 7. Average annual flows in the Imnaha subbasin (Imnaha gage #13292000) (USGS data)

Diversions, Impoundments, and Irrigation Projects

The Imnaha subbasin has one large diversion and various smaller irrigation projects. There are no known water storage structures large enough to require inspection by the county water master because of their potential threat to people or property (S. Hattan, OWRD, personal communication February 2, 2001).

Water diversions were built in the subbasin starting in the early 1900s (Wallowa County and Nez Perce Tribe 1993). Early diversions enabled people to irrigate and more successfully farm land along streams and in the subbasin's valleys (Wallowa County and Nez Perce Tribe 1993). Big Sheep Creek, Little Sheep Creek, Imnaha River, and their tributaries all had water diverted from them for agriculture (Wallowa County and Nez Perce Tribe 1993). Many of the smaller water diversion projects in the subbasin were abandoned during the World War II era, as people left to join the war effort and industrialized agriculture replaced the reliance on canal systems (Wallowa County and Nez Perce Tribe 1993). Current water withdrawals are used primarily for livestock and irrigation and are regulated by the county water master (Wallowa-Whitman National Forest 1998).

The Wallowa Valley Improvement Canal is the only major irrigation diversion in the subbasin (Nez Perce Tribe et al. 1990). The project was started in the early 1900s. By the time the project was completed, a canal was built from Big Sheep Creek in the Imnaha subbasin to Prairie Creek in the Wallowa Valley (Wallowa County and Nez Perce Tribe 1993). Downstream of the Big Sheep Creek forks, water is diverted from Big Sheep Creek and sent via a canal to Little Sheep Creek (Nez Perce Tribe et al. 1990). A diversion dam in Little Sheep Creek leads to a second canal that transports the water to the Wallowa Valley where it is used for irrigation (Nez Perce Tribe et al. 1990). Along the course of the canal, water from Big Sheep Creek, Salt Creek, Little Sheep Creek, Redmont Creek, Cabin Creek, Canal Creek and Ferguson Creek is diverted (USDA Forest Service 2000a). Most of the canal supports populations of resident bull and rainbow trout.

In 1983, three small hydroelectric production facilities, Upper Little Sheep Creek, Canal Creek, and Ferguson Ridge were constructed along the Wallowa Valley Improvement Canal in the Sheep Creek subwatershed (USDA Forest Service 2000a; Mason et al. 1993). A separate canal, known locally as the “Power Canal”, was constructed above the Wallowa Valley Improvement Canal in an effort to obtain the necessary head required for electricity generation. Dropping diverted water rapidly through a penstock to the powerhouse, and then returning flows to the canal generated electricity. The facilities and canal, which were operated and maintained by Joseph Hydro Associates, were eventually removed in 1997 (USDA Forest Service 2000a). During its removal, approximately three miles of ditch was de-watered, necessitating a bull trout salvage operation by the USFS and ODFW during which an estimated 600 fish were saved (USDA Forest Service 2000a).

Water Rights

In 1877, a decree was filed for 23.16 cfs of water to be diverted from McCully Creek between April 1 – July 31 for irrigation, plus an undefined amount for stock and domestic use, which was estimated to be about 0.09 cfs (Bliss 2001). As shown in Table 6, additional rights were filed over the years for the annual diversion of McCully Creek waters into the Wallowa subbasin for use during different times of the year. The decree of 1905 is considered to be the first water right filed associated with the Wallowa Valley Improvement Canal, which at the time was called Sheep Creek Ditch, granting an undefined contribution of as much as 162.74 cfs from McCully Creek, Little Sheep Creek, and all tributaries crossed by the ditch up to but not including Big Sheep Creek during the months April – July (Bliss 2001; NPT et al. 1990). A subsequent filing for 33.65 cfs from Big Sheep Creek and again all springs or tributaries along the canal (not including Little Sheep Creek or McCully Creek) was added to the system in 1919 (Nez Perce Tribe et al. 1990).. Permits were granted in following years that provided for a total right of 114.57 cfs (based on 1877, 1941 & 1976 rights) of water to be diverted from McCully Creek each year during April 1 – July 31 for irrigation. Similarly, annual irrigation rights for 57.79 cfs (based on 1877, 1941 & 1976 rights) of McCully Creek water were granted for use during August 1 – October 15. Between 0.85 cfs and 2.55 cfs of water is used for stock and domestic use during October 16 – March 31, with about 0.18 – 0.27 cfs assigned to McCully Creek diversion #2 (Table 6) (Bliss 2001). The net result of water rights appropriated on McCully Creek is that all water from the creek is diverted all year.

Table 6. Summary of rights to divert McCully Creek waters into the Wallowa subbasin (Bliss 2001)

Diversion Rights April 1 – July 31	Diversion Rights August 1 – October 15	Diversion Rights October 16 – March 31
Decree (1877 rights[1/]): 23.16 cfs primary rights from McCully Creek for irrigation, plus an undefined amount for stock and domestic use estimated to be about 0.09 cfs	Decree (1877 rights): 11.58 cfs from McCully Creek for irrigation, plus an undefined amount for stock and domestic use estimated to be about 0.09 cfs	Decree (1877 rights): An undefined amount for stock and domestic use estimated to be about 0.09 cfs plus an undefined flow needed to keep ditches from freezing during the winter. Out of stream domestic use is estimate to be negligible during non-irrigation season. Total use is estimated to be less than 0.18 to 0.27 cfs, 2 to 3 times the estimated minimum.
Decree (1905[2/] & 1919[2/] rights): Undefined McCully Creek contribution to 162.74 cfs primary rights diverted into Sheep Creek Ditch, including undefined part of 129.09 cfs for stock and domestic use estimated to be about 0.76 cfs. Supplemental 1919 right does not include McCully Creek.	Decree (1905 & 1919 rights): Undefined McCully Creek contribution to 81.35 cfs diverted into Sheep Creek Ditch, including undefined part of 64.54 cfs for stock and domestic use estimated to be about 0.76 cfs. Supplemental 1919 right does not include McCully Creek.	Decree (1905 & 1919 rights): An undefined amount for stock and domestic use estimated to be about 0.76 cfs plus an undefined flow needed to keep ditches from freezing during the winter. Out of stream domestic use is estimate to be negligible during non-irrigation season. Total use is estimate to be less than 1.52 to 2.28 cfs, 2 to 3 times the estimated minimum. Current ditch management limits this to water intercepted north of Ferguson Creek in the winter.
Permits (1941 & 1976[1/] rights): 91.41 cfs from McCully Creek, including 2.28 cfs primary rights and 89.13 cfs supplemental rights.	Permits (1941 & 1976 rights): 46.21 cfs from McCully Creek, including 1.14 cfs primary rights and 45.05 cfs supplemental rights.	Permits: No diversion allowed.
Permits (1912[2/], 1913[2/], 1917[2/] & 1921[1/] rights): Undefined McCully Creek contribution to 22.21 cfs diverted into Sheep Creek Ditch, including 2.29 cfs primary rights and 19.92 supplemental rights.	Permits (1912, 1913, 1917 & 1921 rights): Undefined McCully Creek contribution to 22.21 cfs diverted into Sheep Creek Ditch, including 2.29 cfs primary rights and 19.92 supplemental rights.	Permits: No diversion allowed.
Total Right: 114.57 cfs from 1877, 1941 & 1976 rights, plus an estimate of 0.85 cfs for stock and domestic use from 1877 and 1905 rights, plus undefined 1905 and 1919 diversion rights for irrigation.	Total Right: 57.79 cfs from 1877, 1941 & 1976 rights, plus an estimate of 0.85 cfs for stock and domestic use from 1877 and 1905 rights, plus undefined 1905 and 1919 diversion rights for irrigation.	Total Right: Estimated to be between 0.85 cfs and 2.55 cfs for stock and domestic use, with about 0.18 to 0.27 cfs assigned to McCully Creek diversion #1 and 1.52 to 2.28 cfs assigned to McCully Creek diversion #2.

[1/] 1877, 1921 & 1976 rights are believed to be diverted from the stream diverted at McCully Creek diversion #1, somewhere along the stream as it flows through the Prairie Creek drainage.

[2/] 1905, 1912, 1913, 1917, 1919 & 1941 rights are diverted from McCully Creek diversion #2 on Sheep Creek Ditch (Wallowa Valley Improvement District canal).

Tim Bliss of the Wallowa-Whitman National Forest has conducted an exhaustive evaluation of water rights, water use, and associated allocation of McCully Creek water in an attempt to define watershed boundaries occurring within the National Forest. Findings from the assessment are listed below and in Appendix C.

(1) The Forest has some stream survey data for McCully Creek above Point A. Terry Carlson, Wallowa Mountains Zone Hydrologist, has estimated Q bankfull to be between 110 cfs and 120 cfs, with a range of 91 cfs to 170 cfs, depending on the variables and equations used. This estimate of bankfull flow closely matches water rights of about 114 cfs for the April 1 to July 31 period which are diverted at Point A (refer to Table 6).

(2) Oregon Water Resources Department has not developed Water Availability Tables for McCully Creek. Oregon Department of Fish and Wildlife has not filed for an instream water right on McCully Creek.

(3) Domestic use is mentioned on the 4 1877 water rights and the 1905 right, but the number of households is not. The watermaster indicates OWRD assumes one household per property. There are 4 properties on the 1877 rights. If one assumes one property per 160 acres on the 1905 right, there would be 32 properties. Total estimates households would be 36. If one uses the current state allowance of 0.01 cfs per household for domestic use expanded, which includes a ½ acre of lawn & garden irrigation, this right would be only 0.36 cfs.

(4) Stock use is mentioned on 5 water rights, but the number of livestock is not. If one assumes each of the 36 properties (identified for the estimate for the domestic rights) has 139 cows, there would be 5,000 cows requiring a flow of 0.50 cfs, plus enough water to prevent freezing of the streams and ditches in the winter.

(5) Information in Table 6 suggests the stream is fully to over-appropriated during the irrigation season. This means landowners have the right to divert all flow for irrigation use from April 1 through October 15.

(6) It is unclear if the stream is fully appropriated during the non-irrigation season. Answers to some questions are needed.

- Should the upper diversion be treated as a diversion, or as the natural flow of McCully Creek into Prairie Creek? (Locals treat the upper diversion as a natural stream).
- What is the mean monthly flow of McCully Creek at the upper and lower diversions? Is there any data? (There may be some data for Sheep Creek Ditch
- How much water is diverted by the upper and lower McCully Creek diversions in comparison with the estimate of 2.0 cfs needed for domestic/stock use?
- Should any unappropriated flow during any month continue to flow into Prairie Creek, or be diverted back into the old McCully Creek channel below Sheep Creek Ditch?

(7) Bill Knox, ODFW fish biologist comments that the changing of the McCully Creek boundary might complicate efforts to return flow below the two out-of-basin diversions.

(8) Rick Lusk, Baker County Watermaster (former Union/Wallowa County Watermaster) comments that OWRD still treats McCully Creek as part of the Imnaha subbasin; it is part of the Imnaha Decree. Changing the boundary might confuse water rights issues.

(9) Coby Menton, NRCS comments that Prairie Creek is on the 303d List. NRCS is studying water delivery from Sheep Creek Ditch (Wallowa Valley Improvement District Canal). A gage was installed on the canal in June 2000 just above the blocked McCully Creek turnout (McCully Creek diversion #2). The low flow was 1.4 cfs on October 17. There is no gage on the upper diversion (McCully Creek diversion #1), which should be diverting more water. The Wallowa Valley Canal is providing only about 10% of augmented flow of Prairie Creek; the rest of the water is coming from Wallowa Lake/Wallowa River.

(10) Ralph Browning, Fish Program Manager, Wallowa-Whitman NF comments that the USFWS would like to reconnect the bull trout population in upper McCully Creek with other populations in the Imnaha River subbasin. NMFS would like to reconnect the steelhead population in lower McCully Creek with former habitat in upper McCully Creek. The consultation watershed boundary between the Wallowa and Imnaha subbasins includes McCully Creek as part of the Imnaha subbasin. It would appear best to leave McCully Creek in the Imnaha subbasin, even though the watershed delineation protocol suggests otherwise.

There are 59 water rights on the Imnaha River mainstem for a total of 37.33 cfs. Out of this total, the Lower Snake River Compensation Program (LSRCP) chinook hatchery facility will use 15 cfs in a non-consumptive manner. There are an additional 69 water rights on tributaries (excluding the Big Sheep system) for a total of 24.98 cfs. There are 18 water rights on Big Sheep Creek for a total of 6.36 cfs and 5 additional water rights on tributaries (excluding Little Sheep Creek) for a total of 1.65 cfs (this does not include the Wallowa Valley withdrawals). There are four additional water rights filed on springs for 0.29 cfs. In Little Sheep Creek there are 13 claims for 22.47 cfs, 19.6 cfs of which will be used by the LSRCP steelhead facility in a non-consumptive manner. There are an additional 11 claims on tributaries for 26.55 cfs and eight claims on springs for 0.41 cfs. This equals a combined water right of 279.61 cfs (including the Wallowa Valley diversions), 34.6 of which is non-consumptive. There are an additional 36 recent filings that have not yet been approved. In 1955 the legal means to reserve instream flows was created with the passage of the “minimum stream flow law” (ORS536.300-310). This law recognizes water requirements of fish and wildlife as a beneficial use of water and establishes a “public water right” to minimum stream flows to be designated by the state Water Resources Board (Nelson et al 1978 as cited in ODFW et al. 1990c). In 1961 minimum flows were established in the Imnaha River at the USGS gage for 85 cfs. Prior to 1987, established minimum flows were not, technically speaking, water rights and could be revised, suspended, or withdrawn by administrative rule. Since 1987 these minimum flows could be converted to legal water rights with a priority date the same as the date the flows were established. Minimum flows were established for Big Sheep and Little Sheep Creeks in 1993 (Table 7), but they are ungaged. All minimum flows were converted to instream water rights on February 1, 1989.

Table 7. Minimum instream water rights (cfs) at the confluence of Big Sheep Creek and the Imnaha River (reproduced from Wallowa County and NPT 1993)

	Monthly Flows (cfs)											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
BIG SHEEP	25	25	30	45	45	37	55	55	55	37	37	25
Little Sheep	10	10	13	20	20	13	13	10	10	10	10	10

Streamflow Restoration Priorities

ODFW and OWRD have established priorities for restoration of streamflow from consumptive users, as part of the Oregon Plan for Salmon and Watersheds (Measure IV.A.8). ODFW has identified the "need" for streamflow restoration through ranking of biological and physical factors, water use patterns and the extent to which water is a primary limiting factor (Figure 8). OWRD ranked the opportunities and likelihood for achieving meaningful streamflow restoration. Rankings were performed for subwatersheds at approximately the fifth field hydrologic units (HUCs). OWRD Watermasters will incorporate the priorities into their fieldwork activities as a means to implement flow restoration measures. The "needs" priorities will be used by the Oregon Watershed Enhancement Board as one criterion in determining funding priorities for enhancement and restoration projects. Watershed councils and other entities may also use the needs priorities as one piece of information determining high priority restoration projects.

Barriers

Diversions for the Wallowa Valley Improvement Canal influence Big Sheep Creek, Little Sheep Creek, Salt, Cabin, Redmont, Canal, and Ferguson Creeks (Nez Perce Tribe et al. 1990). Along Big Sheep Creek, fish habitat quality is reduced or eliminated due to low flows below the Wallowa Valley Improvement Canal diversion dam and diversion dams that are migration barriers (Nez Perce Tribe et al. 1990). Similar impacts on habitat from the canal diversion dam occur along Little Sheep Creek (Nez Perce Tribe et al. 1990). The impacts on fish habitat from reduced flows on these streams were identified as needing further study (Wallowa County and Nez Perce Tribe 1993). Except for one, all diversions in the subbasin covered by the Mitchell Act have NMFS approved fish screens (B. Smith, ODFW, personal communication February 5, 2001). Diversions on non-anadromous streams are not covered by the Mitchell Act and therefore lack screens. Some diversions without screens occur on Little Sheep Creek and McCully Creek (B. Smith, ODFW, personal communication February 5, 2001). None of the diversions that are a part of the Wallowa Valley Improvement Canal contain fish screens.

Information on road culverts acting as fish barriers are unknown for private lands, but three have been identified on National Forest land in tributaries of the Imnaha (Wallowa-Whitman National Forest 1998). These include:

- Road 4240-250 in the headwaters of Horse Creek
- Road 3955 in Mahogany Creek
- Road 3900-420 in Gumboot Creek

Natural barriers (not related to irrigation projects or impoundments), such as inadequate streamflow, excessive gradient, or elevated stream temperatures may prohibit or prolong adult migration in certain areas of the subbasin at certain times of the year. Although the high gradient reach above the Blue Hole may limit passage of adult spring chinook during some years (Ashe et al. 2000), a more consistent migration impediment is excessive stream temperatures (NPT 1999; Huntington 1993). Elevated summer water temperatures in the Imnaha River below Freezeout Creek may limit the upstream migration period for spring chinook, thereby effectively preventing use of spawning and rearing habitat in that section of river (Carmichael 1993 cited in Huntington 1993).

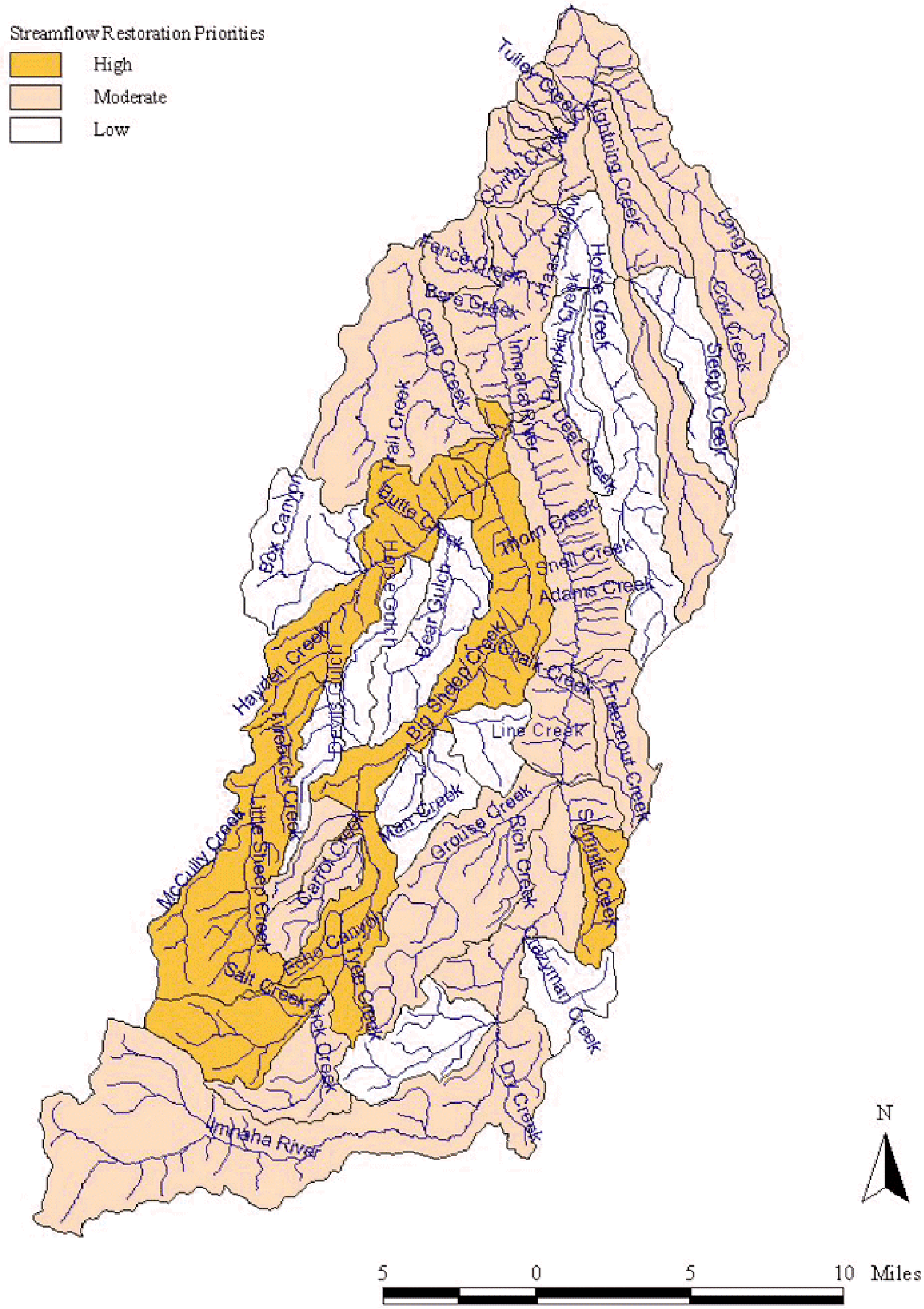

Figure 8. Streamflow restoration priorities in the Imnaha subbasin (ODFW, 2001

Water Quality

The entire Imnaha River channel and some stream reaches in key tributaries are listed on the 303(d) list for summer temperatures exceeding the desired 50^0F for adult bull trout or 64^0F for salmonid rearing (Figure 9) (ODEQ 1996). Big Sheep Creek is also listed for habitat modification from the confluence with the Imnaha River upstream to Owl Creek (ODEQ 1996). Table 8 provides stream reaches within the Imnaha River subbasin that qualify for 303(d) listing, whileTable 9 provides information about how the listings relate to State standards.

Table 8. Imnaha River watershed 303(d) listings (ODEQ 1996)

Watershed	Reach	Parameter	Criteria	Season
Big Sheep Creek	Mouth to Owl Creek	Habitat Modification		
		Temperature	Rearing 64°F (17.8°C)	Summer
Big Sheep Creek	Owl Creek to Wilderness Boundary	Temperature	Oregon Bull Trout 50°F (10°C)	Summer
Grouse Creek	Mouth to headwaters	Temperature	Rearing 64°F (17.8°C)	Summer
Gumboot Creek	Mouth to Headwaters	Temperature	Rearing 64°F (17.8°C)	Summer
Imnaha River	Mouth to Summit Creek	Temperature	Rearing 64°F (17.8°C)	Summer
Imnaha River	Summit Creek to North/South Fork Confluence	Temperature	Oregon Bull Trout 50°F (10°C)	Summer
Lick Creek	Mouth to Mud Springs Cr.	Temperature	Oregon Bull Trout 50°F (10°C)	Summer
Lightning Creek	Mouth to Headwaters	Temperature	Rearing 64°F (17.8°C)	Summer

Lower Imnaha subbasin

The lower Imnaha River (mouth to Summit Creek) is listed on the Oregon Department of Environmental Quality's 303d list for summer temperatures. The seven-day moving average of daily maximum temperatures recorded in 1995 below the town of Imnaha was 69.1°F, with 21 days exceeding temperature standards of 64°F (ODEQ Data). The only 303d-listed tributaries occurring in the lower Imnaha subbasin are Lightning Creek and Grouse Creek. Temperatures recorded in 1993 (65.5°F) at a USFS monitoring site on Lightning Creek exceeded state standards, however zone fisheries biologists and hydrologists contend the current temperature regime to be within the natural potential, given the low elevation grassland ecosystem, the size of the drainage basin, and limited amount of riparian modifications (Wallowa-Whitman National Forest 1998). In 1992 the seven-day moving average of daily maximum temperatures recorded on Grouse Creek was 65.3°F (ODEQ data).

Big Sheep Creek

Water temperatures in Big Sheep Creek, from its confluence with the Imnaha up to the wilderness boundary, exceeded State standards on numerous occasions (ODEQ Data). From its mouth to Owl Creek, the seven-day moving average of daily maximum temperatures was 69.6°F in 1992 and 64.4°F in 1993. In addition, the State bull trout temperature requirement of 50°F has been regularly exceeded in the upper portion of Big Sheep Creek (from Owl Creek to the wilderness boundary). Stream temperatures recorded at USFS monitoring stations in the Big Sheep Creek subwatershed are shown in Table 10. Zone fisheries biologists and hydrologists suggest that Big Sheep Creek, above the Wallowa Valley Irrigation Canal, be removed from the 303d list, as water temperatures in this area may currently be within their natural potential (Wallowa-Whitman National Forest 1998). The State has currently not responded to this concern.

Table 9. Grande Ronde standards, applicable to the Imnaha, used in 303(d) (OAR 340-041-0722) listings (Oregon Administrative Rules Composition 1998, pp 5-298 – 5-302)

Factor	**Desired Habitat Condition for Salmon**	**[1]Oregon State water quality standards for the Grande Ronde River Basin**
Temperature	[2/]40-57° F for spawning and incubation, 38-68° F for adult migration, and 39-68° F is the optimum range for freshwater rearing (juvenile fish prefer 54-57° F)	No measurable surface water temperature increase is allowed in: • A basin for which salmonid rearing is a designated beneficial use, and in which surface water temperatures exceed 64°F (17.8°C) • In waters and periods of the year determined by ODEQ to support native salmonid spawning, egg incubation, and fry emergence from the egg and from the gravels in a basin which exceeds 55.0°F (12.8°C) • In waters determined by ODEQ to support or to be necessary to maintain the viability of native Oregon bull trout, when surface water temperatures exceed 50.0°F (10.0°C). • In waters determined by ODEQ to be ecologically significant cold-water refugia • In stream segments containing T&E species if the increase would impair the biological integrity of the T&E population • In Oregon waters when the d.o. levels are w/in 0.5 mg/l or 10% saturation of the water column or intergravel DO criterion for a given stream reach or subbasin
Dissolved Oxygen (DO)	[2/]Adult migration=greater than 7.0 mg/L; Spawning and incubation=greater than 8.0 mg/L; Rearing=greater than 7.0 mg/L	≥11.0 mg/l from spawning until fry emergence, or ≥9.0 mg/l if spatial median = ≥8.0 mg/l. Where conditions of barometric pressure, altitude, and temperature preclude attainment of the 11.0 mg/l or 9.0 mg/l criteria, d.o. levels shall be ≥ 95% saturation
Chlorophyll a	Use State standard	Concentration greater than 0.015 mg/L is an indicator of nuisance algal growth.
Streamflow	Streamflow should provide access to adequate spawning gravel, and stream depth should be no less than 18 cm. [2/]Spawning velocity of 1 to 2.25 f/s, maximum adult migration velocity of 8 f/s	No standard for streamflow, however, there are instream water rights on many streams
Turbidity	[2/]Turbidity should be limited and not sustained	No more than a 10% cumulative increase in natural stream turbidities is allowed.
Bacteria Standards (Fecal coliform)	Use State standard	• 30-day log mean of 126 *E. coli* organisms/100 ml, based on a minimum of 5 samples • No single sample shall exceed 406 *E. coli* organisms per 100 ml • Raw sewage (untreated) discharge is prohibited Runoff contaminated with domesticated animal wastes shall be minimized and treated to the maximum extent possible
Total dissolved solids (TDS)	Not established	200 mg/l
pH	Use state standard	6.5 – 9.0
Pesticides	Pesticide dependent – use State standard	Current State and Federal regulations

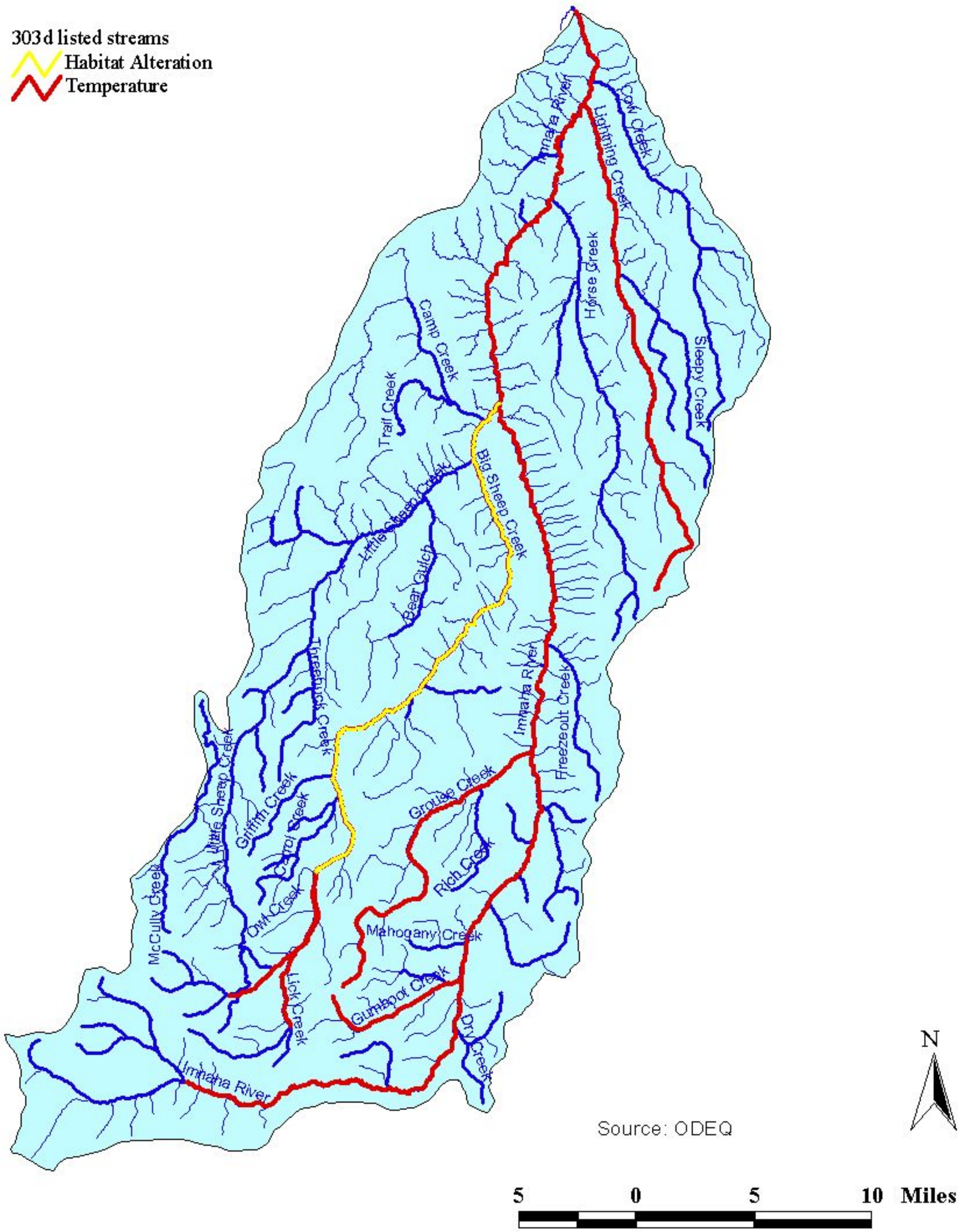

Figure 9. 303d listed streams of the Imnaha subbasin.

Upper Imnaha subbasin

The mainstem Imnaha, from Summit Creek to the North/South Fork confluence, violates State temperature standards for bull trout and is on the Oregon Department of Environmental Quality's 303d list. The seven-day moving average of daily maximum temperatures measured in 1993 at Indian Crossing and Nine Point Creek were 56.2°F and 61.5°F (respectively), exceeding the bull trout temperature standard of 50°F (Wallowa-Whitman National Forest 1998). Similarly, the seven-day moving average of daily maximum temperatures measured by the Oregon Department of Environmental Quality in 1995 at Coverdale Camp ground was 57.2°F (ODEQ data). Zone fisheries biologists and hydrologists contend that the inclusion of the upper mainstem Imnaha (from Ollokot Campground to the North/South Fork confluence) on the 303d list should be reevaluated given the size of the river and limited riparian modification (Wallowa-Whitman National Forest 1998). The State of Oregon has not addressed these concerns.

The only 303d-listed tributary in the upper Imnaha subbasin is Gumboot Creek. The moving seven-day maximum stream temperature in Gumboot Creek was 66°F, measured in 1992.

Table 10. Seven-day moving maximum stream temperatures (°F) recorded at USFS monitoring stations in the Big Sheep Creek subwatershed (from USDA Forest Service et al. 1998b)

Site	Year	May	Jun	Jul	Aug	Sep	Oct
Big Sheep @ Echo Canyon	1989	36	38	40	42	45	46
	1990	49	59	66	68	63	57
	1991	47	52	65	67	62	56
	1992	50	62	N/A	N/A	N/A	56
	1993	51	55	60	65	61	54
	1994	48	64	71	71		50
Big Sheep @ Lick Creek	1991	56	51	65	66	61	55
	1992	N/A	67	67	68	59	50
	1993	51	54	59	64	59	52
	1994	N/A	63	70	69	61	N/A
	1995	N/A	48	54	61	59	48
	1996	N/A	N/A	64	64	60	52
Big Sheep below canal	1993	47	N/A	54	59	55	49
	1994	N/A	57	65	65	57	N/A
	1995	N/A	42	52	55	54	44
Big Sheep above canal	1996	N/A	N/A	51	51	50	46
	1997	N/A	N/A	57	55	53	48
Lick Creek @ mouth	1990	47	57	64	65	60	53
	1991	45	50	63	64	56	N/A
	1992	N/A	N/A	65	66	51	N/A
	1994	46	61	67	67	58	46
	1995	N/A	51	58	60	57	48
	1996	N/A	N/A	63	62	58	51
	1997	N/A	N/A	59	60	56	50
Little Sheep @ FS boundary	1996	N/A	N/A	59	58	57	54
Cabin above canal	1996	N/A	N/A	51	51	50	46
McCully @ USFS boundary	1996	N/A	N/A	52	51	50	46
Redmont Creek above canal	1989	45	54	56	N/A	N/A	N/A

Land Use

Approximately 75 percent of the Imnaha subbasin is under public ownership (Figure 10). The majority of the subbasin lies within the Wallowa-Whitman National Forest, with management by three Ranger Districts (Eagle Cap, Hells Canyon National Recreation Area, and Wallowa Valley). Each Ranger District maintains distinct mandated management directives, ranging from the least restrictive in the Wallowa Valley Ranger District to the most restrictive in the Eagle Cap District.

Ranching and grazing, timber harvest, transportation, mining, recreation, and agriculture are primary forms of land use considered to have potentially affected terrestrial and aquatic resources in the subbasin (Figure 11).

Ranching and Grazing

The first domestic livestock grazing known for the Imnaha were Nez Perce horses in the early 1700's (Wallowa-Whitman National Forest 1998). Estimates for the number of horses grazed are around 1,000. The Nez Perce also grazed as many as 500–650 cattle in the Imnaha following their introduction in the mid 1800's (Chalfant 1974; Womack 1996, cited in Wallowa-Whitman National Forest 1998). In the late 1800's, settlers brought in large herds of sheep and cattle, the effects of which can still be seen today around seeps, springs and some stream segments where the native fescue plant communities were removed (Ashe et al. 2000).

As in much of the western U. S., the number of cattle grazing in the Imnaha peaked in the late 19th century and has declined since (Johnson 1982, cited in Wallowa-Whitman National Forest 1998). Despite the decline, cattle grazing remains the major land use activity on private lands in the Imnaha subbasin (Beamesderfer et al. 1997). There are 29 existing grazing allotments on federal land within the Imnaha watershed (Wallowa-Whitman National Forest 1998). At least two of these allotments are not currently being used: one in the upper Imnaha in the Wallowa Mountains and another in the Hat Point area (H. Lyman, Wallowa-Whitman National Forest, personal communication, 08 February 2001). Five large allotments in the lower reach of the watershed are used fall, winter, and spring. Most of the remaining allotments are small and associated with individual residences on private land along the river corridor.

Sheep grazing, once prevalent in the Imnaha subbasin, no longer occurs. A record of decision signed in 1995 formally terminated sheep grazing in the subbasin. The primary goal of the removal of sheep from the area was to reduce potential interaction between domestic and bighorn sheep (refer to wildlife discussion below). The HCNRA was grazed through the 1996 season, at the end of which all allotments occurring in the area became vacant. The Eagle Cap Wilderness Area was grazed through the end of the 1998 season and became vacant in 1999 (D. Bryson, NPT, personal communication, May, 2001).

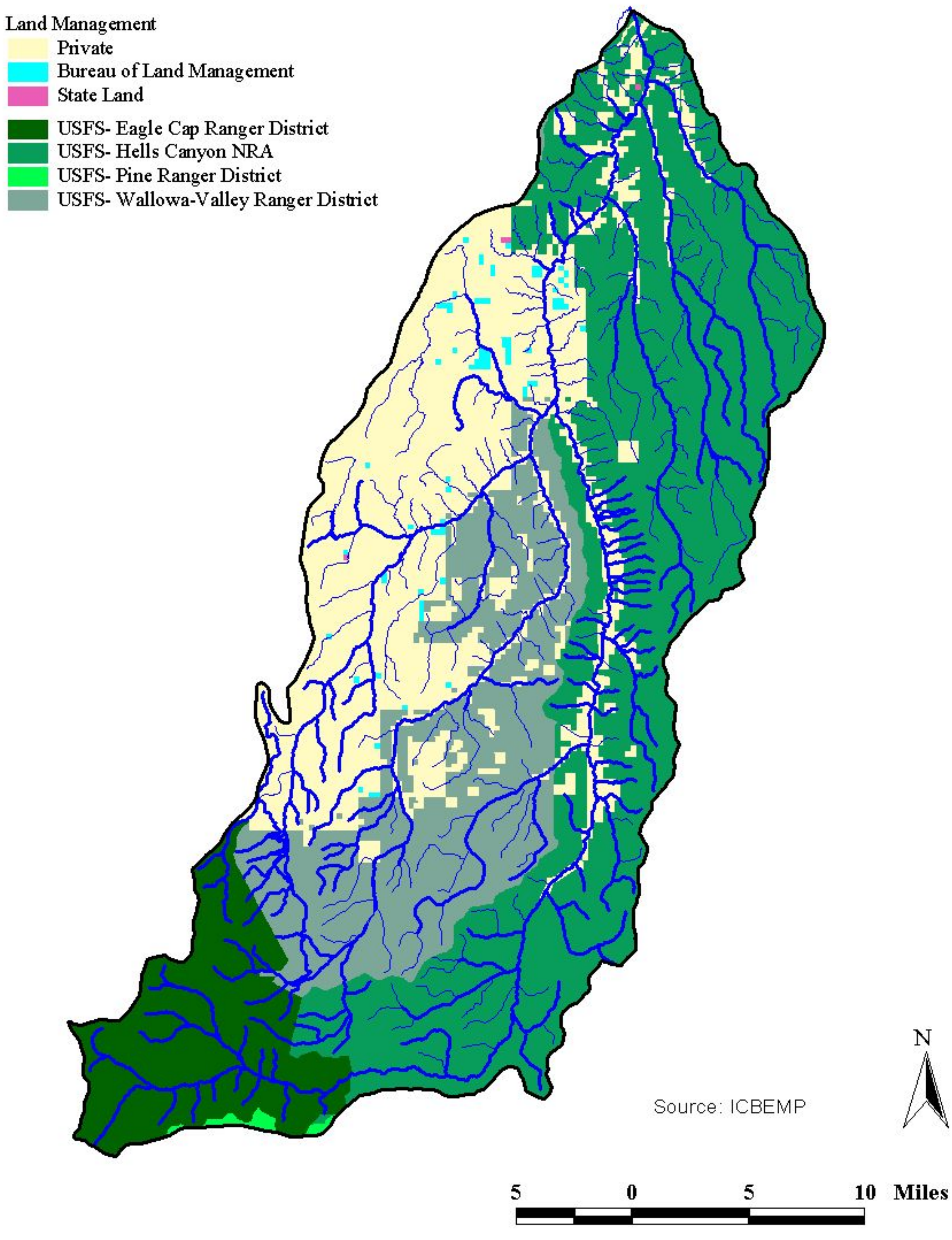

Figure 10. Land ownership in the Imnaha subbasin

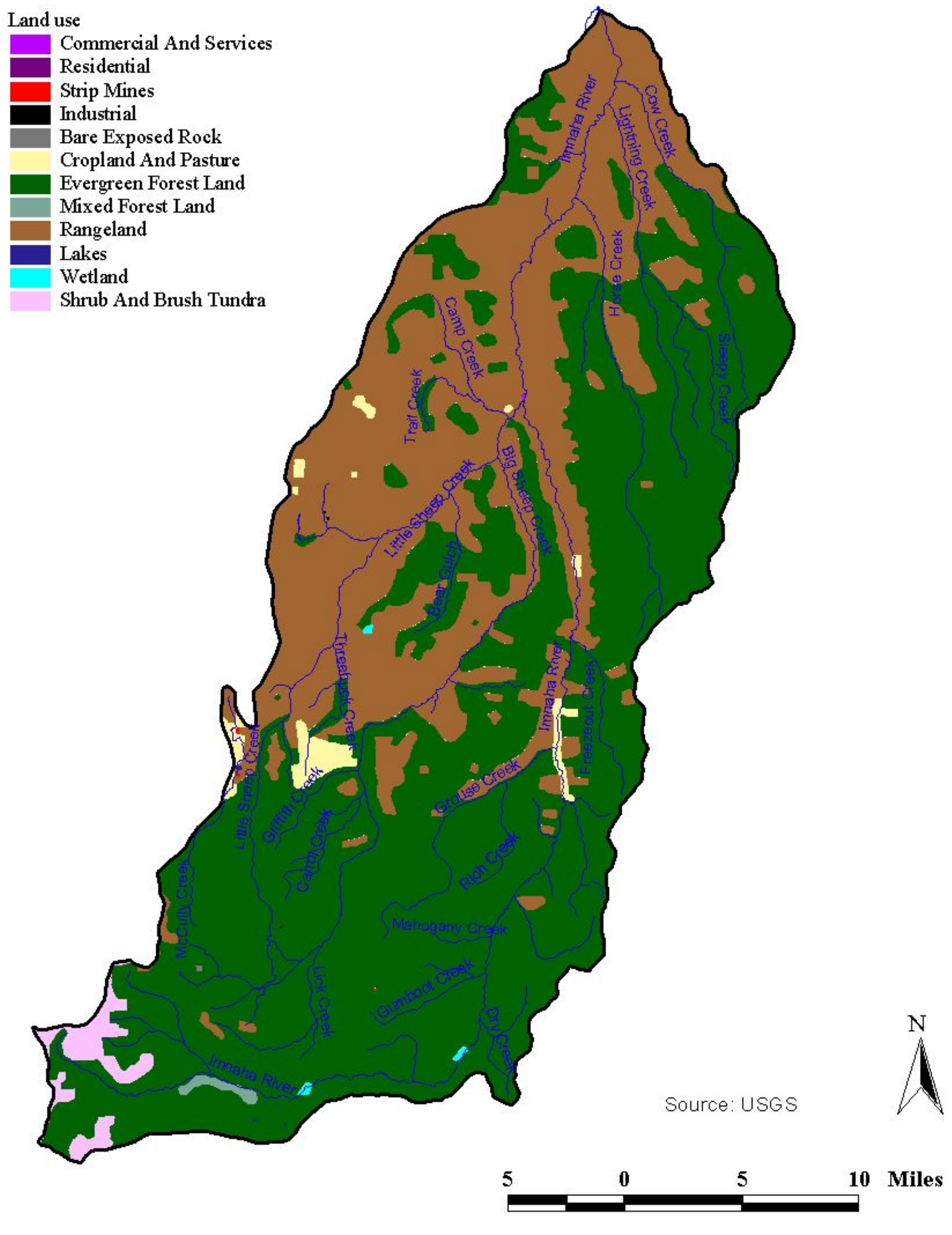

Figure 11. Land use patterns in the Imnaha subbasin

Evidence of grazing exists throughout the watershed including streambank disturbances, soil compaction, and changes to plant communities (Wallowa-Whitman National Forest 1998). Grazing and cattle allotments in the Grouse, Big Sheep and Little Sheep watersheds have contributed to reduced water quality (increased nutrients) and fish habitat degradation (reductions in shade-providing vegetation). Feedlots, located on private lands along Little Sheep Creek and the lower mainstem Imnaha, contribute varying amounts of nutrients to surface water (Nez Perce Tribe et al. 1990), most notably following localized, high-intensity thunderstorms (B. Smith, ODFW, personal communication, April 12, 2001). The impacts of this pollution on the aquatic environment are, however, considered to be short in duration and scope due to the volume and velocity of flows in the affected areas (B. Smith, ODFW, personal communication, April 12, 2001). More excessive grazing impacts to the aquatic and terrestrial environment are believed to occur in the upland areas of the subbasin (B. Smith, ODFW, personal communication, April 12, 2001).

Recently, strategies have been implemented to improve vegetative cover and retention of soil protecting vegetation. For example, the current management of active livestock allotments has placed increased emphasis on attainment of forage utilization standards, riparian management standards and objectives, and improved control over livestock operations by both the Forest Service and permittees (Wallowa-Whitman National Forest 1999). There has also been a downward trend in AUMs in recent years and an upward trend in the number of cross fences, exclosures and off-stream water developments constructed in or near riparian areas. The Wallowa-Whitman National Forest has recently excluded three miles of stream (a total of six miles of fence) from livestock, and has completed 38 upland exclosures, ensuring protection of springs, seeps, wetlands, intermittent draws, perennial nonfish-bearing streams, ephemerals, and ponds (J. Platz, Wallowa-Whitman National Forest, personal communication, May, 2001). The Forest Service has also planted coniferous and deciduous trees along 19 miles of stream channel deficient in riparian vegetation.

Timber and Special Forest Products Harvesting

Prior to 1950, the majority of timber harvested in the Imnaha subbasin was large-diameter Douglas fir, ponderosa pine and western larch trees accessible from roads (USDA Forest Service 2000a). Even-aged timber management practices increased in the late 1950’s, due to the growing demand for timber products. Extraction techniques included the use of animals or tractors for skidding logs along haul routes located in creek bottoms or draws (USDA Forest Service 2000a). The first prescribed clearcut in the subbasin was implemented in the Gumboot Butte area in the late 1950’s (USDA Forest Service 2000a). An estimated 20% of the basin contained saw lumber in 1960 (OWRB 1960 cited in Beamesderfer et al. 1997). In 1992, clearcutting was eliminated as a harvest method on the Wallowa-Whitman National Forest (USDA Forest Service 1994; USDA Forest Service 1998a).

Establishment of the Eagle Cap Wilderness in 1964 (PL 88-577) precluded logging in that portion of the subbasin. Designation of the Hells Canyon National Recreation Area in 1975 (PL 94-199) also changed timber management practices in the Imnaha subbasin, restricting harvest to uneven-aged stands only (Wallowa-Whitman National Forest 1998; USDA Forest Service 2000a).

Timber harvest on federal lands in the Imnaha subbasin has declined from nearly 80,000 mbf to 1,200 mbf in the last 20 years (Wallowa-Whitman National Forest 1998). Total acreage harvested within the Imnaha subbasin from 1989 to 1997 was approximately 11,918 acres (USDA Forest Service 2000a). Of this amount, approximately 2,017 acres were clearcut and 9,901 acres were partial cut (USDA Forest Service 2000a). The reduction in harvest is in response to the changing management emphasis from commodity production to resource protection. Establishment of the Eagle Cap Wilderness in 1964, designation of the HCNRA in 1975, designation of the Imnaha as a Wild and Scenic River in1988, ESA listings for chinook salmon in 1992, 1994 federal land use regulations, ESA listings for bull trout in 1998, and various high priority watershed designations have drastically reduced timber harvest on USFS lands within the Imnaha River watershed. Current methods of harvest on federal lands are restricted to salvage logging and selective thinning only (USDA Forest Service 2000a). Silvicultural activities such as tree planting, cone harvesting, cone tree selection, and precommercial thinning occurs throughout the watershed where timber has been removed by harvest or fire (USDA Forest Service 2000a).

Today, harvest only occurs in USFS Management Area 1 on the Wallowa Valley Ranger District and USFS Management Area 11 in the HCNRA. These two management units comprise 21% of the watershed, or 57,913 acres. The units are located in the southern portion of the watershed and are characterized by flat ridge tops and timbered draws (USDA Forest Service 2000a). Many of the timbered stands (27,152 acres) in the Imnaha subbasin are less than 30 years old, a result of insect infestations, windstorms, harvest and fire. For example, in the Big Sheep Creek subwatershed, the 1989 Canal Fire consumed considerable portions of the upper drainage, which contributed to the current 9,139 timbered acres that are 30 years old or less (USDA Forest Service 2000a).

Special forest product harvesting (e.g. poles, Christmas trees, firewood) is only permitted in Management Units 1, 3, 6, 10, and 11, and only to the extent that it does not adversely impact wildlife or aquatic biota (Wallowa-Whitman National Forest 1998). PACFISH buffer stipulations prohibit harvesting near streams and other water bodies. Buffers range in size from 300' for perennial fish-bearing streams to 100' for intermittent streams and other water bodies.

Transportation

Roads established along the mainstem Imnaha River, Big Sheep and Little Sheep creeks during early settlement remain in use today, although they have been improved. From the late 1970's to 1985, the miles of road constructed on the Wallowa-Whitman National Forest doubled from 4,350 miles to over 8,700 miles (McIntosh et al. 1994). Currently, 1,292 miles of open and closed roads exist in the Imnaha watershed (USDA Forest Service 2000a). Of these, 834 miles occur on lands administered by the Wallowa-Whitman National Forest, and 438 miles occur on private, state, and BLM land (USDA Forest Service 2000a).

The overall road density for open and closed roads (all management jurisdictions) is 1.52 miles of road per square mile of land (USDA Forest Service 2000a). On that portion of the watershed not administered by USFS, the road density (open and closed) is 1.43 miles of road per square mile, compared to USFS-administered land where it is 1.05 miles per square mile (land area includes non-roaded wilderness). Road densities in USFS-managed non-wilderness areas may be higher than in other areas of the watershed. Generally, road densities on federally administered lands fall within the Forest Plan Standards and Guidelines of less than 2.5 miles of open roads per square mile of land.

In two subwatersheds of the Imnaha, road densities are considerably higher than the road density for the watershed as a whole (Wallowa-Whitman National Forest 1998). The

Gumboot subwatershed has 3.2 miles of open road per square mile of land, while the upper Imnaha (near RM 55) subwatershed has 3.66 miles of open road per square mile of land.

Although the actual road density in the Imnaha may not be as high as that found in similar subbasins, the combination of steep topography and historic construction practices have contributed sediment to stream channels. A common road construction practice by the USFS and other entities was to sidecast the excess or “overburden” material as the road was being built (Mason et al. 1993). Invariably, much of this material would enter stream channels due to the inherently steep gradient common to the drainage. The USFS now endhauls this material to designated dumpsites.

During the winter of 1952-53, road construction activities along the Imnaha River (Road 3955) triggered a rockslide approximately 15 miles above the town of Imnaha. The deposition of material posed a serious barrier to fish migration, albeit partial, for at least two years (Beamesderfer et al. 1997). Similarly, USFS road #3900, which borders Gumboot Creek, posed a potential sediment source to the channel due to the undermining effects of the 1997 flood. The road has recently been completely rebuilt.

In response to sedimentation, wildlife harassment, and access concerns, the USFS has closed, restricted access and decommissioned several roads and/or road segments on federally administered lands. In 1990 and 1991, 14.4 miles of road were closed (6.8 miles were obliterated) and 659 acres of roadbed seeded (USDA Forest Service 2000a). Road obliteration projects have occurred in the Ferguson, Big Sheep and West Fork Carrol Creek subwatersheds. Road relocation projects, designed to ameliorate sedimentation to streams, have occurred along a five-mile section of USFS road #3900 between the Imnaha River and Lonesome Saddle (USDA Forest Service 2000a). Seasonal road use restrictions between October and December are implemented to protect soils and wildlife habitat, minimize harassment of wildlife, maintain adequate bull [elk] escapement and promote quality hunting. These seasonal restrictions, otherwise known as Cooperative Travel Management Areas or Green Dot Closure Areas, are those roads *not* marked by a carbonite stake with a green dot at the road intersection.

Since 1989, Forest Service road maintenance has been performed every one to seven years depending on circumstances and road use (Wallowa-Whitman National Forest 1998). In 1990, a full time position was established at the Wallowa Mountains Engineering Zone to coordinate the Access and Travel Management Program, including annual maintenance (USDA Forest Service 2000a).

Mining

Gold, silver, copper and cinnibar mining have all occurred in the Imnaha watershed (Wallowa-Whitman National Forest 1998; Ashe et al. 2000). Placer mining began in the 1890s and continued until World War I; hydraulic dredging techniques were employed beginning in the early 1900s as a more efficient technique to work placer gravels. Mining was concentrated around the mouth and in the upper Imnaha from Ollokot campground to Indian Crossing campground (Wallowa-Whitman National Forest 1998). Overall, mining activities have not severely degraded riverine habitat (Beamesderfer et al. 1997).

There are currently no active mining claims in the Imnaha watershed (Wallowa-Whitman National Forest 1998), however some hobby mining still occurs (Ashe et al. 2000). Regulations associated with the establishment of the HCNRA, Eagle Cap Wilderness, and Imnaha Wild and Scenic River Management Plan withdrew lands associated with these areas from mineral entry. The remainder of the watershed, although open for mineral entry, is unlikely to be mined as it is composed entirely of basalt, which does not contain a marketable source of minerals. Although basalt is crushed to produce paving gravel, given its abundance throughout the region, it is unlikely that basalt in the Imnaha would be exploited for this purpose because of its remoteness from developed areas that require large quantities of paving gravels.

Recreation

The Imnaha watershed provides a variety of recreational activities, and because of the Wilderness designation, the Wild and Scenic designation, and the Hells Canyon National Recreation Area designation, it draws a wide variety of users (Wallowa-Whitman National Forest 1998).

During winter months, snowmobilers, cross-country skiers and alpinists comprise the majority of recreationalists. The “Sno-Park” at Salt Creek Summit is a major use area during the winter, providing access to portions of the Eagle Cap

Wilderness and Imnaha subbasin. The Mountain Loop Road (a.k.a. Gumboot Road, or 39 road) is not plowed past the Salt Creek Sno-Park during the winter, nor are roads plowed past the Pallette Ranch on the main Imnaha River Road (RM 42.8).

During summer months, hiking, horseback riding, fishing, hunting and camping are popular recreational activities within the subbasin. Foot and pack animal travel are allowed within the trail system. Within the Eagle Cap Wilderness, there are 59 miles of trail, which was used by more than 1000 people in 325 groups in 1997.

The watershed contains eight developed campgrounds, three scenic viewpoints, and multiple trailheads. The increased use of developed and undeveloped campgrounds has compacted soil horizons, and negatively impacted the various flora and fauna inhabiting respective sites. In an effort to address this problem, the Wallowa-Whitman National Forest recently completed five campground rehabilitation projects in the subbasin. Included in the projects were plantings, campsite relocation away from streams, installation of educational signs, and the definition of access routes within the riparian area (J. Platz, Wallow-Whitman National Forest, personal communication, May, 2001).

Urban Development

Commercial development within the Imnaha watershed is restricted to the small town of Imnaha (population 25), which consists of a café, store and tavern, gas station, motel, and a GTE field office (Wallowa-Whitman National Forest 1998). Community buildings include an elementary school, library, post office, and church. There are also home-based businesses and a privately owned lodge, outfitter and guide services.

Private residences are scattered along the river corridor, including the Imnaha River Woods subdivision, a privately owned housing development. Hydrologists have expressed concern over the amount of bank armoring adjacent to dwellings and structures, fearing that the rip rap will alter downstream flow regimes and channel morphology (T. Carlson, Wallowa-Whitman National Forest, personal communication, April 12, 2001). Current land use regulations passed by the Wallowa County Planning Commission restrict the sale of land for subdivision. In general, the pattern of settlement and use of private land within the watershed has not changed much since the 1940s, and many descendents of the original settlers still reside in the Imnaha Valley.

Agriculture

Farming in the Imnaha subbasin began in the mid to late 1800's with settlement of the watershed by non-Indians (Ashe et al. 2000). Relative to total subbasin area, a proportional amount of the Imnaha is used to raise cattle and to a lesser extent grow barley, wheat, and hay (Wallowa County Chamber of Commerce 2001). The primary effects agricultural activities have had on natural resources in the Imnaha has been associated with channelization efforts to protect cropland and infrastructure (homes, outbuildings, barns, etc.), sediment inputs, and irrigation withdrawals (Ashe et al. 2000). Agricultural spraying is minimal (Nez Perce Tribe et al. 1990). Although the majority of irrigation withdrawals have negligible effects on the streams and rivers, the Wallowa Valley Improvement Canal significantly affects flows in the Big and Little Sheep Creek watersheds, as it maintains a 120 cfs water right on Big Sheep Creek, Little Sheep Creek, and all associated streams, seeps, or springs (Ashe et al. 2000).

Protected Areas

The Imnaha River mainstem, from its headwaters to its mouth (excluding the North Fork), was included in the Oregon Omnibus Wild and Scenic Act of 1988. The Imnaha subbasin is protected from impoundment due to provisions set forth in the Act. From RM 80 to RM 65 (headwaters to Indian Crossing) the Imnaha maintains a 'Wild River' designation. From RM 65 (Indian Crossing) to RM 22 (Cow Creek Bridge) the river is classified as 'Recreational', and from RM four to RM zero, the Imnaha maintains a 'Scenic River' designation (Wallowa County-Nez Perce Tribe 1993). All of the Imnaha Wild and Scenic area occurs in the HCNRA except from the town of Imnaha to Fence Creek. Approximately 36,711 acres of the upper drainage occur within the Eagle Cap Wilderness, which is managed according to provisions set forth under the Wilderness Act of 1964 (Public Law 88-577) (Wallowa-Whitman National Forest 1998).

In 1988, the Northwest Power Planning Council directed extensive studies of existing habitat in an effort to 1) identify fish and wildlife resources of critical importance to the region, 2) establish the degree to which mitigation projects would affect the areas, 3) assess the effects of hydroelectric development on the areas and 4) determine whether or not areas should be protected from future hydroelectric development. The studies provided the Council with a means upon which to designate certain river reaches as "protected areas" based on their productive capacity, unique habitat, or risk of loss to fish and wildlife species of concern. The list for the Imnaha was completed in 1994 and is shown in Table 11. These and other areas in the Imnaha subbasin with unique protection status are shown in Table 12 and F.

Table 11. Protected areas in the Imnaha subbasin based on reviews conducted by the Northwest Power Planning Council, 1994 (http://www.streamnet.org).

Watershed/ Reach	Protected Category	Total Stream Miles	Total Stream Miles Protected	Percent in Protected Status
Imnaha mainstem	Anadromous and resident fish & wildlife	88.10	71.41	81.04
Imnaha mainstem	Resident fish only		10.00	11.35
Cow Creek	Anadromous only	29.10	14.60	50.17
Lightning Creek	Anadromous only	48.90	27.80	56.85
Horse Creek	Anadromous only	34.00	17.70	52.06
Big Sheep Creek	Anadromous only	186.00	108.00	57.88
Freezeout Creek	Anadromous only	8.30	7.90	95.18
Grouse Creek	Anadromous only	27.90	20.90	74.91
Summit Creek	Anadromous only	7.00	4.40	62.86
Crazyman Creek	Anadromous only	7.00	5.40	77.14
Gumboot Creek	Anadromous only	9.90	3.00	30.30
Dry Creek	Anadromous only	8.00	5.00	62.50
Skookum Creek	Anadromous only	4.30	0.89	20.70
	Total:	**371.00**	**296.99**	**80.05**

Table 12. Areas in the Imnaha subbasin that are managed and/or protected using a conservation-based strategy

Site	Location	Acreage in subbasin (approximate)	Agency	Type of Protection/Management
Eagle Cap Wilderness	Upper 15 miles Imnaha	41,610	USFS	Managed and protected under the Wilderness Act of 1964
Imnaha Wild and Scenic River	Mainstem Imnaha River	9,354	USFS, ODF	Managed and protected under the Wild and Scenic Rivers Act of 1968
Little Sheep Wildlife Area	Little Sheep Creek (@ approx. RM 5.0)	510	ODFW	Managed for the protection of wildlife habitat
Hells Canyon National Recreation Area	Imnaha River corridor	249,844	USFS, ODFW, NPT	Managed and protected under the National Recreation Area Act
Nez Perce (Nee-Me-Poo) Natl. Historic Trail	Lower 16 miles of Dug Bar road	16 linear miles	USFS (11mi) Private	Managed under the Nez Perce National Historic Trail Act of 1986
Bonner Flat Proposed Research Natural Area	Upper South Fork Imanha	1662	USFS	Managed for the preservation of the natural ecosystem
Duck Lake Proposed Research Natural Area	Edge of Eagle Cap Wilderness Area	337	USFS	Managed for the preservation of the natural ecosystem
Basin Creek Proposed Research Natural Area	Imnaha River above Horse Creek	735	USFS	Managed for the preservation of the natural ecosystem
Clear Lake Ridge	Little Sheep Creek drainage (RM 6.0)	3455	Nature Conservancy	Managed for the preservation of the natural ecosystem
Zumwalt Prairie Conservation Area	Camp Creek		Nature Conservancy	Managed for the preservation of the natural ecosystem

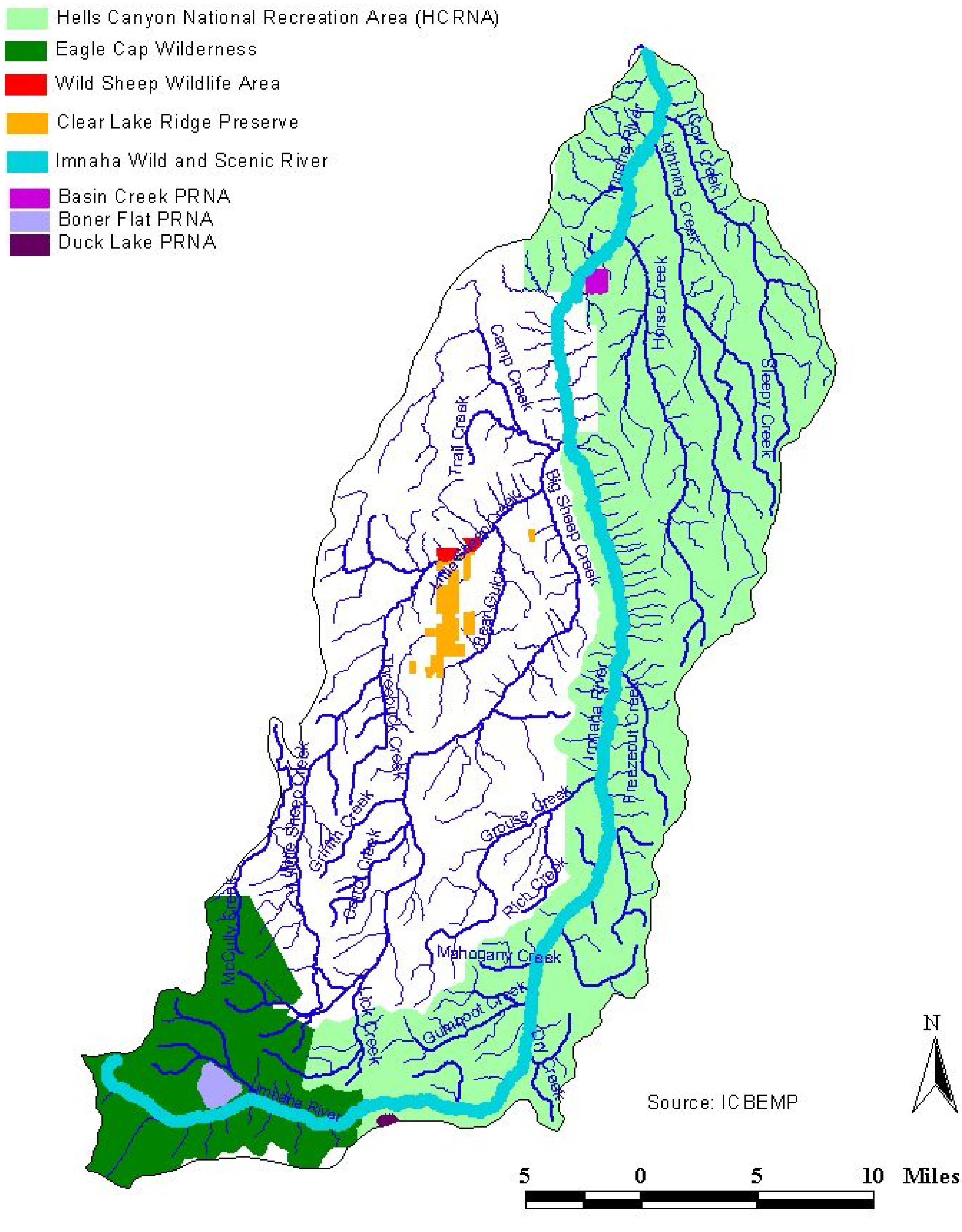

Figure 12 Areas in the Imnaha subbasin that are managed and/or protected using a conservation-based strategy

Fish and Wildlife Resources

Fish and Wildlife Status

Fish

There are currently 22 native and 9 exotic fish species inhabiting the Imnaha subbasin (Table 13; Mundy and Witty 1998).

Table 13. Fish Species present in the Imnaha River Subbasin (Mundy and Witty 1998)

Species	Origin[1]	Location[2]	Status[3]	Comments
Bull trout (*Salvelinus confluentus*)	N	R, T	C	
Spring chinook salmon (*Oncorhynchus tshawytscha*)	N	R, T	C	Spawn in Aug/early Sep
Summer/early fall chinook salmon (*O. tshawytscha*)	N	R, T	R	
Fall chinook salmon (*O. tshawytscha*)	N	R	R	Spawn in Nov. Considered part of Snake River pop.
Summer steelhead (*Oncorhynchus mykiss*)	N	R, T	C	
Rainbow trout (*O. mykiss*)	N	R, T	C	
Redband trout (*O. mykiss*)	N	R, T	C	
White sturgeon (*Acipenser transmontanous*)	N	R	R	Transitory residence in lower Imnaha
Mountain whitefish (*Prosopium williamsoni)*	N	R, T	C	
Pacific lamprey (*Lampetra tridentata*)	N	R, T	U	Considered extinct
Lamprey (*Lampetra spp*.)	N	R, T	R	Considered extinct
Peamouth (*Mylocheilus caurinus*)	N	R, T	I	
Northern pikeminnow (*Ptychocheilus oregonensis*)	N	R, T	C	
Bridgelip sucker (*Catostomus columbianus*)	N	R, T	C	
Largescale sucker (*Catostomus macrocheilus*)	N	R, T	C	
Chiselmouth (*Acrocheilus alutaceus*)	N	R, T	C	
Longnose dace (*Rhinichthys cataractae*)	N	R, T	R/I	
Speckled dace (*Rhinichthys osculus*)	N	R, T	A	
Leopard dace (*Rhinichthys falcatus*)	N	R, T	I	
Redside shiner (*Richardsonius balteatus*)	N	R, T	C	
Torrent sculpin (*Cottus rhotheus*)	N	R, T	R	
Paiute sculpin (*Cottus beldingi*)	N	R, T	C	
Shorthead sculpin (*Cottus confusus*)	N	R, T	C	
Mottled sculpin (*Cottus bairdi*)	N	R, T	C	
Common carp (*Cyprinus carpio*)	E	R, T	R/I	
Bullhead, brown (*Ictalurus nebulosus*)	E	R, T	R/I	
Channel catfish (*Ictalurus natalis*)	E	R, T	R/I	
Smallmouth bass (*Micropterus dolomieu*)	E	R, T	U/I	
Largemouth bass (*Micropterus salmoides*)	E	R, T	I	
White crappie (*Pomoxis annularis*)	E	R, T	I	
American shad (*Alosa sapidissima*)	E	R, T		

1 Origin: N=Native stock, E=exotic

2 Location: R=mainstem rivers, T=tributaries

3 Fish species abundance based on average number of fish per $100m^2$: A=abundant, R=rare, U=uncommon, C=common, and I=insufficient data

Naturally occurring anadromous species in the Imnaha subbasin include spring/summer and fall chinook salmon (*Oncorhynchus tshawytscha*), summer steelhead (*Oncorhynchus mykiss*), and Pacific lamprey (*Lampetra tridentata*). Naturally reproducing Imnaha chinook populations were listed by the National Marine Fisheries Service as threatened on May 22, 1992 (Federal Register, Vol. 57, 14653) (National Marine Fisheries

Service 1997). Similarly, wild Snake River summer steelhead were federally listed as threatened on August 18, 1997 (Federal Register, August 18, 1997, Vol. 62, 43937). (National Marine Fisheries Service 1997). Pacific lamprey are a federally listed species of concern, but considered extinct in the Imnaha subbasin.

Non-anadromous salmonids endemic to the Imnaha subbasin include interior redband trout (*O. mykiss spp.*), rainbow trout (*O. mykiss spp.*), bull trout (*Salvelinus confluentus*), and mountain whitefish (*Prosopium williamsoni*). As of April 20, 2000, redband trout were listed as a sensitive species in Oregon and managed similarly as steelhead when occurring in anadromous waters. Bull trout, which are under the jurisdiction of the U. S. Fish and Wildlife Service (USFWS) are also listed under the ESA. On July 10, 1998, the USFWS listed the Klamath and Columbia River bull trout as threatened (Federal Register, June 10, 1998, Vol. 63, 31647). Bull trout are also listed as a species of critical concern in Oregon. White sturgeon (*Acipenser transmontanous*), a federally listed species of concern (CBFWA 1999), occasionally utilize lower portions of the mainstem Imnaha (Wallowa County and Nez Perce Tribe 1993) but do not likely inhabit the river for extended periods (D. Bryson, NPT, personal communication, March, 2001). Although Pacific lamprey are currently considered to be extinct, there is likely a population of the non-anadromous brook lamprey in portions of the subbasin.

Exotic species inhabiting the Imnaha subbasin are comprised primarily of centrarchids, ictalurids and cyprinids. Their distribution and abundance has increased following the construction of major hydroelectric projects on the Snake River (Wallowa-Whitman National Forest 1999). For example, the introduction of smallmouth bass (*Micropterus dolomieu*) into the Hells Canyon Hydroelectric Complex was accompanied by a subsequent expansion of the fishery into free flowing reaches of the Snake and Imnaha rivers (Wallowa-Whitman National Forest 1999). The development of the smallmouth population in free flowing environments warrants concern due to the piscivorous and competitive behavior smallmouth exhibit toward salmonid species.

Summer Steelhead

Snake River summer steelhead population distribution in the Imnaha subbasin was historically similar to current conditions. Although actual historic escapement data does not exist, it is estimated that prior to the construction of the four lower Snake River dams (in the early 1960’s - mid 1970’s), up to 4,000 A-run summer steelhead returned to the Imnaha subbasin on an annual basis (U. S. Army Corps of Engineers 1975). In the absence of historic distribution data, it is difficult to determine which streams were inhabited by summer steelhead. However the lack of residual rainbow trout above Imnaha Falls (RM 73) suggests that steelhead were likely restricted to all accessible areas downstream from this probable migration barrier (Mundy and Witty 1998).

Annual steelhead spawning surveys in the Imnaha are limited (USDA Forest Service 1998a; 1998b). Current escapement estimates are based on data collected in Camp Creek, a tributary to Big Sheep Creek. Camp Creek, a spring-fed stream, is used for annual redd surveys due to its accessibility, flows and water clarity during survey periods, and an early spawning group of fish (B. Knox, ODFW, personal communication, April 12, 2001). Annual escapement of wild/naturally spawning A-run fish has declined over the past three decades with recent estimates ranging from 300 to 1,000 adults. Summer steelhead redd counts in the lower six miles of Camp Creek are shown in Figure 13. The increase in the number of redds observed from 1985 to 1987 was consistent with trends observed during the same period throughout the Columbia basin (B. Knox, ODFW, personal communication, April 19, 2001) but may also be related to the Lower Snake River Compensation Program (LSRCP) facility constructed on Little Sheep Creek in 1982 (D. Bryson, NPT, personal communication, April 27, 2001).

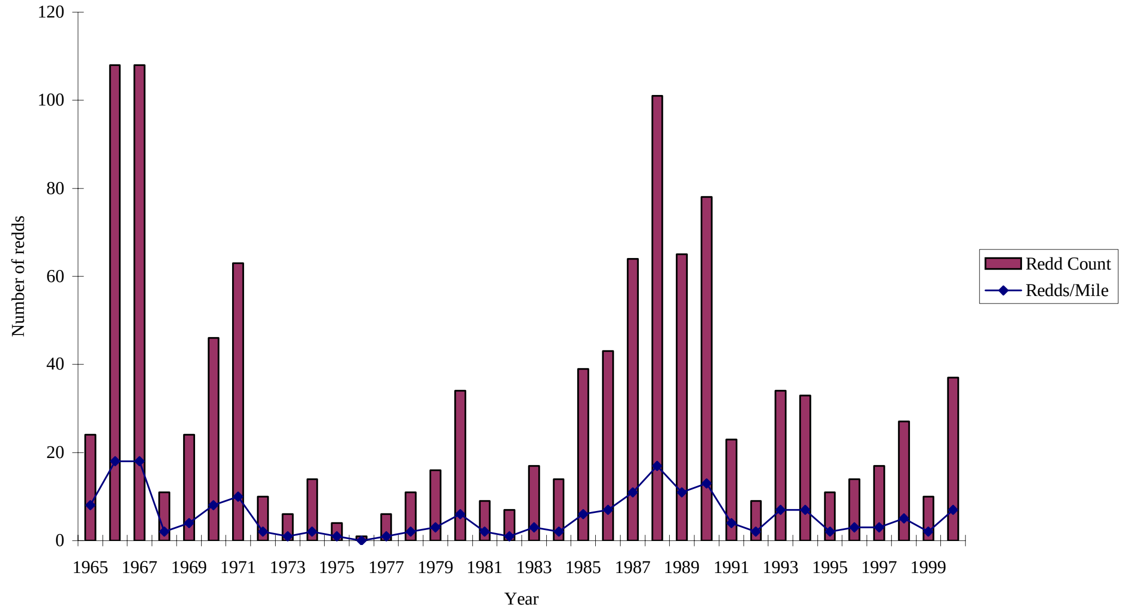

Figure 13. Summer steelhead redd counts in the lower six miles of Camp Creek for the run years 1965-2000 (Streamnet database)

Quantification of adult steelhead abundance is generally lacking throughout the Imnaha River subbasin. Adult abundance monitoring via weirs has been limited to Little Sheep Creek from 1982 to present and Lightning Creek 2000 to present. Adult escapement monitoring in Lightning Creek enumerated 35 adults (34 natural origin and one hatchery origin). Run timing ranged from March 28 to June 8th, with 80% of the upstream movement occurring between April 10th and May 20th (Miller and Hesse Draft 2001).

Juvenile rearing density monitoring has been limited. Snorkeling observations have been conducted in Big Sheep Creek, Lick Creek, and in the mainstem Imnaha River from 1992 to 2000. Densities of juvenile *O. mykiss* (multiple year classes) were highest in Lick Creek, but never exceeded 0.5 fish/m^2. (Table 14; Blenden and Kucera in prep 2001). Multiple pass electrofishing surveys were conducted in Lightning, Big Sheep, Little Sheep creek, and Gumboot creeks in 1999 and 2000. Densities of wild *O. mykiss* parr never exceeded 0.5 fish / m^2 (Table 15; ODFW and NPT unpublished data).

Table 14. Snorkeling observations conducted in Big Sheep Creek, Lick Creek, and the Imnaha River (1992-2000).

Stream	Year	Habitat Type/ # of Transects	Mean Density (#/100m²) of Chinook (age = 0+)	Mean Density (#/100m²) of Chinook (age = 1+)	Mean Density (#/100m²) of Steelhead
Big Sheep Cr.	1992	Pool (3) Run (4)	20.2 24.7	2.7 3.9	12.6 24.1
Big Sheep Cr.	1993	Pool (2) Run (3)	17.2 5.6	4.6 5.3	25.4 15.5
Upper Big Sheep Cr. (7/7)	1994	Pool (2) Run (2)	0.0 0.0	0.0 0.0	36.2 26.2
Upper Big Sheep Cr. (8/16)	1994	Pool (2) Run (2)	8.3 (317.60) 2.4 (166.46)	0.0 0.0	24.9 16.0
Lower Big Sheep Cr. (7/8)	1994	Pool (2) Run (4)	18.6 13.5	0.0 1.8	28.0 20.8
Lower Big Sheep Cr. (8/17)	1994	Pool (2) Run (4)	22.2 (12.88) 16.1 (1.78)	0.0 1.2	19.5 25.5
Big Sheep Cr.	1995	Pool (3) Run (3)	0.0 0.0	1.8 0.6	18.9 22.0
Imnaha River	1992	Pool (5) Run (8)	40.6 16.3	0.7 0.2	2.0 2.8
Imnaha River	1993	Pool (5) Run (8)	61.7 17.9	1.5 1.1	2.9 1.5
Imnaha River	1994	Pool (5) Run (8)	72.4 38.0	2.2 0.1	0.4 0.5
Imnaha River	1995	Pool (5) Run (7)	36.2 16.5	1.1 1.2	1.8 1.6
Imnaha River	1996	Pool (5) Run (7)	30.4 9.8	5.3 1.6	2.5 2.4
Upper Lick Cr. (7/7)	1994	Pool (3) Run (3)	314.4 200.8	0.0 0.0	13.4 19.5
Upper Lick Cr. (8/16)	1994	Pool (3) Run (3)	224.0 208.8	0.0 0.0	23.9 30.2
Lower Lick Cr. (7/7)	1994	Pool (3) Run (3)	0.0 2.0	0.0 0.0	41.4 29.4
Lower Lick Cr. (8/16)	1994	Pool (3) Run (3)	37.2 (6.37) 39.0 (2.42)	0.0 0.0	38.0 37.7
Lick Cr	1996	Pool (7) Run (7)	0.0 0.0	0.0 0.0	19.0 9.8
Lick Cr.	1997	Pool (6) Run (5)	0.0 0.0	0.0 0.0	21.3 15.9
Lick Cr.	1998	Pool (6) Run (4)	149.3 76.0	1.0 0.0	24.0 13.9
Lick Cr.	1999	Pool (6) Run (4)	47.3 32.5	5.4 2.1	11.7 13.7

Table 15. Juvenile *O. mykiss* rearing density (Number/m^2) estimates for Lightning, Big Sheep, Little Sheep creek, and Gumboot creeks in the Imnaha River subbasin, 1999 and 2000. ODFW and NPT unpublished data collected under LSRCP evaluation studies.

Year	Stream	Reach	Wild age 0	Wild age 1	Wild age 2+	Hatchery age 0	Hatchery age 1	Hatchery age 2+
1999	Little Sheep Cr.	1	0.094	0.010	0.00	0.754		0.136
		2	0.198	0.005	0.005	0.166		0.005
		3	0.209	0.023	0.004	0.039		0.009
		4	0.020	0.020	0.031	1.552		0.060
		5	Not sampled in 1999					
		6	0.093	0.061	0.008	1.089		0.030
	Gumboot Cr.	1	0.229	0.172	0.111			
		2	0.217	0.084	0.059			
		3	0.033	0.202	0.118			
		4	0.381	0.184	0.110			
		5	0.019	0.164	0.104			
		6	0.253	0.349	0.245			
	Big Sheep Cr.	1	0.129	0.074	0.050	0.350		0.000
		2	0.039	0.177	0.078	0.624		0.008
		3	0.004	0.018	0.012	1.129		0.000
		4	0.004	0.042	0.011	2.101		0.004
	Lightning Cr.	1	0.122	0.191	0.028			
		2	0.172	0.168	0.035			
		3	0.081	0.078	0.036			
		4	0.106	0.066	0.062			
2000	Little Sheep Cr.	1	0.238	0.037	0.000		0.044	0.030
		2	0.355	0.022	0.000		0.000	0.008
		3	0.474	0.029	0.004		0.033	0.000
		4	0.358	0.005	0.019		0.150	0.005
		5	0.608	0.037	0.005		0.042	0.000
		6	0.111	0.011	0.011		0.071	0.000
	Gumboot Cr.	1	1.859	0.125	0.066			
		2	0.956	0.081	0.000			
		3	0.259	0.219	0.084			
		4	0.259	0.104	0.025			
		5	0.202	0.061	0.074			
		6	0.000	0.085	0.000			
	Big Sheep Cr.	1	0.326	0.040	0.004	0.000	0.036	0.009
		2	0.211	0.088	0.046	0.000	0.077	0.023
		3	0.111	0.019	0.003	0.000	0.123	0.000
		4	0.104	0.011	0.004	0.008	0.118	0.000
		5	0.167	0.035	0.006	0.000	0.004	0.061
		6	0.213	0.077	0.009	0.000	0.018	0.131
	Lightning Cr.	1	0.000	0.162	0.017			
		2	0.191	0.123	0.037			
		3	0.140	0.080	0.060			
		4	0.253	0.103	0.053			

Season-wide estimates of juvenile steelhead survival from the mouth of Imnaha River to Lower Granite Dam have been made since 1993. Survival estimates of spring emigrating natural steelhead have ranged from 0.860 in 1998 to 0.901 in 1997

(Figure 14; Cleary et al. 2000, in prep.). Survival estimates of hatchery steelhead smolts have ranged from 0.646 in 1996 to 0.829 in 1998 (Figure 15; Cleary et al. 2000, in prep.). Arrival timing of Imnaha river juvenile natural and hatchery steelhead at Snake River Dams has been tracked since 1993 (Table 16 and Table 17).

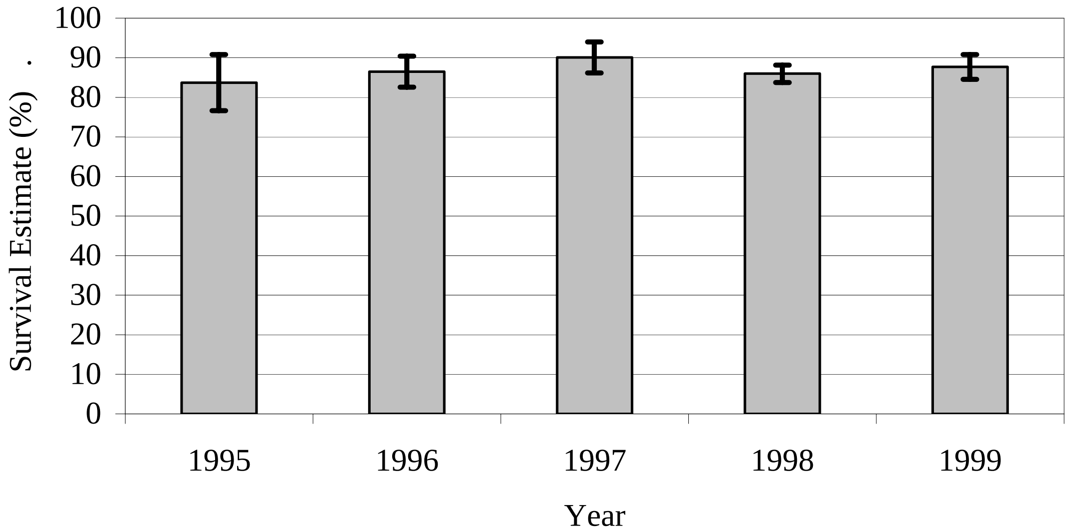

Figure 14. Season-wide estimates for natural steelhead released from the Imnaha River trap to Lower Granite Dam, from 1995 to 1999. Error bars indicate the 95% confidence limit (modified from Cleary et al 2000 and Cleary et al. in prep.)

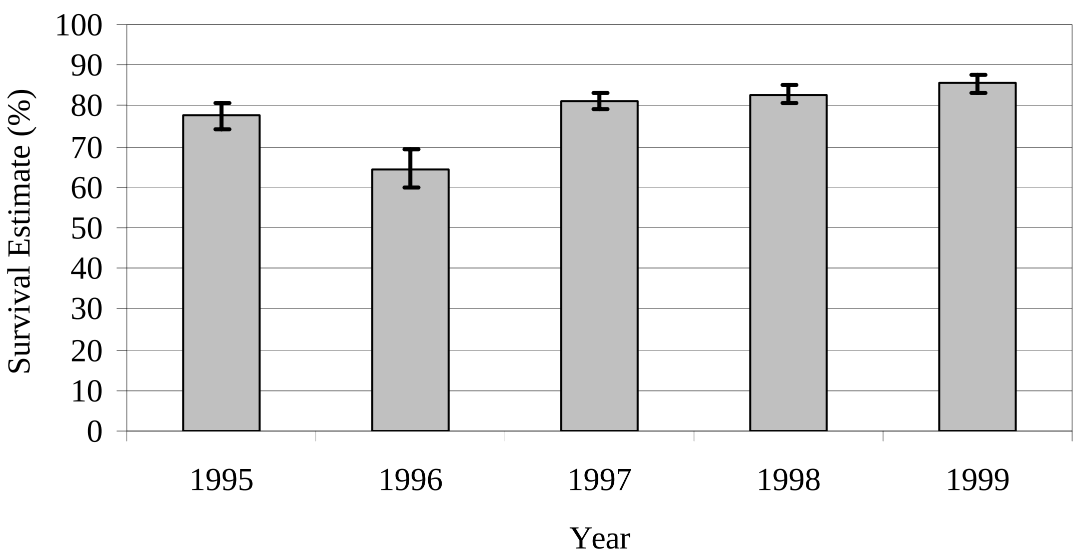

Figure 15. Season-wide estimates for hatchery steelhead released from the Imnaha River trap to Lower Granite Dam, from 1995 to 1999. Error bars indicate the 95% confidence limit (modified from Cleary et al 2000 and Cleary et al. in prep.)

Table 16. Arrival timing of PIT tagged Imnaha River natural steelhead smolts at Lower Granite, Little Goose, Lower Monumental, and McNary dams from 1993 to 1999.

Impoundment	Year	Sample Size n	Date Range		Arrival Timing	
			From	To	Median	90%
Lower Granite	1999	649	Apr 19	Jun 26	May 18	Jun 5
	1998	1,474	Apr 2	Jun 12	May 3	May 22
	1997	368	Apr 20	Jul 10	May 8	May 24
	1996	537	Apr 19	Jun 10	May 6	Jun 4
	1995	128	Apr 28	Jun 19	May 2	May 9
	1994[1]	332	Apr 25	Aug 15	May 8	Jun 1
	1994[2]	207	May 3	Aug 20	May 9	May 30
	1993	101	May 3	Jun 13	May 26	Jun 8
Little Goose	1999	717	Apr 8	Jun 24	May 21	May 25
	1998	481	Apr 14	Jun 19	May 8	May 26
	1997	319	Apr 20	Jun 19	May 10	May 26
	1996	365	Apr 20	Jun 14	May 9	May 28
	1995	70	May 1	Jun 23	May 7	May 12
	1994[1]	159	Apr 29	Jul 29	May 12	May 31
	1994[2]	121	May 6	Jul 26	May 15	Jun 1
	1993	48	May 6	Jun 11	May 24	Jun 7
Lower Monumental	1999	342	Apr 19	Jun 21	May 23	May 27
	1998	213	Apr 16	Jun 11	May 10	May 27
	1997	264	Apr 21	Jun 6	May 11	May 25
	1996	397	Apr 22	Jun 15	May 14	May 29
	1995	81	May 3	May 17	May 9	May 14
	1994[1]	148	May 1	Aug 8	May 12	Jul 8
	1994[2]	91	May 9	Jul 31	May 15	Jul 10
	1993	43	May 6	Jun 15	May 30	Jun 11
McNary	1999	55	Apr 17	May 31	May 25	May 27
	1998	53	Apr 20	Jun 4	May 7	May 28
	1997	62	Apr 24	Jun 5	May 13	May 18
	1996	157	Apr 25	Jun 11	May 11	May 21
	1995	35	May 5	May 27	May 11	May 17
	1994[1]	66	May 5	Jun 22	May 18	Jun 9
	1994[2]	42	May 13	Jun 25	May 18	Jun 6
	1993	17	May 11	Jun 13	May 25	May 31

[1] NPT PIT tagged fish
[2] FPC PIT tagged fish

Table 17. Arrival timing of PIT tagged Imnaha River hatchery steelhead smolts at Lower Granite, Little Goose, Lower Monumental, and McNary dams from 1993 to 1999.

Impoundment	Year	Sample Size n	Date Range		Arrival Timing	
			From	To	Median	90%
Lower Granite	1999	1,973	Apr 18	Aug 5	May 24	Jun 18
	1998	1,683	Apr 25	Jul 29	May 15	May 26
	1997	2,346	Apr 19	Jul 24	May 23	Jun 13
	1996	440	Apr 23	Jul 14	May 28	Jun 14
	1995	661	May 6	Jul 12	May 31	Jun 16
	1994[1]	164	Apr 29	Aug 20	May 29	Jul 15
	1994[2]	306	May 6	Aug 21	May 25	Jun 23
	1993	224	May 3	Jun 28	May 17	May 31
Little Goose	1999	1,593	Apr 20	Aug 22	May 25	Jun 18
	1998	555	May 3	Jul 10	May 25	May 30
	1997	1,844	Apr 21	Aug 23	May 26	Jun 13
	1996	261	Apr 24	Jul 11	May 25	Jun 16
	1995	409	May 8	Jul 13	Jun 3	Jun 20
	1994[1]	86	May 2	Jul 30	May 31	Jul 17
	1994[2]	165	May 10	Aug 12	May 27	Jul 9
	1993	106	May 5	Jul 8	May 25	Jun 2
Lower Monumental	1999	790	Apr 21	Jul 20	May 26	Jun 19
	1998	253	May 5	Jul 15	May 26	Jun 3
	1997	1,432	Apr 22	Aug 6	May 27	Jun 15
	1996	232	May 6	Jul 7	May 27	Jun 15
	1995	410	May 9	Jul 13	Jun 6	Jun 16
	1994[1]	30	May 5	Aug 5	Jun 3	Jul 17
	1994[2]	75	May 11	Aug 24	Jun 18	Jul 21
	1993	92	May 7	Jun 14	May 26	Jun 5
McNary	1999	79	Apr 27	Jul 8	May 28	May 31
	1998	31	May 13	Jul 2	Jun 1	Jun 19
	1997	245	Apr 23	Aug 12	May 27	Jun 18
	1996	30	Apr 27	Jul 3	May 23	Jun 7
	1995	69	May 15	Jul 17	Jun 5	Jun 27
	1994[1]	22	May 17	Jul 14	Jun 5	Jul 10
	1994[2]	56	May 20	Jul 11	Jun 17	Jul 8
	1993	7	May 11	Jun 5	May 19	May 30

Imnaha steelhead are generally ubiquitous where other salmonids are found. Currently, Imnaha steelhead maintain widespread distribution throughout most of the subbasin, and generally occur in *all* tributaries that do not have vertical falls near their mouths (Mundy and Witty 1998). Approximately 397.6 river miles of summer steelhead spawning and rearing habitat have been identified in the Imnaha subbasin (Figure 16; USDA Forest Service 1998a; 1998b).

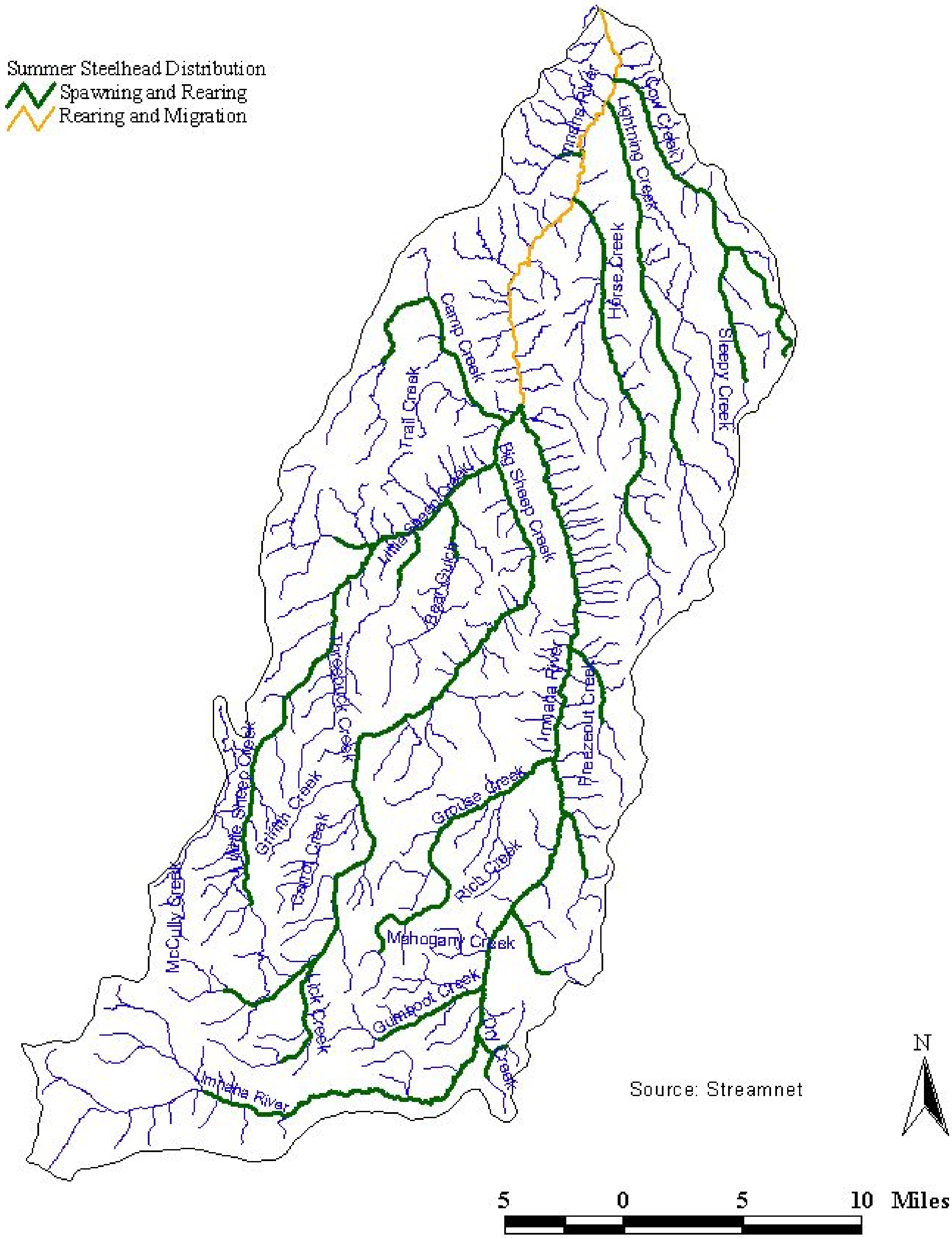

Figure 16. Summer steelhead spawning and rearing areas in the Imnaha subbasin. Due to scale (1:100,000), not all streams containing steelhead are shown (Streamnet data).

The summer steelhead fishery on the Imnaha was closed in 1974 due to declining adult returns, as indicated by adult counts at Ice harbor Dam on the Snake River (U.S. Army Corps of Engineers 1990) and low redd counts at index sites (U.S. Fish and Wildlife Service 1991). Under the auspices of the Lower Snake River Compensation Project (LSRCP), which was initiated in 1982, Imnaha steelhead populations were augmented by hatchery produced fish in an effort to restore a tribal and recreational fishery (Carmichael 1989). A consumptive-based recreational summer steelhead fishery on ad-clipped hatchery origin fish was subsequently re-opened in 1986 due to increased returns from the hatchery program (Figure 17) (Flesher et al. 1993).

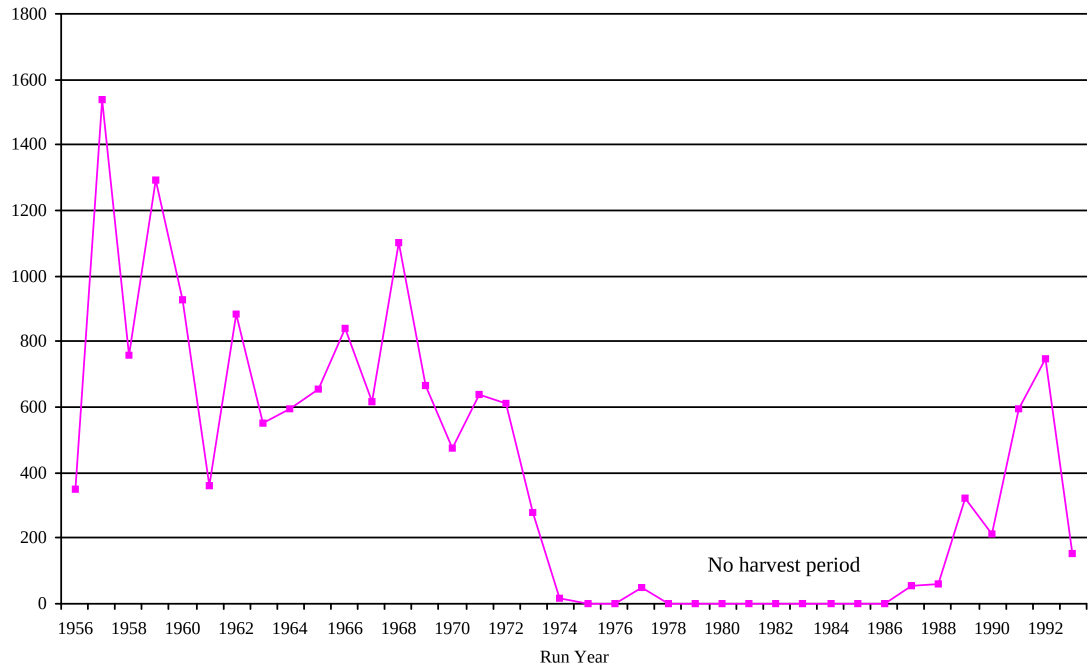

Figure 17. Estimated annual steelhead harvest in the Imnaha subbasin for the run years 1956-1994 (Streamnet data 2001).

Annual creel surveys for Imnaha steelhead have been conducted by the Oregon Department of Fish and Wildlife since the fishery reopened in 1986. The surveys, which are typically conducted in the spring, provide managers with annual harvest information needed to assess LSRCP objectives and compensation goals. Results from creel surveys for the run years 1986-1998 are shown in Table 18.

Table 18. Creel survey results for summer steelhead caught in the Imnaha River for the run years 1987-1998 (ODFW data presented in Carmichael et al. 1989a; 1989b; Carmichael et al. 1991; Flesher et al. 1992; Flesher et al. 1994a; 1994b; Flesher et al. 1995; 1996; 1997; 1999)

Run Year	No. Anglers	Effort (Hrs.)	Catch		Catch Rate Index (hrs./fish)
			# Wild	# Hatchery kept	
1986-92	Punchcard Data Only				
1992-93	789	2,910	130	171	8.0
1993-94	298	1,336	72	29	13.0
1994-95	219	1,048	39	24	17.0
1995-96	588	2,599	210	112	7.0
1996-97	209[1]	N/A	N/A	97[1]	6.0
1997-98	111[1]	N/A	N/A	27[1]	10.0

1/Value represents a subsample of total

Spring Chinook

Historically, the Imnaha subbasin supported one of the largest runs of spring/summer chinook in Wallowa County (Wallowa County and Nez Perce Tribe 1993). Prior to the construction of the four lower Snake River dams, an estimated 6,700[1] adult chinook escaped to the subbasin annually (USACE 1975). In 1957, peak escapement of chinook into the subbasin was 3,462 adults (Ashe et al. 2000; Mundy and Witty 1998).

Returns of natural origin chinook (not including jacks) have declined to levels below 150 individuals during some years (ODFW 1998b cited in Ashe et al. 2000), which is notable since it is estimated that up to 10% of the annual escapement of wild Snake River spring/summer chinook salmon are of Imnaha origin (NMFS 2001). Run reconstructions for Imnaha chinook have been derived from spawning ground surveys, age frequencies, mainstem and tributary harvest rates, and mainstem conversion rates for upstream passage of adults available from the 1940's to present (Table 19).

Table 19. Mean ± coefficient of variation (and range) for spawners, recruit and recruit per spawner numbers in aggregate and index populations of wild spring and summer chinook in the Imnaha subbasin (1939-1990). Values for recruits per spawner represent geometric means and standard deviations (coefficient of variation is standard deviation divided by the mean and expressed as a percentage) (reproduced from Beamesderfer et al. 1997).

Population	N[1/]	Spawners	Recruits to freshwater	Recruits per spawner
Mainstem (1939-1990)	41	1,110 ± 69% (169 – 3,462)	2,845 ±90% (125 – 10,720)[2/]	2.0 ± 139% (0.3 – 16.3)
Big Sheep/Lick (1962-1990)	27	201 ±93% (0 – 644)	349 ± 140% (0.0 – 1,895)[3/]	0.9 ± 332% (0.0 – 13.7)

1/ Number of brood years for which data was collected
2/ Represents the maximum and minimum number of freshwater recruits over 41 years
3/ Represents the maximum and minimum number of freshwater recruits over 27 years

[1] LSRCP used 5.5% of the peak (1957) escapement over McNary Dam to estimate spring/summer chinook returns into the Imnaha

Adult spring chinook begin entering the Imnaha in late-April, with peak entry in mid-to-late June (Ashe et al. 2000). Returning summer-run adult chinook enter the Imnaha later than the spring run, however the majority of chinook are probably in the Imnaha by the end of July. Peak spawning for both spring and summer chinook is in the late summer, occurring usually in late August to early September (Ashe et al. 2000; NMFS 2001). Spawning ground surveys conducted by the Oregon Fish Commission established peak spawning in the Imnaha slightly prior to August 24, although peaks may occur earlier or later depending upon the run year (Thompson and Haas 1960).

Spring chinook most commonly use the mainstem Imnaha between Summit Creek and the Blue Hole (RM 59.6) for spawning (Figure 18; Mundy and Witty 1998). In addition to this 17-mile reach, mainstem chinook spawning has been documented as far downstream as Freezeout Creek (RM 29.4). Fewer numbers of fish spawn in primary tributaries, including the South Fork Imnaha, Big Sheep Creek and Lick Creek. Although spawning has been observed in the South Fork Imnaha, it is not known if it occurs on an annual basis. The majority of spawning in Big Sheep Creek currently occurs from RM 29.4 to RM 33.4 (Ashe et al. 2000), while in Lick Creek, spawning locations are generally found in the lower 4.5 miles (B. Knox, ODFW, personal communication, April 12, 2001). Juvenile chinook use portions of the mainstem for rearing, but are also present in lower Cow, lower Lightning, lower Horse, Big Sheep, and Lick creeks (Gaumer 1968; Huntington 1994), and are suspected to use the lower reaches of Skookum (RM 53.7), Gumboot (RM 46.8), Mahogany (RM 45.0), Crazyman (RM 42.8), Summit (RM 37.5), Grouse (RM 34.7), and Freezeout creeks (RM 29.4) (Mundy and Witty 1998).

Prior to their emigration in June, parr and presomolts will distribute throughout Big Sheep Creek and the upper, middle and lower Imnaha, and Snake River from September through winter and spring (Schwartzberg et al. in prep; Ashe et al. 2000). Gaumer (1968) documented some movement of fry and small parr into the lower Imnaha and lower Big Sheep Creek during spring months, however determined that the peak movement of parr into lower Big Sheep Creek occurred in November, while peak movement into the lower Imnaha occurred during October and November. The fact that little or no movement of juvenile fish occurred during summer months could be due to elevated water temperatures from July into September (Ashe et al. 2000). During summer months, water withdrawals by irrigation diversions in upper portions of Big and Little Sheep Creek may contribute to higher water temperatures in lower Big Sheep Creek and the lower Imnaha River due to a reduction in flow volume.

Naturally produced Imnaha chinook smolts exhibit different emigration patterns than hatchery-reared smolts. Naturally produced fish typically maintain a protracted emigration from the system, and have been documented passing the Cow Creek fish trap (RM 4) from the middle of September to the middle of July (Schwartzberg et al. in prep. and Ashe et al. 2000).

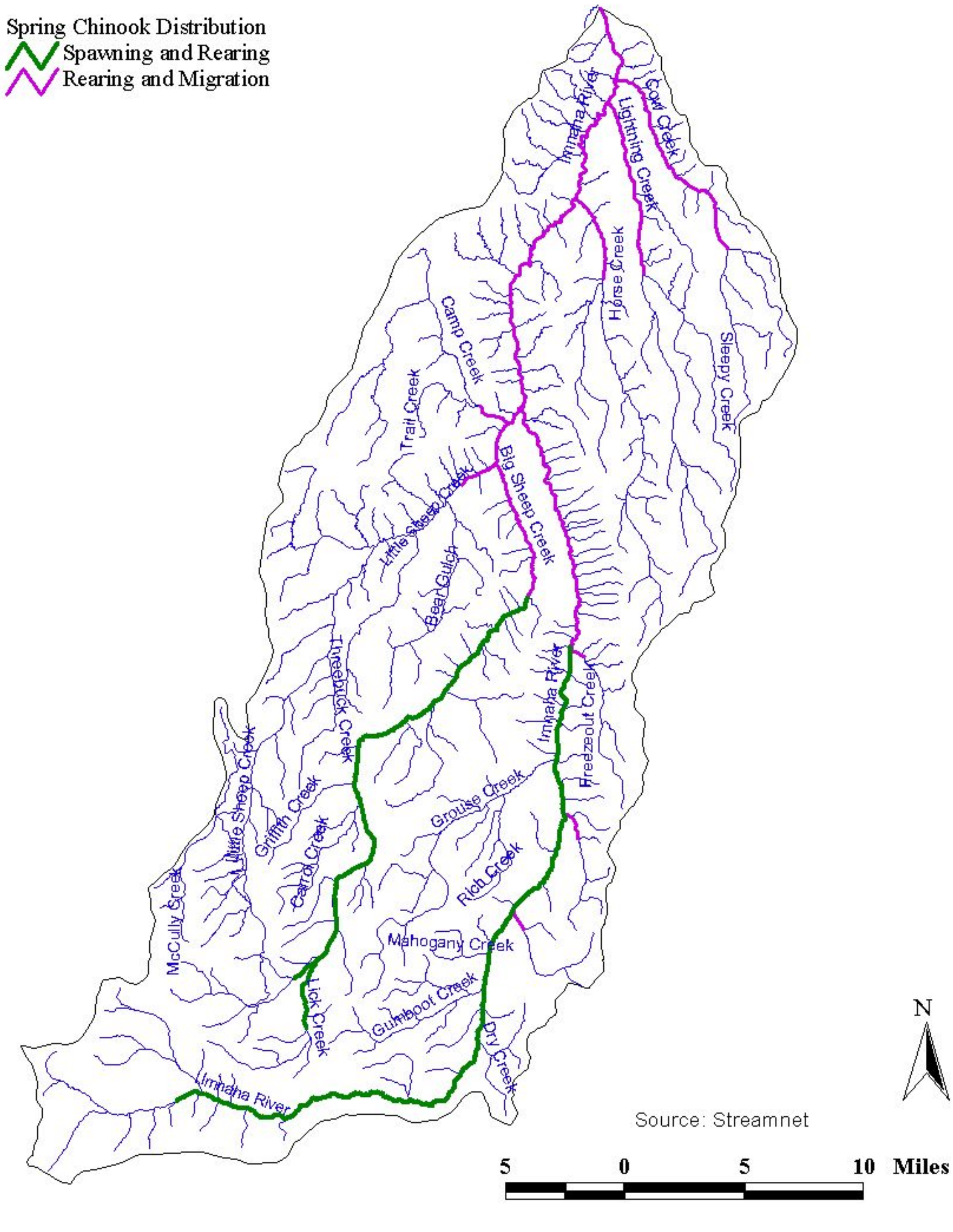

Figure 18. Spawning and rearing locations of Imnaha spring/summer chinook

Hatchery produced chinook salmon were documented to have short emigration periods in 1994 (Ashe et. al. 1995), 1995 (Blenden et. al. 1996), 1996 (Blenden et. al. 1997), 1997 (Blenden et. al. 1998), 1998 (Cleary et. al. 2000 in prep), and 1999 (Cleary et al. in prep). The emigration timing and pattern of arrival of hatchery chinook salmon at RM 4 may be influenced by the release strategy. The release strategies from 1994 to 1998 where either direct stream releases, acclimated forced stream releases, or a combination of direct and acclimated forced releases.

In 1999, the first volitional release of hatchery smolts occurred and resulted in fish passing the Cow Creek facility from early March to early June, and peaking between the middle of March and the middle of May. It appears that the acclimated volitional release strategy used in 1999 allowed for a more prolonged migration of hatchery chinook salmon at RM 4 in 1999. Arrival timing of natural and hatchery chinook salmon smolts at Snake River dams has been documented since 1992 (Table 20, Table 21). The observed median arrival dates for natural chinook salmon at Lower Granite Dam have ranged between April 22 and May 4 from 1993 to 1999, with 90% of arrivals occurring between May 6 and 22nd. Hatchery chinook have similar arrival timing at Lower Granite Dam with median arrival times of April 21 to May 12 and 90% arrival completed by May 6 and May 16th from 1992 to 1999. Overall, downstream movement of Imnaha chinook to the lower four Snake River dams, appears to be earlier than for other Snake River Basin populations (Mundy and Witty 1998; Ashe et al. 2000).

Season-wide estimates of juvenile chinook salmon survival from the mouth of Imnaha River to Lower Granite Dam have been made since 1993. Survival estimates of spring emigrating natural chinook salmon have ranged from 0.76 in 1994 to 0.909 in 1995 (Figure 19; Cleary et al. 2000, in prep.). Survival estimates of hatchery chinook salmon smolts have ranged from 0.671 in 1994 to 0.804 in 1997 (Figure 20; Cleary et al. 2000, in prep.).

Table 20. Arrival timing of spring PIT tagged Imnaha River natural chinook salmon smolts at Lower Granite, Little Goose, Lower Monumental, and McNary dams from 1993 to 1999 (Cleary et al. in prep).

Impoundment	Year	Sample Size n	Date Range		Arrival Timing	
			From	To	Median	90%
Lower Granite	1999	1,288	Mar 28	Jul 15	Apr 27	May 22
	1998	1,630	Apr 1	Jun 27	Apr 25	May 6
	1997	74	Apr 6	May 18	Apr 22	May 11
	1996	421	Apr 6	Jun 12	Apr 30	May 18
	1995	184	Apr 11	Jul 11	May 1	May 11
	1994	348	Apr 14	Jun 23	Apr 24	May 11
	1993	109	Apr 21	Jun 12	May 4	May 14
Little Goose	1999	2,099	Apr 9	Aug 1	Apr 29	May 22
	1998	837	Apr 14	Jun 25	May 3	May 12
	1997	70	Apr 15	May 22	Apr 26	May 11
	1996	358	Apr 12	Jun 16	Apr 27	May 20
	1995	144	Apr 15	Jul 15	May 7	May 20
	1994	194	Apr 23	Jun 17	Apr 28	May 7
	1993	46	Apr 27	Jun 2	May 3	May 16
Lower Monumental	1999	688	Apr 9	Aug 4	May 1	May 23
	1998	289	Apr 19	Jun 8	Apr 30	May 11
	1997	74	Apr 20	Jun 1	Apr 30	May 14
	1996	359	Apr 13	Jun 15	May 10	May 22
	1995	142	Apr 19	Aug 4	May 8	Jun 4
	1994	215	Apr 25	Jul 26	May 1	May 24
	1993	37	May 3	Jun 2	May 8	May 13
McNary	1999	152	Apr 18	Jun 27	May 6	May 21
	1998	187	Apr 19	Jun 2	May 1	May 15
	1997	24	Apr 22	May 19	May 1	May 12
	1996	148	Apr 19	Jun 8	May 14	May 24
	1995	89	Apr 28	Jul 9	May 12	May 21
	1994	229	Apr 29	Jul 16	May 12	May 28
	1993	20	May 3	Jun 15	May 9	May 21

Table 21. Arrival timing of PIT tagged Imnaha River hatchery chinook salmon smolts at Lower Granite, Little Goose, Lower Monumental, and McNary dams from 1992 to 1999 (Cleary et al in prep).

Impoundment	**Year**	**Sample Size n**	**Date Range**		**Arrival Timing**	
			From	**To**	**Median**	**90%**
Lower Granite	1999	267	Apr 18	May 25	May 5	May 14
	1998	696	Apr 15	May 22	May 2	May 9
	1997	227	Apr 16	May 22	May 5	May 14
	1996	169	Apr 13	May 26	May 7	May 16
	1995[1]	128	Apr 13	Jun 7	May 2	May 13
	1995[2]	83	Apr 16	May 22	May 8	May 15
	1994	129	Apr 24	May 18	May 12	May 12
	1992[3]	273	Apr 12	Jun 6	Apr 21	May 6
Little Goose	1999	387	Apr 16	Jun 6	May 10	May 19
	1998	391	Apr 25	May 26	May 7	May 14
	1997	267	Apr 20	May 27	May 9	May 18
	1996	131	Apr 23	Jun 6	May 13	May 20
	1995[1]	114	Apr 26	Jun 11	May 10	May 20
	1995[2]	67	Apr 27	Jun 7	May 12	May 23
	1994	65	Apr 28	Jun 2	May 14	May 21
	1992[3]	116	Apr 17	May 22	Apr 27	May 5
Lower Monumental	1999	124	Apr 23	May 25	May 11	May 20
	1998	143	Apr 23	May 26	May 8	May 15
	1997	199	Apr 25	Jun 3	May 10	May 19
	1996	136	Apr 23	May 29	May 15	May 23
	1995[1]	106	Apr 27	Jun 10	May 12	May 21
	1995[2]	71	Apr 29	Jun 9	May 17	May 26
	1994	73	Apr 30	Jun 7	May 14	May 20
McNary	1999	56	May 2	May 26	May 19	May 24
	1998	53	May 2	May 30	May 11	May 19
	1997	61	May 1	Jun 1	May 10	May 19
	1996	55	May 1	May 27	May 16	May 23
	1995[1]	67	Apr 29	Jun 9	May 16	May 23
	1995[2]	36	May 3	May 30	May 16	May 22
	1994	119	May 6	Jun 17	May 21	May 26
	1992[3]	61	Apr 27	Jun 1	May 8	May 17

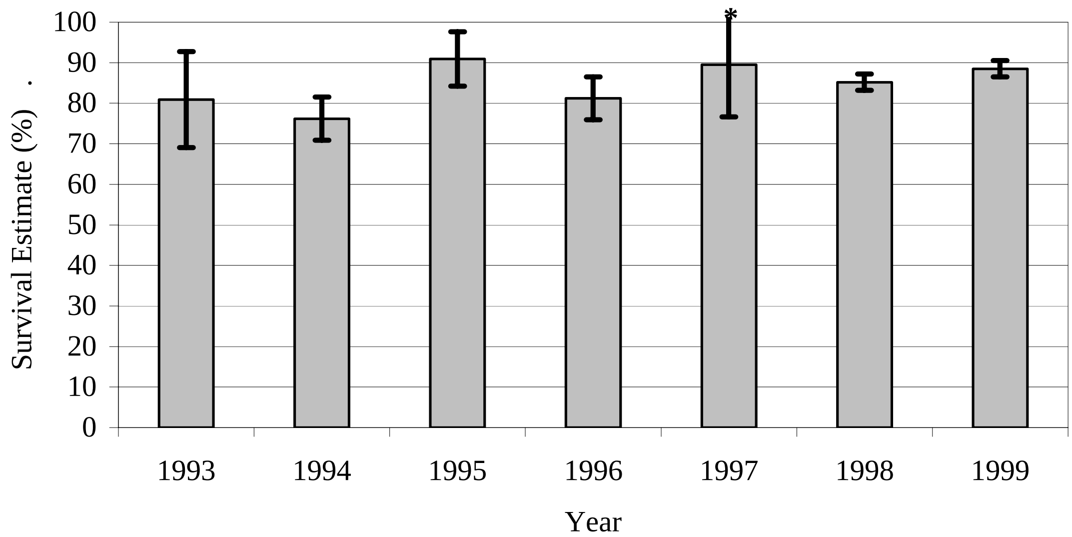

Figure 19. Season-wide survival estimates for natural chinook salmon released from the Imnaha River trap to Lower Granite Dam, from 1993 to 1999. Error bars indicate 95% confidence limits. Asterisks indicate upper confidence levels greater than 100% (Modified from Cleary et al. 2000 and Cleary et al in prep).

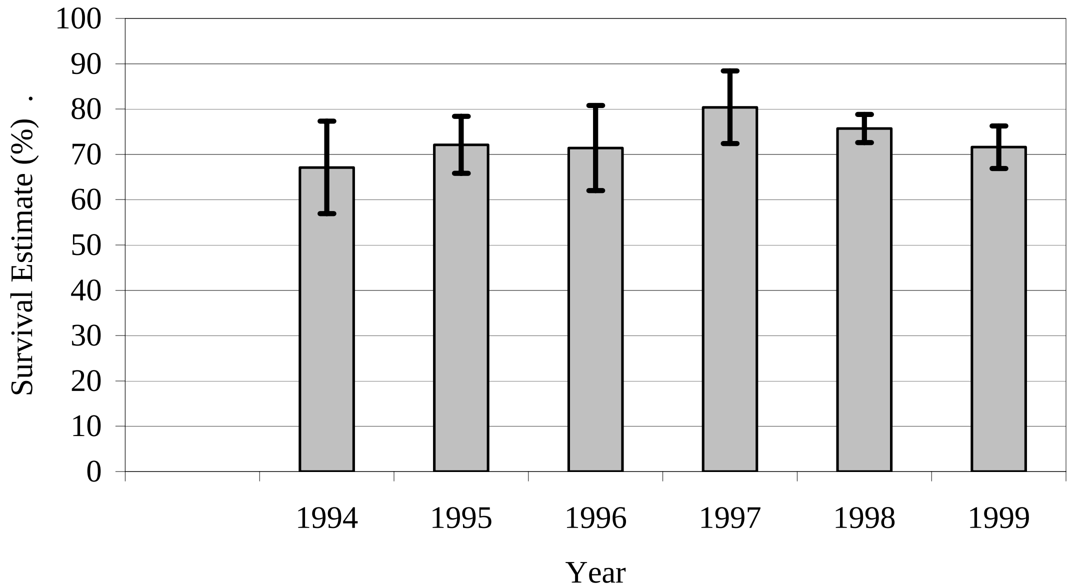

Figure 20. Season-wide survival estimates for hatchery chinook salmon released from the Imnaha River trap to Lower Granite Dam, from 1993 to 1999. Error bars indicate 95% confidence limits (Modified from Cleary et al. 2000 and Cleary et al in prep).

In comparison with spring chinook pre-smolts from other Snake River subbasin streams, the mean length and weight of juvenile chinook sampled from the Imnaha in late

September each year between 1988-1990 were among the smallest recorded (Mundy and Witty 1998). The mean length and weight of the same pit-tagged Imnaha smolts interrogated at Lower Granite dam was considerably greater however, than other Snake River chinook. The difference suggests that the Imnaha population probably increases in length and weight during the winter faster than other Snake River chinook populations, and that this difference may account for their earlier arrival at the lower four hydroelectric facilities on the Snake River (Mundy and Witty 1998).

Spring chinook harvest in the Imnaha has fluctuated over the years. Sport harvest restrictions were first imposed by the State of Oregon on spring chinook anglers in 1916, where the daily bag limit was set at 50 pounds of chinook per day (Mundy and Witty 1998). This limit was reduced to 20 pounds per day in 1925, and eventually reduced to two fish per day, or 10 jacks per day, at the close of the fishing season in 1978 (Ashe et al. 2000).

Accompanying bag limits were restrictions on season of harvest and location of harvest. Fishing was prohibited above Grouse Creek circa 1944-1954 in an effort to protect spawning chinook. The upper boundary gradually moved downstream to Freezeout Creek restricting anglers to waters below Freezeout Creek Bridge. Between 1974 and 1979, the sport-fishing season was closed three times due to declines in adult returns (Table 22). Adult returns have not been sufficient to support a sport fishery since 1978 despite hatchery supplementation efforts (Ashe et al. 2000).

Table 22. Sport harvest of Imnaha river chinook salmon between 1953 and 1997 (Beamesderfer et al. 1997). Table 22 reflects results from the PATH analysis. Data are from punch card records that were adjusted for non-response bias and for entries that showed harvest during times of the year when there was not an open season on the Imnaha

Year	Sport	Tribal	Total	Year	Sport	Tribal	Total
1953	149	149	298	1971	19	19	37
1954	15	15	30	1972	17	17	34
1955	20	20	39	1973	107	107	214
1956	21	21	41	1974	0	0	0
1957	187	187	374	1975	0	0	0
1958	117	117	234	1976	0	0	0
1959	168	168	336	1977	44	44	88
1960	201	201	402	1978	0	0	0
1961	42	42	84	1979	0	0	0
1962	9	9	18	1980	0	0	0
1963	14	14	28	1981	0	0	0
1964	0	0	0	1982	0	0	0
1965	3	3	6	1983	0	0	0
1966	24	24	49	1984	0	0	0
1967	10	10	21	1985	0	0	0
1968	61	61	121	1986	0	0	0
1969	9	9	19	1987	0	0	0
1970	4	4	7	1988-2000	0	0	0

Fall Chinook

Fall chinook salmon are present in the Imnaha subbasin, however their abundance is significantly reduced from historic levels. Anecdotal accounts suggest that fall chinook may have historically used the lower 19.5 miles of the Imnaha mainstem for spawning, and generally did not occur above the town of Imnaha (Chapman 1940). Others contend that fall chinook spawning occurred as far upstream as the confluence of Freezeout Creek (Fernan Warnock personal communication cited in Mundy and Witty 1998).

Fall chinook redd surveys, which have occurred since 1964, document the occurrence of spawners along the lower four miles of the Imnaha (Figure 21), although spawning fish have been observed as high as Fence Creek (RM 14.3). Due to the low escapement, the contribution of spawning to brood-year recruitment has not been demonstrated (Chapman and Witty 1993), and it is likely that some of the spawners represent hatchery strays (Wallowa-Whitman National Forest 1999; Neeley et al 1993). A total of nine fall chinook redds were observed in the lower Imnaha [RM 0.0 (mouth) – RM 4.0 (Cow Creek Bridge)] during nine searches in 1999. Two additional flights from Cow Creek up to Freezeout Creek (RM 35) did not identify any redds.

The suitability and availability of fall chinook spawning substrate does not appear to be a factor limiting production of the species. Surveys conducted by Thompson and Hass in 1959 identified 2,566 square yards of good, and 12,967 square yards of marginal fall chinook spawning gravel in the Imnaha River between Imnaha and the mouth (Mundy and Witty 1998). Thompson and Haas (1960) reported enough gravel was available for the construction of 600-fall chinook redds in the mainstem between Horse Creek and the mouth.

Some have suggested that excessively low temperatures may limit embryonic development of Imnaha fall chinook and consequently reduce production (Mundy and Witty 1998), although supporting data is limited. Others suggest that juvenile fish may be swept out of the system during spring runoff, however this theory is also speculative and currently unfounded.

Information relating to juvenile fall chinook rearing in the Imnaha subbasin is limited. Development of parr is considered to be rapid, with fish initiating their seaward migration in July and August as zero-aged smolts (Mundy and Witty 1998). Differentiation between fall and spring chinook (Table 23) may be inferred by studies conducted on growth and movement patterns of other Snake River fall chinook populations (Connor et al. 1993).

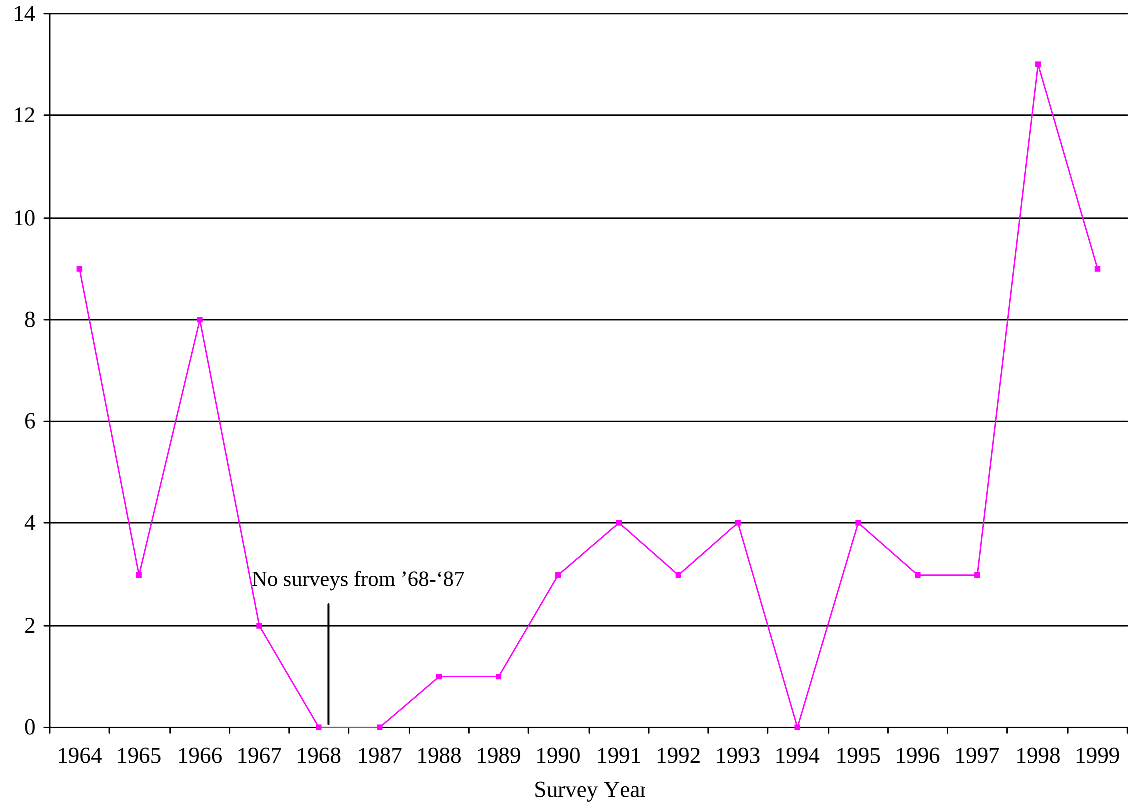

Figure 21. Number of fall chinook salmon redds counted in the Imnaha River between the years 1964 – 1999 (from Garcia 2000; Mundy and Witty 1998).

Table 23. Maximum and minimum fork lengths for in-season race identification of fall chinook salmon seined on the Snake River (Connor 1993).

Limit	**Estimated fall chinook salmon size (mm) by date**								
	5/21	**5/28**	**6/4**	**6/11**	**6/18**	**6/25**	**7/2**	**7/9**	**7/16**
Maximum	70	73	76	78	81	84	87	89	92
Minimum	55	55	55	55	55	58	61	64	66

Bull trout

Historical accounts of bull trout populations in the Imnaha are limited. Short segments of historic resident bull trout spawning and rearing habitat have been identified in upper Little Sheep Creek and Cabin Creek (USDA Forest Service 2000a). Unlike other salmonids, it is doubtful that bull trout occupied all accessible streams at any one time (USDA Forest Service 2000a), due to their current patchy distribution in even pristine, “stronghold” habitat types (Rieman and McIntyre 1993; Rieman and McIntyre 1995). In the Imnaha, historic distribution likely was similar to current distribution ((M. Hanson, ODFW, personal communication, April 23, 2001). Anecdotal accounts from anglers who fished the Imnaha River in the 1940’s describe the river as “a good Dolly Varden stream” with large bull trout being caught frequently (Buchanan et al. 1997).

Bull trout currently occur in the mainstem Imnaha River and its tributaries. Imnaha bull trout are also suspected to use habitat outside of the subbasin, including Granite Creek, Sheep Creek and some portions of the Snake River from Hells Canyon Dam downstream to a point as yet undefined (M. Hanson, ODFW, personal communication, April 23, 2001). The Imnaha bull trout recovery unit team, a group lead by ODFW biologists, suspects that the Imnaha/Snake Recovery Unit contains up to two core areas, but for the purposes of recovery should be considered as one core area. These areas include the Imnaha Core Area, which is comprised of all tributaries containing local populations (both current and potential as identified by the recovery unit team), and the mainstem Imnaha River from the headwaters downstream to the confluence with the Snake River (M. Hanson, ODFW, personal communication, April 23, 2001). Sheep and Granite Creek populations could constitute a separate core area. The lack of understanding of Snake River utilization by Imnaha bull trout currently represents a research need (M. Hanson, ODFW, personal communication, April 23, 2001).

Potential subpopulations of bull trout have been identified in the Imnaha subbasin. These include the Imnaha River above and below Imnaha Falls, Big Sheep Creek and Little Sheep Creek (USDA Forest Service 2000a). Based on sampling of bull trout densities (Table 24) ODFW believes there are greater than 2,000 bull trout in the upper Imnaha River and Big Sheep Creek and fewer than 500 in Little Sheep Creek.

Table 24. Estimated density of bull trout in selected streams in the Imnaha subbasin sampled in 1992 (ODFW data presented in Buchanan et al. 1997)

Stream	Site Number	Estimated density (fish/100 sq. m) By size class[1]	
		1 to 75 mm	76 to 300 mm
Big Sheep Creek	1	0.00	0.00
	2	18.32	5.61
	3	0.00	7.40
Salt Creek	1	5.87	18.77
Lick Creek	1	0.66	0.00
	2	55.49	15.76
Little Sheep Creek	1	0.00	0.00
	2	0.00	0.00
McCully Creek	1	1.74	7.84
	2	0.57	7.35
	3	0.00	5.79

[1/] Size class 1 to 75 mm considered to be 0+ age, while fish 76 to 300 mm are considered to be older than 0+ age.

Both resident and fluvial forms of bull trout occur in the Imnaha subbasin. Generally, most bull trout occurring above Imnaha Falls are considered to be resident forms, while those occurring below the falls are considered fluvial. Fluvial populations occur throughout the mainstem up to Imnaha falls (Figure 22) (USDA Forest Service 2000a). Fluvial forms are also found in Big Sheep Creek and Little Sheep Creek. Although unconfirmed, it is likely that fluvial forms of Imnaha bull trout use the Mid-Snake River for overwintering and as a migration corridor, as bull trout occurrence has been reported from the mouth of the Imnaha up to Hells Canyon Dam (Buchanan et al. 1997). Idaho Fish and Game personnel have observed bull trout in Idaho streams entering this reach of the Snake River at the mouth of Sheep, Granite, Deep, and Wolf creeks (T. Cochanaur, Idaho Fish and Game, personal communication, November 1995 cited in Buchanan 1997).

Resident forms are most common in the North Fork and Middle Fork of the North Fork Imnaha (USDA Forest Service 2000a). The recent decommissioning of the “Power” canal has not improved connectivity between bull trout populations occurring in McCully, Ferguson, Canal, and Redmont Creeks (USDA Forest Service et al. 2001), since the presence of the Wallowa Valley Improvement Canal continues to isolate populations from downstream groups of fish (Buchanan et al. 1997; M. Hanson, ODFW, personal communication, April 23, 2001). The resident population in Big Sheep Creek, estimated at less than 2,000 individuals, exists above the Wallowa Valley Improvement Canal in both the North and South forks of Big Sheep Creek (USDA Forest Service et al. 2001).

Imnaha River bull trout rearing and migratory habitat primarily occurs below (Freezeout Creek Service 2000a). Spawning occurs in Big Sheep Creek above its confluence with Carrol Creek (RM 25) and in Little Sheep Creek above the USFS boundary (RM 28) (USDA Forest Service 2000). Presence of 0+ age fish in big Sheep Creek and its tributaries (Lick and Salt Creek), McCully Creek, Cliff Creek, and the South Fork Imnaha indicate that these streams are also used for spawning (Buchanan et al. 1997).

Samples for genetic analysis were taken in 1995 from the North Fork Imnaha River, McCully Creek, and Lick Creek, and compared to bull trout throughout Oregon, Washington, and elsewhere in the Columbia Basin (Buchanan 1997). Analysis from these data show that populations from the John Day Basin and Northeastern Oregon (including the Imnaha River basin) comprise major genetic lineages (Spruell and Allendorf 1997).

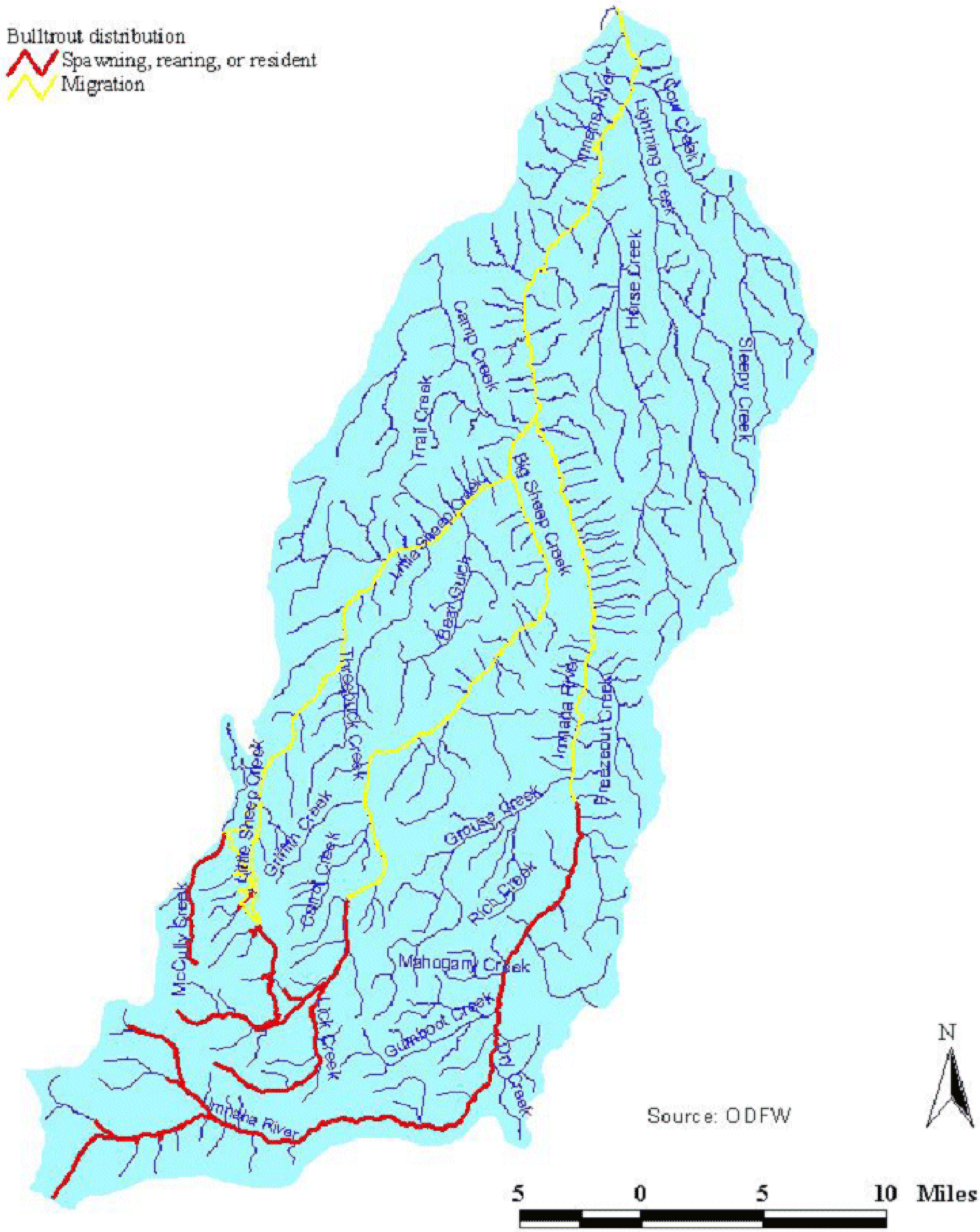

Figure 22. Bull trout rearing, spawning and migration corridors in the Imnaha subbasin

Wildlife

The Imnaha subbasin is inhabited by approximately 12 amphibian species, 19 reptile species, 239 bird species, and 69 mammal species (refer to Appendix D) (Wallowa-Whitman National Forest 1998). Some of these species, including many of the birds, only reside in the area for short periods of the year during their migration (Wallowa-Whitman National Forest 1998). The list of 339 wildlife species present in the subbasin was developed using information available from watershed assessments and restoration planning documents for the subbasin (Wallowa-Whitman National Forest 1998).

Most of the wildlife species of the Imnaha subbasin are thought to have healthy and stable populations but there are many exceptions. Many of the wildlife species within the subbasin need special consideration by managers because of known declining populations or unknown population statuses. Over a dozen endangered, threatened, or sensitive species on the Regional Forester’s sensitive species list are known to exist within the subbasin, include the subbasin in their recovery zone, or have questionable population viability (Wallowa-Whitman National Forest 1998). Table 25 shows that 38 species in the subbasin are listed or candidates for listing at the state or federal level.

The subbasin is also home to many valuable game species. Game species harvested in the Imnaha subbasin include mule and white-tailed deer, Rocky Mountain elk, black bear, cougar, turkey, pheasant, California quail, chukar partridge, Hungarian partridge, forest grouse, snipe, and mourning dove. Trapped furbearers include beaver, coyote, mink, muskrat, otter, skunk, raccoon, and weasel (Oregon Department of Fish and Wildlife 2000).

Table 25. State, federally listed, or candidate wildlife in the Imnaha subbasin (ODFW website 2000; ODFW 1997; USFWS 2001; USDA Forest Service Pacific Northwest Region 2000; Wallowa-Whitman National Forest 1995; Marshal et al. 1997)

Species		Oregon State	U.S. Forest Service	U. S. Fish and Wildlife Service
Accipiter gentilis	Northern Goshawk	Sensitive Critical	N/A	N/A
Aegolius funereus	Boreal Owl	Sensitive Undetermined	N/A	N/A
Antrozous pallidus	Pallid Bat	Sensitive Vulnerable	Sensitive	N/A
Ascaphus truei	Tailed Frog	Sensitive Vulnerable	N/A	N/A
Bartramia longicauda	Upland Sandpiper	Sensitive Critical	Sensitive	N/A
Bucephala albeola	Bufflehead	Sensitive Undetermined	Sensitive	N/A
Bucephala islandica	Barrow's Goldeneye	Sensitive Undetermined	N/A	N/A
Bufo boreas	Western Toad	Sensitive Vulnerable	N/A	N/A
Buteo regalis	Ferruginous Hawk	Sensitive Critical	N/A	N/A

Species		Oregon State	U.S. Forest Service	U. S. Fish and Wildlife Service
Buteo swainsoni	Swainson's Hawk	Sensitive Vulnerable	N/A	N/A
Chrysemys picta	Painted Turtle	Sensitive Critical	Sensitive	N/A
Coccyzus americanus	Yellow-billed Cuckoo	Sensitive Critical	Sensitive	N/A
Contopus borealis	Olive-sided Flycatcher	Sensitive Vulnerable	N/A	N/A
Dendragapus canadensis	Spruce Grouse	Sensitive Undetermined	N/A	N/A
Dolichonyx oryzivorus	Bobolink	Sensitive Vulnerable	Sensitive	N/A
Dryocopus pileatus	Pileated Woodpecker	Sensitive Vulnerable	N/A	N/A
Falco peregrinus anatum	American Peregrine Falcon	Endangered	Sensitive	N/A
Glaucidium gnoma	Northern Pygmy-owl	Sensitive Critical	N/A	N/A
Grus canadensis tabida	Greater Sandhill Crane	Sensitive Vulnerable	N/A	N/A
Gulo gulo	Wolverine	Threatened	Sensitive	N/A
Haliaeetus leucocephalus	Bald Eagle	Threatened	Sensitive	Threatened
Histrionicus histrionicus	Harlequin Duck	Sensitive Undetermined	Sensitive	N/A
Lasionycteris noctivagans	Silver-haired Bat	Sensitive Undetermined	N/A	N/A
Lepus townsendii	White-tailed Jackrabbit	Sensitive Undetermined	N/A	N/A
Lynx canadensis	Lynx	N/A	N/A	Threatened
Martes americana	American Marten	Sensitive Vulnerable	N/A	N/A
Myotis ciliolabrum	Western Small-footed Myotis	Sensitive Undetermined	N/A	N/A
Myotis evotis	Long-eared Myotis	Sensitive Undetermined	N/A	N/A
Myotis thysanodes	Fringed Myotis	Sensitive Vulnerable	Sensitive	N/A
Myotis volans	Long-legged Myotis	Sensitive Undetermined	N/A	N/A
Otus	Flammulated Owl	Sensitive	N/A	N/A

Species		Oregon State	U.S. Forest Service	U. S. Fish and Wildlife Service
flammeolus		Critical		
Pelecanus erythrorhynchos	American White Pelican	Sensitive Vulnerable	N/A	Sensitive
Picoides albolarvatus	White-headed Woodpecker	Sensitive Critical	N/A	N/A
Picoides arcticus	Black-backed Woodpecker	Sensitive Critical	N/A	N/A
Picoides tridactylus	Three-toed Woodpecker	Sensitive Critical	N/A	N/A
Podiceps grisegena	Red-necked Grebe	Sensitive Critical	Sensitive	N/A
Rana luteiventris	Columbia Spotted Frog	N/A	Sensitive	Candidate
Riparia riparia	Bank Swallow	Sensitive Undetermined	N/A	N/A
Sitta pygmaea	Pygmy Nuthatch	Sensitive Critical	N/A	N/A
Sphyrapicus thyroideus	Williamson's Sapsucker	Sensitive Undetermined	N/A	N/A
Strix nebulosa	Great Gray Owl	Sensitive Vulnerable	Sensitive	N/A
N/A = No ranking for species				

The large number of wildlife species that occur in the Middle Snake subbasin makes management on a species by species basis impractical. Wildlife management in the subbasin is conducted in an ecosystem-based framework with the goal of providing a variety of wildlife habitat conditions in all vegetative communities (Wallowa-Whitman National Forest 1999). To facilitate the discussion, wildlife species will be discussed based upon Wisdom et al.'s (2000) habitat requirement families. In constructing the families, Wisdom selected species that serve as indicators of ecosystem health and for which there is concern about habitat or population status. Representatives of 22of the 12 families designated occurring in the subbasin some cases similar families have been grouped together to facilitate the discussion. Population and trend data are discussed for wildlife species in the family when available.

Old-Forest Dependent Species

Over two-dozen species in the subbasin belong to Wisdom's low-elevation old forest or broad-elevation old forest families. Varying levels of information are available concerning the population status of these species. Many species within these families are management indicator species for the Wallowa-Whitman National forest. They include the American or pine marten (*Martes americana*), white-breasted nuthatch (*Sitta carolinensis*), pygmy nuthatch (*Sitta pygmaea*), Lewis woodpecker (*Melanerpes lewis*), pileated woodpecker (*Dryocopus pileatus*), Williamson's sapsucker (*Sphyrapicus thyroideus*), white-headed woodpecker (*Picoides* *albolarvatus*), black-backed woodpecker (*Picoides arcticus*), northern goshawk (*Accipter gentilis*), and three-toed woodpecker (*Picoides tridactylus*).

Pileated woodpecker

The pileated woodpecker, the largest woodpecker in North America is one of the most sensitive primary cavity nesters because of its large size (Wallowa-Whitman National Forest 1999). This species relies on old-forest habitat, and particularly upon large diameter snags and fallen trees under a canopy with at least 60% closure (Wallowa-Whitman National Forest 1998). Viable populations of pileated woodpeckers and other primary excavators are essential for maintaining populations of secondary cavity users (Cassirer 1995). Pileated woodpecker pairs have been documented in the subbasin during timber sale surveys (Wallowa-Whitman National Forest 1998). The HCNRA provides large amounts of unharvested forest much of it with high densities of snags and down wood habitat. In these areas populations of primary excavators are thought to be near natural population levels (Wallowa-Whitman National Forest 1999).

American marten

American marten individuals are known to occur in the subbasin, but little other population information exists (Wallowa-Whitman National Forest 1998). Winter track snow surveys located some marten tracks, with most of them occurring in late or old growth forest habitat (Wallowa-Whitman National Forest 1998). Martens need old forest habitat with snags and down wood to provide prey habitat and canopy closure to protect them from predation (Wallowa-Whitman National Forest 1998).

Flammulated owl

Flammulated owls also depend upon old-growth forests. Flammulated owl habitat tends to be a mosaic containing densely forested areas, grasslands, and areas with old-growth ponderosa pine (Wallowa-Whitman National Forest 1998). Population information for the subbasin is unknown, but reductions in ponderosa pine habitat suggest that the population size may be lower than historic levels (Wallowa-Whitman National Forest 1998).

Northern goshawk

The northern goshawk is a seasonal member of the old-forest dependent family it belongs to this family in the summer and the forest, woodland, and shrub dependent family in the winter. Nesting surveys in timber sale areas of the subbasin have located nests in old mixed-conifer stands (Wallowa-Whitman National Forest 1998; Wallowa-Whitman National Forest 1995). The Big Sheep Creek watershed's northern goshawk population is smaller than the potential population size for the area (Wallowa-Whitman National Forest 1995).

Blue grouse

Blue grouse breed in open foothills and are closely associated with streams, springs, and meadows during spring and summer. In the fall they migrate to higher elevations where they spend the winter feeding on fir needles. Large fir trees are a food source for wintering blue grouse and are required for roost sites. Blue grouse exhibit strong site fidelity to their wintering areas in true fir (*Abies spp*.) and Douglas fir (*Pseudotsuga menziesii*) forests (Larsen and Nordstrom 1999). Populations of Blue Grouse in Wallowa County have exhibited significant variation in the past 40 years. Counts conducted by ODFW of blue grouse per 10 miles ranged from 1.0 –8.9 during the period from 1961 to 1999. In 1999 5.2 birds per 10 miles were counted which is just above the averade of 4.7 (ODFW unpublished data).

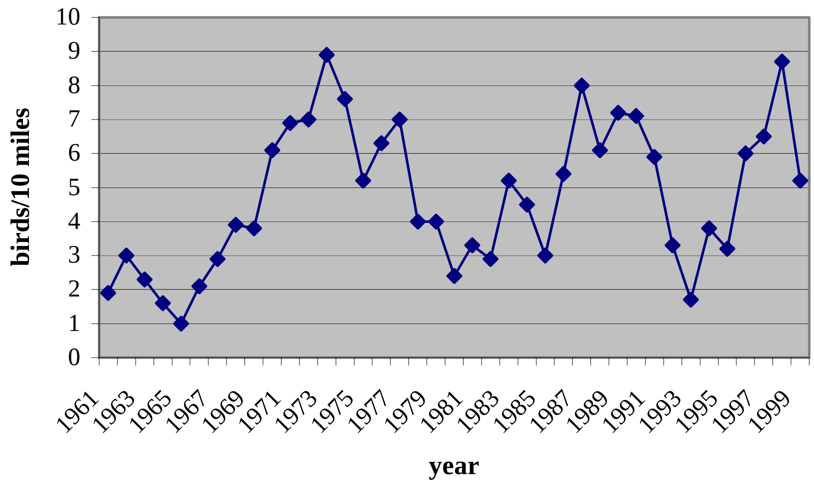

Figure 23. Blue Grouse poulation trends (birds/10 miles) Wallowa County 1961-1999 (ODFW unpublished data)

Forest Mosaic Dependent Species

Three species, the wolverine (*Gulo gulo*), the lynx (*Lynx canadensis*), and the blue grouse (*Dendragapus obscurus*), belong to the forest mosaic dependent family. From 1991 to 1994, wolverine surveys were conducted by the Wallowa-Whitman National Forest (WWNF) and concluded that wolverines were rare within the area (Wallowa-Whitman National Forest 1998). Eight sightings of wolverines have been reported to the Oregon Natural Heritage program in the Imnaha subbasin. The lynx was believed to have been extirpated from Oregon, but some believe they may still inhabit the state (Wallowa-Whitman National Forest 1995). The Oregon Department of Fish and Wildlife considers the species extirpated from Oregon (Wallowa-Whitman National Forest 1999). Two occurrences of lynx have been reported to the Oregon Natural Heritage Program in the Imnaha subbasin. No lynx reports have been confirmed for many years and surveys for lynx conducted simultaneously with the wolverine surveys by WWNF found no evidence of lynx (Wallowa-Whitman National Forest 1998). Blue grouse has a seasonally split membership in this family and the old-forest dependent family. Population information for blue grouse is discussed in the old-forest dependent species section.

Forest Mosaic and Forest Range Mosaic Dependent Species

Four species, the mountain goat (*Oreamnos americanus*), the Rocky Mountain big horn sheep (*Ovis canadensis*), the long-eared owl (*Asio otus*), and the western bluebird (*Sialia mexicana*), inhabiting the subbasin belong to the forest mosaic, and forest and grassland mosaic dependent families.

Bighorn sheep

Rocky mountain bighorn sheep have been present in the subbasin for thousands of years (Wallowa-Whitman National Forest 1995). Archeological evidence from Downey Gulch suggests that the ridge was used to drive sheep into a corral 3410 years ago (Wallowa-Whitman National Forest 1995). Early Anglo-American settlers noted the presence of big horn sheep and considered them a pest because they competed with livestock (Wallowa-Whitman National

Forest 1995). Overhunting, poor range conditions, and domestic sheep diseases led to the extirpation of bighorn sheep from Oregon in the 1940s (Oregon Department of Fish and Wildlife 1992c). Between 1979 and 1984, 36 bighorns were released into the subbasin; these animals originated from the Salmon River and Jasper National Park bighorn sheep populations (Idaho Fish and Game et al 1997). The population of this herd was estimated to be 115 in 1999(Oregon Department of Fish and Wildlife unpublished data). Bighorn hunting permits are in high demand but their issue is carefully controlled by Oregon Department of Fish and Wildlife. Between 1979 and 1996, 48 bighorn sheep permits were issued for the Imnaha bighorn sheep herd through auction and lottery. These permits resulted in the harvest of resulting in the harvest of 45 bighorns; the Imnaha herd provides more hunting opportunities than neighboring herds (Idaho Department of Fish and Game et al 1997).

Reestablishment of bighorn populations in most areas has been hampered by reoccurring pneumonia die-offs. Pasturella haemolytic and multicida bacteria have been identified as the primary causes of pneumonia in bighorns and are often the result of contact with domestic sheep. Sheep grazing, once prevalent in the Imnaha subbasin, no longer occurs (D Bryson NPT, personal communication May 2001).

Big horn sheep habitat consists of steep rocky open terrain with abundant bunchgrasses. Lambing occurs on steep cliffs, which helps the young avoid predation (USDA Forest Service 1999). The pumpkin creek drainage was highly rated as a potential release site based on the availability of lambing and winter range habitat and a low risk of exposure to domestic sheep populations.

Mountain goat

Mountain goats were extirpated from northeast Oregon prior to European settlement. Moutain goats were reintroduced to the area four times and the descendents of these goats now comprise the Wallowa Mountain herd. In 2000 the population of the Wallow mountain herd was estimated at 150 goats. Goats are beginning to pioneer vacant habitat adjacent to traditional core use areas, which will help to establish subpopulations throughout the Wallowas. Habitat is available for an estimated 600 mountain goats in the Wallowa Mountains. Mountain goats offer extremely limited hunting opportunities in the subbasin; one tag was issued for the area in 2000 and Oregon law allows hunters to hold only one mountain goat tag in a lifetime. Mountain goat management in the subbasin is guided by Oregon’s Interim Mountain Goat Management Plan (ODFW 2000b), (Nowak 2001).

Long-eared owls

Long-eared owls in the area most commonly nest in dwarf mistletoe brooms in Douglas fir-forest. Gophers voles and deer mice are the predominant prey, at least during nesting season. Populations in the region appear to be stable (Wallowa-Whitman National Forest 1999)

Gray wolf and Grizzly bear

Two additional species, the gray wolf (*Canis lupus*) and the grizzly bear (*Ursus arctos*), in these families historically occurred in the subbasin but have been extirpated (Wallowa-Whitman National Forest 1995).

Forests, Woodland, and Sagebrush; Forests, Woodland and montane shrub

Over a dozen species inhabiting the subbasin belong to these families. They include the rufous hummingbird (*Selasphorus rufus*), broad-tailed hummingbird (*Selasphorus platycercus*), black-chinned hummingbird (*Archilochus alexandri*), pine siskin (*Carduelis pinus*), northern goshawk during the winter, yuma myotis (*Myotis yumanensis*), long-eared myotis (*Myotis evotis*), fringed myotis (*Myotis thysanodes*), long-legged myotis (*Myotis volans*), Townsend's big-eared bat (*Corynorhinus townsendii*), western small-footed myotis (*Myotis ciliolabrum*), spotted bat (*Euderma maculatum*), and pallid bat (*Antrozous pallidus*).

Townsend' big-eared bat

Townsend's big-eared bat, like many of the species in this family, can inhabit a variety of macrohabitats such as forests, woodlands or shrublands but requires specific components within these general habitat types (Wallowa-Whitman National Forest 1998). Specific habitat components needed for breeding, roosting, and resting include tunnels, caves, crevices, talus, and abandoned buildings (Wallowa-Whitman National Forest 1998). Townsend's big-eared bats are year round residents of the Imnaha subbasin which contains nursery, foraging and hibernating habitat (Wallowa-Whitman National Forest 1998). Populations of Townsend's big-eared bats are thought to be decreasing in the subbasin and across the western United States; they are listed as a USFWS species of concern, and as sensitive or canidate in Oregon, Washington and Idaho. One of six significant maternity colonies of Townsend's big-eared bats documented to occur in Oregon lies entirely within the HCNRA (Wallowa-Whitman National Forest 1999).

Spotted bat

The spotted bat has specific habitat components similar to Townsend's big-eared bat. The spotted bat uses specific components such as caves, talus, cliffs, and rimrock within broader grassland, shrubland, or riparian habitats (Wallowa-Whitman National Forest 1998). Population trend and size information is not known for this species within the Imnaha (Wallowa-Whitman National Forest 1998).

Rangeland Mosaic Dependent Species

Seven Rangeland Mosaic Dependent family members inhabit the subbasin and belong to the rangeland mosaic dependent family (2000a). One mammal, Preble's shrew (*Sorex preblei*), and six birds, ferruginous hawk (*Buteo regalis*), burrowing owl (*Athene cunicularia*), short-eared owl (*Asio flammeus*), vesper sparrow (*Pooecetes gramineus*), lark sparrow (*Chondestes grammacus*), and western meadowlark (*Sturnella neglecta*), make up this family. Ferruginous hawks, short-eared owls, burrowing owls, western meadowlarks, and vesper sparrows are all highly associated with non-forested habitats, particularly mosaics of rangeland community types (Wallowa-Whitman National Forest 1998).

Six occurrences of ferruginous hawks in the subbasin have been reported to the Oregon Natural Heritage Program. In the Big Sheep Creek watershed portion of the subbasin, ferruginous hawks nest primarily on private lands (Wallowa-Whitman National Forest 1995). Population status information shows a downward trend for ferruginous hawks (Wallowa-Whitman National Forest 1995).

Sagebrush and Grassland Dependent Species

One mammal, sagebrush vole (*Lemmiscus curtatus*), and six bird species, sage thrasher (*Oreoscoptes montanus*), Brewer's sparrow (*Spizella breweri*), sage sparrow (*Amphispiza belli*), loggerhead shrike (*Lanius ludovicianus*), Columbian sharp-tailed grouse (*Tympanuchus phasianellus columbianus*), and grasshopper sparrow (*Ammodramus savannarum*), are species recognized by Wisdom et al. as sagebrush or grassland dependent.

Columbian sharp-tailed grouse

The subspecies Columbian sharp-tailed grouse was extirpated from the state of Oregon in the 1960s, but has since been reintroduced (The Nature Conservancy 2000a; The Nature Conservancy 2000b; Wallowa-Whitman National Forest 1995). The dramatic declines in the sharp-tailed grouse populations experienced in the late 1800s and early 1900s are attributed to overharvest, overgrazing, conversion of bunchgrass habitats to agriculture, and human disturbance of breeding populations (Crawford and Coggins 2000). Three reintroductions of sharp-tailed grouse occurred along Clear Lake Ridge south of Little Sheep Creek between 1991 and 1993; resulting in the releas of 86 grouse into the subbasin(Crawford and Coggins 2000). Columbian sharp-tailed grouse have also been reintroduced to the subbasin on The Nature Conservancy's Zumwalt Prairie Reserve (The Nature Conservancy 2000b).

Brewer's sparrow and loggerhead shrike are a neotropical migrants that occur in the subbasin during selected portions of the year. Both have exhibited declining population trends throughout their ranges (Wallowa-Whitman National Forest 1998).

Habitat generalist species

Many species in the subbasin utilize a number of different habitat types and can be considered habitat generalists. Many of these are important game species whose populations are managed by the wildlife biologists in the subbasin including elk, mule deer, and black bear.

Elk

Elk require a mosaic of early forage-producing stages and later cover-forming stages of forest development; both in close proximity. Management of elk in eastern Oregon is guided by the Rocky Mountain Elk Plan (Oregon Department of Fish and Wildlife 1992b). The plan was developed through a public review process and identifies acceptable population numbers and management options for each big game management unit. Big game management units all or partially contained by the Imnaha subbasin include Chesnimnus, Minam, Snake River, and Imnaha, these units are within the Wallowa district. Elk populations in the Wallowa district met or exceeded the Management Objective of 17,050 for most of the 1980s. Since 1990 Elk populations have declined; an estimated elk population of 11,800 was reported for the Wallowa district in 2001 (Oregon Department of Fish and Wildlife Oregon Department of Fish and Wildlife unpublished data). Potential factors in this decline include, poor calf survival, large predator populations, and the spread of noxious weeds on elk range. In the last three years ODFW has spent an estimated $20,000 on habitat improvements in the lower Imnaha subbasin. These projects were done in collaboration with private landowners and include weed control, seedings, fertilizing burnings and water developments (Oregon Department of Fish and Wildlife unpublished data). The majority of the elk range in the subbasin is publicly owned and damage reports are rare. The number of hunting tags issued in the area has declined by 5,000 tags in recent years, yet elk hunting opportunities remain good (Nowak 2001).

Rocky Mountain mule deer

Rocky mountain mule deer occupy a wide range of habitat types including desert shrub, woodland and conifer forest. They inhabit higher elevation areas in the summer and migrate to the lower elevation areas of the subbasin to escape deep snows in winter. Mule deer population estimates for the Wallowa district have been below the ODFW management objective of 26,800 for many years. Mule deer populations in the area have trended upwards for the last five years from a low of 17,400 in 1996 to 20,000 in 2001 (Oregon Department of Fish and Wildlife unpublished data). Unmanaged livestock grazing, encroachment of human development, invasion of noxious weeds and loss of riparian vegetation have adversely affected habitat quality and quantity on winter ranges (Nowack *et a*l 2001). Management strategies regarding mule deer were developed through a public review process and are identified in the Mule Deer Plan (Oregon Department of Fish and Wildlife 1990a).

Black Bear

The black bear is an indicator of ecosystem health (Oregon Department of Fish and Wildlife 1993a) and among the nine species determined by Cederholm et al. (2000) to have a strong consistent link to salmon. Partially as a result of recent restrictions on the use of bait and hounds when hunting bears population in the region have increased. Black bears management in the subbasin is guided by the Black Bear Management Plan (Oregon Department of Fish and Wildlife 1993a). High levels of bear predation on elk calves may be a factor in poor calf recruitment rates (Oregon Department of Fish and Wildlife 1993a).

Habitat Areas and Quality

Fish

Fish habitat quality in the Imnaha subbasin is considered to be good to excellent, especially in relation to similar subbasins (Wallowa-Whitman National Forest 1998). Habitat condition for anadromous and resident species is generally highest in the upper portions of the subbasin, and decreases with elevation, depending upon season and type of use (most notably through reaches bordered by private ground). Tributaries and mainstem reaches are used by both resident and anadromous species for spawning, rearing, and migratory life history stages.

Anadromous habitat

The total estimated number of stream miles containing anadromous fish habitat is estimated to be 397 (Wallowa-Whitman National Forest 1998; USDA Forest Service 1998a; USDA Forest Service 1998b). Without the Sheep Creek drainage area, the subbasin has 174.5 miles of fish-bearing perennial streams, 147.9 miles of non-fish-bearing perennial streams and 1,094.3 miles of intermittent streams (Wallowa Whitman National Forest 1998). The Imnaha subbasin contains an estimated 263 stream miles of summer steelhead spawning and rearing habitat (USDA Forest Service 1998a), 130.6 stream miles of spring/summer chinook spawning and rearing habitat (USDA Forest Service 1994), and approximately four to six miles of fall chinook habitat (USDA Forest Service 1994).

The National Marine Fisheries Service has designated critical salmon and steelhead habitat for species endemic to the Snake River Basin to include all areas currently accessible to the species within the range of the Evolutionarily Significant Unit (U. S. Federal Register 2000). Critical habitat inherent to this definition includes “all waterways, substrate, and adjacent riparian zones below longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years)”, which functionally provides “spawning sites, food resources, water quality and quantity and riparian vegetation” (U. S. Federal Register, 2000).

Instream habitat assessment using the NMFS Matrix of Pathways and Indicators (NMFS 1996) has been conducted throughout the Imnaha subbasin. The inventory is used to assess the ESA status of west coast steelhead populations in California, Oregon, Idaho, and Washington by evaluating the condition of their habitat (NMFS 1996). The procedure was designed to comply with Section 7 consultation requirements of the ESA, and was jointly developed by NMFS and Forest Service personnel from Regions 1, 4, and 6 (USDA Forest Service 1998a). Ratings are based upon habitat indicators, which are relative to the various life history pathways of steelhead. Criteria used to evaluate indicators are shown in Appendix E. Table 26 and Table 27 define environmental baseline for habitat indicators in the upper and lower Imnaha (respectively). Table 28 defines environmental baseline conditions for habitat indicators in the Big Sheep Creek watershed.

Table 26. Environmental baseline for habitat indicators in the lower[1] Imnaha subbasin (reproduced from USDA Forest Service 1998a)[2]

Pathways/ Indicators	Environmental Baseline		
	Properly Functioning	**At Risk**	**Not Properly Functioning**
Water Quality			
Temperature			**3**
Sediment/Substrate		**4**	
Chemical Contamination	**X**		
Habitat Access			
Physical Barriers	**5**		
Habitat Elements			
Large Woody Material			**6**
Pool Frequency and Quality			**7**
Off Channel Habitat	**8**		
Refugia	**9**		
Channel Condition			
Width:Depth Ratio	**10**		
Streambank Condition	**11**		
Floodplain Connectivity		**12**	
Flow/Hydrology			
Peak/Base Flows	**13**		
Drainage Network	**X**		
Watershed Conditions			
Road Density		**14**	
Disturbance History		**15**	
Riparian Reserves		**16**	
OVERALL WATERSHED CONDITION	**17**		
CONDITION: USFS SYSTEM LANDS	**X**		
CONDITION: PRIVATE LANDS		**X**	

Notes:

1. The lower Imnaha River Watershed encompasses the mainstem Imnaha River from RM 0 to approximately RM 24.
2. Information Source: Stream Surveys. Wallowa County-Nez Perce Salmon Recovery Plan 1994 (revised September 1999).

3. TEMPERATURE: Stream temperatures are at environmental potential but do not meet PACFISH and NMFS matrix criteria. The Lower Imnaha River flows through low elevation grasslands and basalt rock. At the confluence with the Snake River the elevation is approximately 950 feet. By RM 23, the Imnaha has climbed to an elevation of 1,600 feet. Modification to the floodplain and riparian vegetation has been noted on private land along the mainstem. Here cultivation, farming, and settlement has reduced the occurrence of cottonwood. Personal observation has shown that **Perennial Tributaries** are Properly Functioning.
   Mainstem of the Imnaha River, Reach 1-6, is at environmental potential for most of the length.
4. SEDIMENT: **Perennial Tributaries** – appears to be a result of fire and windfall. Stream surveys have little reference to cattle related impacts. **Mainstem of the Imnaha River, Reach 1-6;** unstable cobble and gravel bars related to the 1997 flood.
5. PHYSICAL BARRIERS: The only known barrier is a culvert on Rd. 4240-250 at the head of Upper Horse Creek Subwatershed.
6. LARGE WOODY MATERIAL: **Perennial Tributaries** – Properly Functioning. Channel modification in Lower Lightning Creek, on private property, has reduced future recruitment. **Mainstem of Imnaha River, Reach 1-6** is at natural potential even though it does not have $\geq$20 pieces per mile and recruitment potential is limited. Because of the arid grassland environment, channel size, and flow velocities: most large wood is floated in from upstream. LWM collects in jams of smaller pieces having been tumbled and worn during transport. Cultivation of riparian areas has reduced the abundance of cottonwood adjacent to the river.
7. POOL FREQUENCY: Does not meet PACFISH guidelines and the NMFS Matrix. This is due to the Stream Survey methodology for collecting pool information and inherent channel limitations. Stream Survey methodology does not collect information in pools which are less than full width in size, thus pocket pools and partial width pools are not counted. Stream survey notes indicate that pocket pool habitat may occupy up to 30 percent of the channel. In addition, bedrock outcrops, boulders, and channel morphology features (sinuosity, gradient) are the primary pool forming factors in the mainstem of the Imnaha River. Given the Imnaha Rivers' width and gradient, most wood is found along the channel margins or in large wood jams. Here it provides slow water habitat and pocket pools. **Perennial Tributaries** are at natural potential and Properly Functioning. Perennial tributaries are Rosgen A and B type channels with step pool morphology formed by boulders and wood. **Mainstem of the Imnaha River, Reach 1-4,** pool frequency is at natural potential (Properly Functioning) from the Snake River confluence upstream to Reach 4 (beginning of the cultivated lands and channel modifications). The **Mainstem of the Imnaha River, Reach 4-6** is below potential due to cultivation and channel modifications (At Risk). The Imnaha River is a Rosgen B channel with C channel types where the gradient reduces. Pools are primarily plunge and step pools formed at bedrock constrictions, behind boulders, and at sinuosity curves.
8. OFF-CHANNEL HABITAT: Properly Functioning throughout the watershed except where the channel has been modified (Imnaha River Reach 4-6 and Lower Horse Creek and Lightning Creek).
9. REFUGIA: Properly functioning throughout the watershed except where the channel has been modified (Imnaha River Reach 4-6 and Lower Horse Creek and Lightning Creek).
10. WIDTH:DEPTH RATIO: Properly functioning throughout the watershed except where the channel has been modified (Imnaha River Reach 4-6 and Lower Horse Creek and Lightning Creek).
11. STREAMBANK CONDITION: **Perennial Tributaries** – Properly Functioning. Stream surveys note bank instability related to fire and windthrow. **Mainstem of the Imnaha River, Reach 1-6** – At Risk due to the effects of the 1997 Flood. Minor instability related to roading, trails, cultivation on private land.
12. FLOODPLAIN CONNECTIVITY: **Perennial Tributaries** – Properly Functioning. **Mainstem of the Imanaha River, Reach 1-6**, At Risk due to landuse and ownership patterns within the watershed.
13. BASEFLOW/PEAKFLOW: Cumulative effects including impacts within the Upper Imnaha River basin. Throughout the upper and lower basins, activities have been/are concentrated along the river corridor.
14. ROAD DENSITY: Overall road density is low, but most subwatersheds have stream bottom roads.
15. DISTURBANCE HISTORY: ECA is not a concern within the watershed however disturbance has been/is concentrated along the river corridor.
16. RIPARIAN RESERVES: Activities have been/are concentrated in the riparian reserves, especially on private lands.
17. **OVERALL WATERSHED CONDITION: BETWEEN PROPERLY FUNCTIONING AND AT RISK.**

Table 27. Environmental baseline for habitat indicators in the upper[1] Imnaha subbasin (reproduced from USDA Forest Service 1998a)[2]

Pathways/ Indicators	**Environmental Baseline**		
	Properly Functioning	**At Risk**	**Not Properly Functioning**
Water Quality			
Temperature			**3**
Sediment/Substrate	**4**		
Chemical Contamination	**X**		
Habitat Access			
Physical Barriers	**5**		
Habitat Elements			
Large Woody Material			**6**
Pool Frequency and Quality			**7**
Off Channel Habitat	**8**		
Refugia	**9**		
Channel Condition			
Width:Depth Ratio	**10**		
Streambank Condition	**11**		
Floodplain Connectivity	**12**		
Flow/Hydrology			
Peak/Base Flows	**13**		
Drainage Network	**X**		
Watershed Conditions			
Road Density	**14**		
Disturbance History	**15**		
Riparian Reserves	**16**		
OVERALL WATERSHED CONDITION	**17**		
CONDITION: USFS SYSTEM LANDS	**X**		
CONDITION: PRIVATE LANDS		**X**	

Notes:

1. The upper Imnaha River Watershed encompasses the mainstem Imnaha River from RM 24 (approximately 0.7 miles upstream of the town of Imnaha) to RM 77. The river flows eastward from the Eagle Cap Wilderness before turning north to flow to the Snake River. The lower reaches of Subwatershed 09 flow through low elevation grasslands and basalt rock (grassland ecosystems dominate RM 24 to approximately RM 47). Above RM 48, the ecosystem changes to a forested environment with interspersed meadows and grasslands.
2. **INFORMATION SOURCE:** Stream Surveys. Wallowa County-Nez Perce Salmon Recovery Plan 1994 (revised September 1999).
3. TEMPERATURE: Stream temperatures are near or at environmental potential but do not meet PACFISH and NMFS Matrix criteria. Modification to the floodplain and riparian vegetation has been noted on private land along the mainstem. Cultivation, farming, and settlement has reduced the occurrence of cottonwood and conifers. In the upper reaches of the basin, the River flows through wilderness and forested landscapes. Little or no modification of the floodplain and riparian vegetation has been noted. **Perennial Tributaries** are Properly Functioning. **Mainstem of the Imnaha River, Reach 7-16** is near environmental potential, while **Reaches 17-23** are Properly Functioning (these

reaches are located within the Eagle Cap Wilderness or along portions of the river known for its recreation and scenic values).

4. SEDIMENT: **Perennial Tributaries –** The intermittent/upper perennial reaches have reference to cattle related impacts. This concern is being addressed in the Marr Flat Cattle Allotment AMP. The lower reaches of the perennial tributaries are Properly Functioning. **Mainstem of the Imnaha River, Reach 7-16** – Unstable cobble and gravel bars related to the 1997 Flood. **Mainstem of the Imnaha River, Reaches 17-23** – Properly Functioning. There is an active hillslope erosion on the North Fork of the Imnaha within the Eagle Cap Wilderness. This erosion was triggered by a side channel debris flow during a thunderstorm. The hillslope adjacent to the river contributes sediment into the Imnaha River as the river undercuts the toe of the slope.
5. PHYSICAL BARRIERS: The existence of physical barriers is unknown for perennial tributaries on private land. There are no known man-made physical barriers on Forest Service System Lands.
6. LARGE WOODY MATERIAL: **Perennial Tributaries** – Properly Functioning and At Risk. The 1997 flood scoured the channels of Blackhorse, Beaverdam, Grizzly Creek, Gumboot Creek, Summit Creek, and Nine Points Creek. Some of the headwater reaches have been harvested or roaded reducing large wood recruitment. **Mainstem of Imnaha River, Reach 7-16** – at natural potential (Properly Functioning) even though it does not have ≥20 pieces per mile and recruitment is limited. Because of the grassland environment (in the lower end of the basin), channel size, and flow velocities, most large wood is floated in from upstream. LWM collects in jams of smaller pieces having been tumbled and worn during transport. Cultivation of riparian areas has reduced the abundance of conifers and cottonwood on private land adjacent to the river. **Mainstem of the Imnaha River, Reaches 17-23** – Properly Functioning. The headwater area of the Imnaha River consists of high mountain meadows and sub-alpine ecosystems. Wood is transported to the Imnaha River by snow avalanches and debris flows.
7. POOL FREQUENCY: Does not meet PACFISH guidelines and NMFS Matrix. This is due to the Stream Survey methodology for collecting pool information and inherent channel limitations. Stream Survey methodology does not collect information in pools which are less than full width in size, thus pocket pools and partial width pools are not counted. Stream survey notes indicate that pocket pool habitat may occupy up to 30 percent of the channel. In addition, bedrock outcrops, boulders, and channel morphology features (sinuosity, gradient) are the primary pool forming factors in the mainstem of the Imnaha River. Given the Imnaha Rivers' width and gradient, most wood is found along the channel margins or in large wood jams. Here it provides slow water habitat and pocket pools. **Perennial Tributaries** are Properly Functioning or At Risk, depending upon the LWM component. The 1997 Flood scoured the channels of Blackhorse, Beaverdam, Grizzly Creek, Gumboot Creek, Summit Creek, and Nine Point Creek. Perennial tributaries are Rosgen A and B type channels with step pool morphology formed by boulders and wood. **Mainstem of the Imnaha River, Reach 7-16** – Pool frequency is At Risk (where channel modification has occurred). **Mainstem of the Imnaha River, Reaches 17-23** – Properly Functioning. The Imnaha River is a Rosgen B channel with C channel types where the gradient reduces. Pools are primarily plunge and step pools, formed at bedrock constrictions and at sinuosity curves.
8. OFF-CHANNEL HABITAT: Properly Functioning throughout the watershed except where the channel has been modified (Mainstem of the Imnaha River, Reaches 7-16), or in the 1997 Flood-scoured tributaries.
9. REFUGIA: Properly Functioning throughout the watershed except where the channel has been modified.
10. WIDTH:DEPTH RATIO: Properly Functioning throughout the watershed except where the channel has been modified.
11. STREAMBANK CONDITION: **Perennial Tributaries** – Stream surveys note bank instability related to harvest, roads, and grazing in the upper headwaters of the tributaries. Grazing concerns are being addressed during the Marr Flat AMP process. Tributaries, which flow through private land, may have reduced bank stability, depending upon the extent of land management activities. **Mainstem of the Imnaha River, Reach 7-16 –** On the Line between Properly Functioning and At Risk (At Risk in localized locations). Bank stability has been reduced in localized areas by the 1997 Flood or private land activities. **Mainstem of the Imnaha River, Reach 17-23** – Properly Functioning. There is a landslide on the North Fork of the Imnaha River within the Eagle Cap Wilderness. This slide was triggered by a side channel debris flow that formed during a thunderstorm.
12. FLOODPLAIN CONNECTIVITY: Properly Functioning except where tributaries were scoured during the 1997 Flood, or where land use and ownership patterns have altered the riparian communities.
13. BASEFLOW/PEAKFLOW: From the Blackhorse Tributary confluence upstream, there are negligible Cumulative Effects. Downstream of Blackhorse confluence, cumulative effects have been identified within the basin. Activities have been/are concentrated along the river corridor.
14. ROAD DENSITY: Overall road density is low, but most subwatersheds have stream bottom roads.
15. DISTURBANCE HISTORY: ECA is not a concern within the watershed, however disturbance has been/is concentrated along the river corridor. Within the headwater tributaries, outside of the Eagle Cap Wilderness, land use activities have resulted in cumulative effects.
16. RIPARIAN RESERVES: Activities have been/are concentrated in the riparian reserves, especially on private lands.
17. **OVERALL WATERSHED CONDITION: PROPERLY FUNCTIONING**

Table 28. Environmental baseline for habitat indicators in Big Sheep Creek[1], Section 7 Watershed (reproduced from USDA Forest Service 1998b)[2].

Pathways/ Indicators	Environmental Baseline		
	Properly Functioning	At Risk	Not Properly Functioning
Water Quality			
Temperature		**3**	
Sediment/Substrate		**4**	
Chemical Contamination	**5**		
Habitat Access			
Physical Barriers	**X**		
Habitat Elements			
Large Woody Material	**6**		
Pool Frequency and Quality		**7**	
Off Channel Habitat	**8**		
Refugia	**8**		
Channel Condition			
Width:Depth Ratio	**9**		
Streambank Condition	**10**		
Floodplain Connectivity	**8**		
Flow/Hydrology			
Peak/Base Flows		**11**	
Drainage Network	**12**		
Watershed Conditions			
Road Density		**12**	
Disturbance History		**13**	
Riparian Reserves		**14**	
OVERALL WATERSHED CONDITION		**X**	
CONDITION: USFS SYSTEM LANDS	**X**		
CONDITION: PRIVATE LANDS		**X**	

Notes:

1. Table 28 represents an average condition for the entire Big Sheep Creek Section 7 Watershed.
2. **INFORMATION SOURCE:** Big Sheep Creek Watershed Analysis 1995: Stream Survey Reports 1989-1996: Wallowa County-Nez Perce Salmon recovery Plan 1994 (revised 1999). **Stream surveys** were used to evaluate spot water temperatures, sediment/substrate, physical barriers, large woody material, pool frequency and quality, off-channel habitat, refugia, width:depth ratio, streambank condition, floodplain connectivity and riparian reserves. **Data loggers/Ryan Temp. Mentors** were used to obtain stream temperature information. **Professional judgment** and **Big Sheep Creek Watershed Analysis** were used to interpret water temperatures, sediment/substrate, chemical contamination, pool frequency and quality, off-channel habitat, refugia, streambank condition, floodplain connectivity, flow/hydrology, disturbance history and riparian reserves. **Transportation System Plans** were used for road density. On **Non-Forest Service System Lands** the Wallowa County-Nez Perce Salmon Recovery Plan and professional judgment from observations were used.

3. **TEMPERATURE**: At Risk throughout the watershed due to irrigation diversions and loss of streamside canopy through land use and fire. Stream temperatures would be expected to increase throughout the basin as one moves from sub-alpine meadows and mountain forests to grassland canyons near the confluence with the Imnaha River.
4. **SEDIMENT**: Big Sheep Creek watershed is a geologically young, dynamic system responding to mountain uplift and base level changes in the Snake River as well as the effects of land use, hydroelectric power generation, water diversions, and fire. Tributaries are actively migrating. Headwater streambank material is an unconsolidated mix of glacial till, glacial outwash, colluvium, and alluvium. The upper headwaters provide sediment throughout the watershed. Meadow streambanks are composed of fine-grained sands. These materials are easily eroded where streambank vegetation has been reduced. Fine sediment concerns related to grazing within the Marr Flat Cattle Allotment are being addressed during the Marr Flat AMP Process. Fine sediment concerns related to grazing within the Divide Cattle Allotment are addressed during the annual operating plan for the allotment.
5. **CHEMICAL CONTAMINATION:** No portion of the Big Sheep Watershed has been identified as having chemical contamination through the State of Oregon 303 (d) process. Septic tanks and feedlots may be contributing chemical contaminants.
6. **LARGE WOODY MATERIAL:** Throughout 70 percent of the watershed, LWM is at environmental potential. Within dry landscapes, LWM input appears to be cyclic in nature. Most of the streamside ponderosa pine was removed years ago by the private landowners. On the upper watershed reaches, current supplies of LWM are high due to the effects of the Canal and Twin Lakes Fires and Spruce-budworm outbreaks. Future LWM recruitment is going to be limited as new forests grow.
7. **POOL FREQUENCY:** Pool frequency rates Not Functioning when compared to PACFISH guidelines and the NMFS matrix. However, professional judgment based on onsite observations and stream survey notes, indicates an At Risk rating. This is due to the Stream Survey methodology for collecting pool information and channel constraints. Stream Survey methodology does not collect information in pools which are less than full width in size, thus pocket pools and partial width pools are not counted. Stream survey notes indicate that pocket pool habitat may occupy up to 30 percent of the channel, greatly increasing pool habitat. Most of the channels within the watershed are Rosgen A4/3 and B4/3. These channels are typically cascade and riffle systems, with irregularly spaced plunge pools and step pools. Bedrock outcrops, boulders, LWM and channel morphology features (sinuosity, substrate, gradient) are the primary pool forming factors.
8. **OFF-CHANNEL HABITAT, REFUGIA, FLOODPLAIN CONNECTIVITY:** Properly Functioning except in the lower reaches of Big Sheep Creek and Little Sheep Creek where channel and floodplain modification has reduced the occurrence of over bank flow and multi-channel development. The tremendous quantities of blowdown with the Twin Lakes and Canal Fire areas are creating a lot of off-channel habitat.
9. **WIDTH:DEPTH RATIO:** Properly Functioning except in the lower reaches of Big Sheep Creek and throughout Little Sheep Creek where channel and floodplain modification have reduced channel stability or resulted in aggradation.
10. **STREAMBANK CONDITION:** Properly Functioning except at localized locations where channel and floodplain modification or fire have reduced the bank vegetation.
11. **PEAKFLOW/BASEFLOW:** Flow regimes in Big Sheep Creek and Little Sheep Creek have been altered due to aggradation (resulting in subsurface flows), bedload transport (creation of mid-channel bars splitting flows), hydroelectric power generation, and irrigation diversions and withdrawals. The headwaters of Little Sheep Creek, Big Sheep Creek, and Carrol Creek have ECA's at or approaching 30%, resulting from the Canal and Twin Lakes Fires. These basins have localized locations of bank and channel instability.
12. **ROAD DENSITY AND DRAINAGE NETWORK:** Streambottom roads are present in most of the subwatersheds and along Big Sheep and Little Sheep Creeks.
13. **DISTURBANCE HISTORY:** In addition to the natural disturbances of geologic uplift, faulting, debris flows and avalanche, and fire (Canal Fire 25,000 acres; Twin Lakes Fire 1,700 acres), the watershed has a rich human history. Settlement along the mainstem of Big Sheep and Little Sheep Creeks and wagon trails up the tributaries attest to a love and use of the land. Most activity has been concentrated along the riparian areas with channel and floodplain modification in the middle and lower reaches of Big and Little Sheep creeks. Tributaries draining the Marr Flat and Harl Butte plateaus have been roaded, harvested and grazed over many years.
14. **RIPARIAN RESERVES:** Fire and disturbance concentrated in the riparian areas have reduced the function of the riparian zones throughout the watershed. Vegetation conditions are on an improving trend.
15. **OVERALL SUBWATERSHED CONDITION: At Risk**

A more recent application of the NMFS Matrix of Pathways and Indicators was used in an assessment of conditions in Little Sheep Creek, during the planning and investigation phases of a proposed bridge construction project. The assessment identified the following habitat indicators as either at risk or not properly functioning: water temperatures, turbidity/sediment, substrate, large woody debris, pool frequency and quality, off-channel habitat, refugia, streambank condition, floodplain connectivity, peak/base flows, drainage network increase, and disturbance history and regime (NMFS 2001).

Resident Salmonid (bull trout) Habitat Quality

Bull trout habitat in the Imnaha subbasin has been modified largely as a result of legacy effects of land use activities. Timber harvest, road building, mining, grazing, irrigation development, and recreation have contributed to the current amount and condition of available bull trout habitat in the Imnaha (Buchanan et al. 1997). Most of these activities continue to take place, although to different degrees, locations, and manners from what occurred in the past.

Bull trout habitat in the mainstem Imnaha River is generally in good condition with respect to water quality, availability of spawning gravels, and suitability of rearing habitat (Buchanan et al. 1997). Water quality, specifically stream temperatures, may be compromised in some areas due to a lack of riparian vegetation. In the lower Imnaha, stream temperatures exceeding 20°C have been recorded on occasion, which is nearing bull trout tolerance levels.

Bull trout habitat quality in the Big Sheep Creek subwatershed is mixed. The condition of riparian vegetation below the Wallowa Valley Improvement Canal, specifically that occurring along the lower 34 miles of Big Sheep and Lick creeks, is considered to be fair to poor (Buchanan et al. 1997). Riparian vegetation between Owl and Lick creeks, however, is unroaded and in excellent condition. Spawning and rearing habitat in Big Sheep Creek above the Wallowa Valley Improvement Canal occurs primarily within a wilderness area. Habitat in this portion of the subwatershed is considered to be pristine, characterized by a relatively steep gradient. Habitat in Little Sheep Creek is marginal. Land use activities, fires, flooding, and landslides have reduced the quality of bull trout habitat in Little Sheep Creek to what is characterized as the most at-risk population of fish in the subbasin (Buchanan et al. 1997).

Wildlife

Wildlife species composition and numbers naturally fluctuate as weather conditions, competition, predation, and parasitism and other environmental processes alter vegetative and wildlife communities. Manipulation of these natural processes by humans has moved some habitat conditions in the Imanha subbasin outside the natural range of variability (USDA Forest Service 1999). Habitats for wildlife have become increasingly fragmented, simplified in structure, and infringed on or dominated by exotic plants (Quigley and Arbelbide 1997).

Forest

Mixed Conifer Forests

At the landscape level, most forested habitats in the subbasin are classified as northeastern Oregon mixed conifer forests (Figure 6). Forested habitats are used by a variety of wildlife species including those from eight of Wisdom et al.'s twelve families (2000). In the Big Sheep Creek watershed alone, 122 wildlife species have been documented or are suspected to occur in mixed conifer forests (Wallowa-Whitman National Forest 1995).

At elevations of 4600-5600 feet, northern slopes contain mostly mid seral stands dominated by grand fir and Engelmann spruce((Wallowa-Whitman National Forest 1998). Fire suppression has led to overstocked stands with one or two story structures and reductions in early seral species such as ponderosa pine and western larch (*Larix occidentalis*)(Wallowa-Whitman National Forest 1998). Ponderosa pine communities in the subbasin are most common on warm, low elevation sites where they often grade into grassland communities (Wallowa-Whitman National Forest 1995). Historically, small disturbances, particularly low intensity surface fires, favored early seral species dominance (Wallowa-Whitman National Forest 1998). A variety of problems plague current late seral stands: bark beetle attacks, spruce budworm defoliation, and mortality from root rot centers (Wallowa-Whitman National Forest 1998).

Changes in the fire regimes have resulted in changes in plant community composition in forested stands. Mixed conifer forests tend to be densely stocked, providing greater fuel loads than were historically present (Wallowa-Whitman National Forest 1995). Structurally, higher levels of the understory reinitiation and stem exclusion stages exist (Wallowa-Whitman National Forest 1998; Wallowa-Whitman National Forest 1995). Meanwhile, lower levels of mid-seral and the oldest successional stages exist than historically were present (Wallowa-Whitman National Forest 1995). Understory species such as Idaho fescue and bluebunch wheatgrass were favored by the historic fire regime (Wallowa-Whitman National Forest 1998). Today's less frequent, higher intensity fires burn the herbaceous communities more severely than the low intensity fires of the past (Wallowa-Whitman National Forest 1998). As a result, Idaho fescue and bluebunch wheatgrass are out-competed and replaced by less desirable species such as annual bromes (*Bromus* spp.) (Wallowa-Whitman National Forest 1998). The communities and structures present today are "very susceptible" to "uncharacteristic stand replacement events" (Wallowa-Whitman National Forest 1998).

Montane Conifer Forests

At higher elevations, the Imnaha River flows through montane coniferous forests intermixed with alpine tundra communities (Rose *et al*. 1993). Alpine and subalpine forests contain tree species such as subalpine fir, lodgepole pine, Engelmann spruce, western larch, Douglas fir and whitebark pine (Wallowa-Whitman National Forest 1998; Wallowa-Whitman National Forest 1995). In areas where subalpine fir and Engelmann spruce are the climax community dominants, lodgepole pine and western larch are the early successional species (Wallowa-Whitman National Forest 1995). Forested communities of the headwaters area of Lick Creek, a tributary of Big Sheep Creek, contain subalpine fir, Engelmann spruce, and lodgepole pine (Mays 1992). The Imnaha River watershed portion of the subbasin has structural stage patterns in high elevation forests that "compare favorably with historic levels" (Wallowa-Whitman National Forest 1998). The Big Sheep Creek watershed portion of the subbasin differs from historical structural stage ranges (Wallowa-Whitman National Forest 1995). Fire suppression has led to more late successional stands than would have occurred historically (Wallowa-Whitman National Forest 1995). The Big Sheep Creek watershed alpine communities are "relatively healthy" (Wallowa-Whitman National Forest 1995). Subalpine fir forests are used by a variety of wildlife species including at least three amphibian species, 40 bird species, and 30 mammal species (Wallowa-Whitman National Forest 1995).

Grasslands and Shrublands

Grassland and shrubland habitat cover a large portion of the subbasin (refer to Figure 6). Much of this area is currently used or has previously been used for domestic grazing. In the Big Sheep Creek watershed, 4 amphibian, 6 reptile, 28 bird, and 18 mammal species are documented or suspected to inhabit the area's grassland communities (Wallowa-Whitman National Forest 1995). In the watershed's shrublands, 5 amphibian, 6 reptile, 51 bird, and 27 mammal species are documented or suspected to exist (Wallowa-Whitman National Forest 1995).

Canyon Grasslands

Grasslands in the subbasin between 6000 and 3000 feet tend to be members of Idaho fescue or bluebunch wheatgrass associations (Wallowa-Whitman National Forest 1998; Wallowa-Whitman National Forest 1995). At elevations below 3000 feet, bluebunch wheatgrass and sandberg bluegrass grow on warm, dry southern slopes (Nez Perce Tribe et al. 1990). Cool, damp northern slopes below 3000 feet contain bluebunch wheatgrass and Idaho fescue (Nez Perce Tribe et al. 1990). Valley bottom grassland communities are usually bluebunch wheatgrass or bluebunch wheatgrass/Idaho fescue associations (Wallowa-Whitman National Forest 1998).

A long-term analysis of allotment areas grazed from Gumboot Creek downstream showed that grassland communities on slopes are in fair to good condition with a trend of stable or improving (Wallowa-Whitman National Forest 1998). Lower canyon bench communities dominated by sand dropseed or red three-awn are in poor to good condition with a trend of stable or improving (Wallowa-Whitman National Forest 1998). Some communities in the subbasin are in disclimax due to dominant annual grasses (Wallowa-Whitman National Forest 1998). Yellow-star thistle, and other noxious weeds are prominent in many communities particularly those in the lower subbasin (Wallowa-Whitman National Forest 1999) .

Shrublands

Three shrub communities located in the subbasin are stiff sagebrush/sandberg's bluegrass (*Artemisia rigida/Poa esperus*), mountain big sagebrush/Idaho fescue (*Artemisia tridentata vaseyana/Festuca esperus*), and bitterbrush/Idaho fescue/bluebunch wheatgrass (*Purshia tridentata/Festuca esperus/Agropyron esperus*) (Wallowa-Whitman National Forest 1995). When these communities are disturbed, they are susceptible to invasions of gumweed, knotweed, mountain brome, Wyeth's buckwheat, and yarrow (Wallowa-Whitman National Forest 1995). In heavily grazed areas shrub regeneration has been impaired; this results in a loss to wildlife of both food and cover (Wallowa-Whitman National Forest 1999).

Wetlands

Most wetland habitats in the subbasin are riparian wetlands along streams. The quality and quantity of wetland habitat compared to historical ranges has been altered in parts of the subbasin by grazing, road construction, timber harvest, and changes in plant species present (Wallowa-Whitman National Forest 1998). Wetlands are essential habitat for water-dependent species and provide a water source for other species (Wallowa County and Nez Perce Tribe 1993). The availability of prey makes wetlands an important part of the habitat for eagles, hawks, and coyotes (Wallowa County and Nez Perce Tribe 1993). Species of concern that use wetland habitat in the subbasin include northern bald eagles (*Halieetus leucopephalus*), harlequin ducks (*Histronicus histronicus*), Columbia spotted frogs (*Rana luteiventris*), tailed frogs (*Ascaphus truei*), western toads (*Bufo boreas*), and American white pelicans (*Pelecanus erythrorhynchos*) (Wallowa-Whitman National Forest 1998; Wallowa County and Nez Perce Tribe 1993).

Riparian Communities

Riparian habitatis used by many species throughout their lifespan. In the Big Sheep Creek watershed, riparian and deciduous habitat had more wildlife diversity than any other type of habitat (Wallowa-Whitman National Forest 1995). Over 150 species have been documented or are suspected to occur in the watershed (Wallowa-Whitman National Forest 1995). These species include 7 amphibians, 6 reptiles, 115 birds, and 30 mammals (Wallowa-Whitman

National Forest 1995). The riparian communities along the Imnaha River are defined by the geology, drainage, aspect, and elevation of the sites (Wallowa-Whitman National Forest 1998; Wallowa-Whitman National Forest 1995). Throughout the subbasin, primary and secondary riparian zones exist. The primary riparian zone contains water, hydric soils, or hydrophytic plants (Wallowa-Whitman National Forest 1998). The secondary riparian zone shades the stream or provides large woody material to the stream (Wallowa-Whitman National Forest 1998). The canopy coverage of the Imnaha varies per lineal mile from 0% to 20%, although the actual canopy cover often occurs in clumps of up to 80% or more (Mason *et al*. 1993). Noxious weeds have invaded riparian zones along the Imnaha River. Some of the successful invaders include diffuse knapweed, yellow star thistle, and leafy spurge (Mason *et al*. 1993).

Near the headwaters of the Imnaha, the primary riparian zone is an alpine community containing grasses, sedges, and forbs with scattered willows (*Salix* spp.) along the stream bank (Wallowa-Whitman National Forest 1998). The associated secondary riparian zone has only small clusters of small trees (Wallowa-Whitman National Forest 1998). The primary zones of downstream portions of the upper reaches contain red osier dogwood (*Cornus stolonifera*) and alder with scattered patches of black cottonwood (Wallowa-Whitman National Forest 1998). Some grass and sedge meadows also occur (Wallowa-Whitman National Forest 1998). Below the first half-mile of stream, subalpine fir, lodgepole pine, and whitebark pine dominate the secondary riparian zone in downstream portions of the upper reaches (Wallowa-Whitman National Forest 1998). The lower portions of the upper reaches' secondary riparian zone include mixed conifer stands with Engelmann spruce, lodgepole pine, grand fir, ponderosa pine, and western larch (Wallowa-Whitman National Forest 1998). In these areas, the Engelmann spruce and true fir individuals are dead or dying (Wallowa-Whitman National Forest 1998).

The primary riparian zone of the middle reaches of the Imnaha River, from Indian Crossing to the town of Imnaha, contains shrub and grass/sedge communities (Wallowa-Whitman National Forest 1998). Common plants within the communities include willows, hawthorne (*Crataegus columbiana*), alder, Rocky Mountain maple (*Acer glabrum*), carex, poa, and horsetail (*Equisetum* spp.) (Wallowa-Whitman National Forest 1998). The secondary riparian zone of the middle reaches has a ponderosa pine and Engelmann spruce overstory. The understory of this zone contains low shrubs (Wallowa-Whitman National Forest 1998). On the Imnaha River downstream from Grouse Creek, the riparian zone is a mix of grassland communities, rock, and pasture areas (Rose *et al.* 1992). Woody shrubs and small trees occur along the stream banks (Rose *et al.* 1992).

The Imnaha River's lower reaches' primary riparian zone, from the town of Imnaha to the river mouth, contains low shrubs and grasses such as willows, alder, ribes (*Ribes* spp.), dogwood, brome (*Bromus* spp.), carex, and fescue (Wallowa-Whitman National Forest 1998). Cottonwood (*Populus* spp.) and scattered ponderosa pine.

Upper reaches in the Big Sheep Creek watershed have grand fir as the overstory dominant in the primary zone (Wallowa-Whitman National Forest 1995). Engelmann spruce had been an important component of the primary zone, but insect infestations have killed over half of the Engelmann spruce individuals (Wallowa-Whitman National Forest 1995). This has resulted in some areas of the primary zone lacking a tree overstory and instead containing a grass and forb community (Wallowa-Whitman National Forest 1995). Alder and willow are also prevalent in the primary riparian zone within the Big Sheep Creek watershed (Wallowa-Whitman National Forest 1995). The secondary riparian zone contains grand fir, ponderosa pine, lodgepole pine, and western larch (Wallowa-Whitman National Forest 1995). The lower reaches of Big Sheep

Creek have primary zones containing shrubs, grasses, forbs, and some trees like grand fir and Engelmann spruce (Wallowa-Whitman National Forest 1995). Big Sheep Creek's secondary zone contains ponderosa pine, Douglas fir, shrubs, and grasses or forbs (Wallowa-Whitman National Forest 1995). Overall, riparian vegetation in the Big Sheep Creek watershed contains less late seral vegetation than historically was present (Wallowa-Whitman National Forest 1995).

Special Habitat Areas

Caves

Natural caves, are abundant within the subbasin. Cave types vary from rock shelters, solution tubes in limestone formations, and fault-block and talus caves where lithic breakdown has occurred. There are also occasional ''tree-cast'' and superceded stream caves within and between basalt flows (Wallowa-Whitman National Forest 1999). Caves provide critical habitat particularly for bat species in the subbasin. The number of caves has not changed from historic to current times but recreation related disturbance may be reducing their ability to support bats (Wisdom e*t al* 2000). The HCNRA contains 16 caves on the national significant caves list but not all of these are contained in the subbasin (Wallowa-Whitman National Forest 1999).

Late and Old growth Habitat

Old and mature forested stands are an important habitat requirement for wildlife in the old-forest dependent families and some of the species in the forest mosaic family. These families account for over 25 wildlife species including the American marten, flammulated owl, pileated woodpecker, lynx, and wolverine. For the lynx, the forested mosaic must contain old forest habitat with denning sites and early seral habitat with prey species. A forested mosaic needs to have connectivity between the different habitat types. Connectivity can be detrimentally impacted by human activities such as road building or timber harvest (Wallowa-Whitman National Forest 1995).

Old forests contain large diameter trees and trees with softer wood, both qualities that make trees more suitable for some bird species to use as nesting sites. Old forests also contain more downed wood, an important component of denning sites for forest carnivores like the lynx. In the Big Sheep Creek watershed, mature and old growth seral stages have the greatest animal diversity out of all forest stages (Wallowa-Whitman National Forest 1995). In that part of the subbasin, mixed conifer mature forests have a total of 105 species, of which 64% are birds, approximately 30% mammals and the remainder comprised of either amphibians or reptiles (Wallowa-Whitman National Forest 1995). There is an estimated 73% less old forest habitat available now than was historically present in the Big Sheep Creek watershed (Wallowa-Whitman National Forest 1995).

Recent large stand replacing fires have reduced late and old growth forest habitats in the subbasin. Twenty five percent of the late and old growth habitats on the HCRNA have burned since 1970. A continued high incedence of stand replacing fires can be expected unless the high fuel loads present in dense stands of mid-seral species can be reduced. Despite these losses late and old structure forests are estimated to comprise about 30% of the HCRNA and in most parts of the HCRNA are considered above the natural range of variability (USDA Forest Service 1997). On many of the privately owned lands in the subbasin timber harvest combined with the altered fire regime has reduced the extent of late and old structural forests below that present historically (Quigley and Arbelbide 1997). Late and old growth habitat in the subbasin is most commonly found along cool, moist stream bottoms or on north-facing slopes where infrequent or low intensity fires have allowed late and old-growth characteristics to develop.

Snags

In Wallowa County, over 60 animal species use the habitat provided by snags as a food source, as a nesting site, or as a place for shelter (Wallowa County and Nez Perce Tribe 1993; Wallowa-Whitman National Forest 1995). Very large snags are used by species such as pileated woodpecker, Vaux's swift, and black bear (Wallowa-Whitman National Forest 1995). Down wood is used by over 170 animal species, including amphibians, reptiles, birds, and mammals, in Wallowa County (Wallowa County and Nez Perce Tribe 1993). The habitat provided by down wood is used as a food source, as a lookout, as a place for thermal or hiding cover, as a nesting site, as a food storage site, as a hibernation site, or as a living site (Wallowa County and Nez Perce Tribe 1993). Previous management for fire suppression and timber harvest reduced the availability of downed wood and snags in the subbasin (Wallowa-Whitman National Forest 1995). Recent fires in sections of the subbasin, such as the Twin Lakes and Canal fires, have increased availability of these habitat components in some areas (Wallowa-Whitman National Forest 1995).

Watershed Assessment

Watershed assessments completed for the Imnaha subbasin characterize historical conditions, current habitat, analysis, improvement recommendations, propagation, policies, and management planning. Some reports also cover public involvement and agency interactions with regard to implementation of management plans. The following list is not meant to be inclusive of all documents that have been produced for the Imnaha Subbasin but it is meant to be representative.

Duncan, D. and G. Cawthon (1994). *Draft Grande Ronde Model Watershed Program Operations- Action Plan*. La Grande, OR.
Provides an overview of current watershed and fish habitat conditions, describes the Grande Ronde Model Watershed Program, delineates a framework for subbasin needs, describes potential measures as current, proposed, or under consideration. Includes Imnaha River as part of the Grande Ronde watershed.

Gaumer, T. F. (1968). *Behavior of Juvenile Anadromous Salmonids in the Imnaha River, September 1964 - June 1967*. Fish Commission of Oregon; Nez Perce Tribe.
Covers timing of migration, distribution of adult anadromous fish, rearing areas of juvenile anadromous fish, and resident fish.

Huntington, C. W. (1994). *Stream and Riparian Conditions in the Grande Ronde Basin 1993*. Canby, OR: Clearwater BioStudies, Inc.
This report contains information prepared for the Grande Ronde Model Watershed Board to aid in the development of a watershed restoration program for the Grande Ronde Basin in Oregon and Washington.

Johnson Jr., C.G. and S.A. Simon. (1887). *Plant associations of the Wallowa-Snake Province.*
This assessment was conducted in response to the proposed construction of High Mountain Sheep Dam on the Snake River below the Imnaha confluence.

Mays, D. (1992). *Imnaha River Stream Survey Report*.
This report is part of the Wallow-Whitman National Forest Stream Survey Program, initiated in 1989 to inventory existing fisheries conditions and provide baseline information for wild and scenic river planning. The stream survey was collected according to USFS Region Six Version Five methodology based on Hankin and Reeves (1988) riparian vegetation data,

stream management and analysis, and reporting and tracking system. Foxpro was used to analyze the stream habitat data. The survey found the condition in 1992 to be good to excellent and meeting forest plan standards and goals. Grazing, power line right of ways, and home developments have impacted a number of reaches in the watershed. Temperatures probably always exceeded 68˚F in warm seasons.

Mays, D. (1992). Lick Creek Stream Survey Report.

Reported on results from R-6 Hankin/Reeves Stream Inventory Methodology (ver. 4.0). They found the subwatershed to be generally in good condition

Mays, D. (1992). North Fork Gumboot Creek Stream Survey Report.

Reported on results from R-6 Hankin/Reeves Stream Inventory Methodology (ver. 4.0). They found the subwatershed to be in good condition with some livestock issues in the East N. Fork and some channelization at the confluence with Gumboot Creek.

Mobrand, L. and L. Lestelle (1997). *Application of the Ecosystem Diagnosis and Treatment Method to the Grande Ronde Model Watershed Project*. Portland: Prepared for Bonneville Power Administration.

An assessment of the ability of the watershed to support and sustain natural resources and other economic and societal values. Helps guide the development of actions aimed at improving the conditions of the watershed to achieve long-term objectives.

Mundy, P. R. and K. Witty (1998). *Imnaha Fisheries Management Plan: Documentation for Managing Production and Broodstock of Salmon and Steelhead*. Fisheries and Aquatic Sciences; S. P. Cramer and Associates.

Prepared at the request of the Nez Perce Tribe as a record and guide for its fisheries management and mode of communication with its co-manager ODFW. Focus is on the basis for production of salmon and steelhead and managing allocation of spawners to hatchery broodstock and natural spawning. Includes relevant policies, objectives, recommendations, and understandings.

Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation, et al. (1990). *Imnaha River Subbasin Salmon and Steelhead Production Plan*.

This plan is one of the 31 subbasin long-term plans that comprise the NPPC's Columbia River Basin Fish and Wildlife Program for salmon and steelhead production. In addition to providing the basis for production strategies, it also documents current and potential production, summarizes agency and tribal management efforts, goals, and objectives, and identifies problems, opportunities, and strategies.

Nowakowski, M. J. (1978). Soil Depth and Elevation as a Basis for Predicting Three Steppe Habitat Types of Wallowa County, Oregon.

MS Thesis which examines three steppe habitat types by measuring aspect, slope, elevation and soil depth, and vegetation coverage, frequency and productivity. Soil depth and elevation were the best variables for distinguishing habitat types.

Parkhurst, Z. E. (1950). *Survey of the Columbia River and its Tributaries, Part VII: Snake River from above the Grande Ronde River through the Payette River*.

Rose, R. K., G. Sausen and K. Martin (1992). *Imnaha River Drainage: Assessment of Ongoing Management Activities*. Wallowa-Whitman National Forest.

Covers timber sales, silviculture, recreation, engineering, and range.

Sausen, G. (1997). *Imnaha River and Sheep Creek Section 7 Watersheds: Assessment of Ongoing and Proposed Activities. Amendment to Include Proposed Project, Marr Flat Grazing Allotment*. Wallowa-Whitman National Forest.

Classifies streams and determines conditions to help prioritize areas of resource concern within the designated area. Includes description of site-specific recommended activities. Watershed improvements since 1990 include adding large woody material into headwater intermittent and ephemeral draws and constructing exclosures to reduce impacts to headwater seeps and springs from ungulates.

Thompson, Robert N., and James B. Haas. 1960. *Environmental Survey Report Pertaining to Salmon and Steelhead in Certain Rivers of Eastern Oregon and the Willamette River and its Tributaries. Part I. Surveys of Eastern Oregon Rivers*.
Thompson and Haas surveyed watersheds in the Imnaha Subbasin for habitat condition, quantity, and quality for salmon and steelhead. They also reviewed potential hatchery sites.

USDA Forest Service, J. (1994). *Sheep Creek Section 7 Watershed: Assessment of Ongoing and Proposed Activities*. Wallowa-Whitman National Forest.

USDA Forest Service, J. (1998a). *Steelhead Consultation for Big Sheep Creek Section 7 Watershed: Assessment of Ongoing and Proposed Activities*. Wallowa-Whitman National Forest.

USDA Forest Service, J. (1998b). *Steelhead Consultation for Imnaha River Section 7 Watershed: Assessment of Ongoing and Proposed Activities*. Wallowa-Whitman National Forest.

USDA Forest Service, J. and R. B. Mason (2000). *Bull Trout Consultation for Imnaha River Section 7 Watershed: Assessment of Ongoing and Proposed Activities*. Wallowa-Whitman National Forest.

USDA Forest Service (2001). *Imnaha Subbasin Multi-Species Biological Assessment (2000-2001: Assessment of ongoing and proposed activities.* Wallowa-Whitman National Forest. Eagle Cap Ranger District, Hells Canyon Ranger District, Wallowa Valley Ranger District, Pine Ranger District.

Wallowa County and Nez Perce Tribe (1993, updated and expanded in 1999). *Salmon Habitat Recovery Plan with Multi-Species Habitat Strategy*. Assures that watershed conditions in Wallowa County provide habitat necessary for salmonids and other vertebrate species by protecting and enhancing conditions as needed. Analyzes the Imnaha River for water quantity, water quality, stream structure, substrate, and habitat requirements. Appendices include social and economic infrastructure, agriculture history, logging, mining, and vegetation.

Wallowa-Whitman National Forest (1995). *Big Sheep Creek Watershed Analysis.*
Includes erosion characterization, erosion processes, stream channel, hydrology, water quality, vegetation, species and habitat, human uses, and national forest management practices.

Wallowa-Whitman National Forest (1998). *Upper Imnaha River and Lower Imnaha River Watershed Analysis*.
Includes erosion characterization, erosion processes, stream channel, hydrology, water quality, vegetation, species and habitat, human uses, and national forest management practices.

Limiting Factors

Fish

Four tiers of information have been considered for review of limiting factors to fish populations in the Imnaha subbasin, each differing in relative scale and species considerations: (1) regional documentation for review of non-species specific factors limiting production of resident and anadromous fish in the subbasin as a whole, (2) past subbasin specific research documents and current professional judgment for review of species specific factors limiting populations in specific portions of the subbasin, (3) information compiled by the Northwest Power Planning Council as part of the subbasin planning process for review of reach specific limiting factor information related to spring chinook, fall chinook and steelhead, and (4) the 1998 §303(d) list compiled by ODEQ for review of reach specific factors limiting beneficial use(s) including support of cold water biota and/or salmonid spawning.

Subbasin Scale – Regional Sources

Anadromous fish production in the Imnaha River subbasin is currently being limited by out-of-subbasin factors. 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 (IDFG 1998; CBFWA 1991; NPPC 1992; NMFS 1995; 1997a; NRC 1995; Williams et al. 1998). This limiting factor has the effect of keeping yearly effective population size (N_b) low, increasing genetic risk and demographic risk of localized extinction.

Adult escapement of anadromous species remains low even given significant hatchery production/reintroduction efforts. Smolt-to-adult survival rates remain below the 2%-6% needed for recovery (IDFG 1998) mainly due to dams on the lower Snake and Columbia rivers. The dams cause direct, indirect, or delayed mortality, mainly to emigrating juveniles (IDFG 1998, Nemeth and Kiefer 1999) and have been estimated to cause an average mortality of 15% per dam to immigrating adults (Chaney and Perry 1976). Low adult abundance has resulted in stocking at variable rates between years, depending on the availability of brood fish. In addition, bull trout production may be limited by reductions in available forage due to loss of anadromous fish production (CBFWA 1999).

Hatchery influences to fish populations are not addressed here as limiting factors due to the debatable and often site specific nature of hatchery influences to existing fish stocks. Hatcheries play a significant role in meeting social and recovery goals of the Blue Mountain Province. Co-mangers have restructured Imnaha spring chinook programs to support recovery (ODFW 1996, see Artificial Production section). The general body of science regarding hatcheries as recovery tools suggest that natural spawning by hatchery fish can provide benefits as well as pose risks to wild populations (IMST 2001, ISAB 2001, and Brannon 2001). It is clear that hatcheries can provide a production boost for a host population, potentially preserving a population or rescuing it from a production bottleneck. The risks hatchery intervention pose to wild populations tend to be site specific and include management associated (i.e. over-harvest of weak stocks in mixed stock fisheries), genetic (i.e. artificial selection inbreeding and outbreeding depression) and ecological impacts (i.e. increased competition) (Busby et al. 1996; Evans et al. 1997; U.S. Fish and Wildlife Service and Nez Perce Tribe 1995). Given the current state of our knowledge of these benefits and risks, hatchery programs should be used appropriately considering site-specific needs to insure recovery goals are achieved.

Subbasin Specific Scale

Out of basin factors are the primary contributors limiting production and stability of key fish species in the Imnaha (NPT et al. 1990), however in-basin factors have additionally contributed to reductions in salmonid life history stages. Elevated summer water temperatures, insufficient water quantity in portions of the Sheep Creek system, areas of inadequate riparian vegetation, low pool frequency in some tributaries, inadequate habitat diversity in various stream reaches and excessive rates of sedimentation at times due to mass-wasting events and some land management activities (e.g. roads) are commonly cited as the primary in-basin factors limiting Imnaha fish production, distribution and population stability (Ashe et al. 2000; Huntington 1994; Mason et al. 1993; Mobrand and Lestelle 1997; USDA Forest Service 1994; Wallowa-Whitman National Forest 1998). However, factors limiting local fish production or survival may differ from those defined across broader scales, limiting factors in a given location may vary between species.

The following discussion identifies limiting factors by life stage of key salmonid species (spring/summer chinook, steelhead, and bull trout) in the Imnaha subbasin. Tables 27-29 summarize this discussion at a subbasin-specific scale, stratified by life history stage. Much of the spring chinook discussion is taken from Mobrand and Lestelle (1997) and Ashe (et al. 2000), while the assessment of summer steelhead is largely based on documents by USDA Forest Service (1998a; 1998b) and the discussion on bull trout comes primarily from personal communications with ***[Error in text –CBFWA]*** (ODFW), and documents by Buchanan et al. (1997), and USDA Forest Service (2000).

Table 29. In-basin factors limiting various life history stages of spring/summer chinook populations in the Imnaha subbasin (summarized from Ashe et al. 2000; Mobrand and Lestelle 1997; Mundy and Witty 1998)

Location	**Spring/summer chinook**				
	Adult Passage	**Spawning and Incubation**	**Colonization and summer rearing**	**Fall redistribution and overwintering**	**Smolt Migration**
Lower Imnaha[1/]	Temperatures may limit late season migration	Icing conditions limit fall chinook success same years only	Temperatures, habitat diversity, sediment, channel stability		
Big Sheep Cr.[2/]	Temperatures and/or flow may limit late season migration	Low flows, high summer temperatures, shade/canopy	Low flows, high temperatures poor habitat diversity		
Little Sheep Cr.[3/]	Spring/summer chinook not present in Little Sheep Cr.				
Upper Imnaha[4/]					

[1/]Reach defined from mouth (RM 0.0) to Big Sheep Creek confluence (RM 22.3) and all associated tributaries
[2/]Reach defined from mouth (RM 0.0) to headwaters and all associated tributaries
[3/]Reach defined from mouth (RM 0.0) to headwaters and all associated tributaries
[4/]Reach defined from confluence of Big Sheep Creek (RM 22.3) to headwaters and all associated tributaries

Table 30. In-basin factors limiting various life history stages of summer steelhead populations in the Imnaha subbasin (from Huntington 1994; USDA Forest Service 1994; USDA Forest Service 1998a; USDA Forest Service 1998b)

Location[1/]	Summer steelhead				
	Adult Passage	Spawning and Incubation	Colonization & summer rearing	Fall redistribution & overwintering	Smolt Migration
Lower Imnaha	Temperatures exceed PACFISH & NMFS standards (only applies to fish entering v. early in the fall)	Temperatures exceed PACFISH & NMFS standards; Excessive sediment in the mainstem below 9 points Cr	LOD<20 pieces/mi. but close to natural potential		
Big Sheep Cr.			Low flows		
Little Sheep Cr.	Temps exceed PACFISH & NMFS standards		Low flows; Temperatures exceed PACFISH & NMFS standards		
Upper Imnaha		Sediment is excessive in some perennial headwater tribs.			

[1/]Refer to Table 29 for reach description

Table 31. In-basin factors limiting various life history stages of bull trout populations in the Imnaha subbasin (from USDA Forest Service 1999; USDA Forest Service 2000a; Buchanan 1997; M. Hanson, personal communication, April 2001)

Location[1/]	Bull trout			
	Adult Passage	Spawning and Incubation	Colonization and summer rearing	Fall redistribution and overwintering
Lower Imnaha			• High stream temperatures below Fence Creek • Reduced amount and/or quality of riparian veg.	• Reduced amount and/or quality of riparian veg.
Big Sheep Cr.	• Loss of connectivity due to WVI Canal • Low flows resulting from irrigation withdrawals	• High sediment below the WVI canal	• Decreased sinuosity due to riprapping/bank stabilization assd. w/ road construction • Reduced amount and/or quality of riparian veg. • Temperatures >24°C during June-August	• Decreased sinuosity due to riprapping/bank stabilization assd. w/ road construction • Reduced amount and/or quality of riparian veg.
Little Sheep Cr.	• Blocked access to upper Little Sheep Creek through the WVI Canal • Low flows resulting from irrigation withdrawals	• Sediment from recent fires, logging & road construction	• Decreased sinuosity due to riprapping/bank stabilization assd. w/ road construction • Reduced amount and/or quality of riparian veg.	• Decreased sinuosity due to riprapping/bank stabilization assd. w/ road construction • Reduced amount and/or quality of riparian veg. • Water withdrawals reduce summer and fall flows in the upper reaches
Upper Imnaha		• Sedimentation resulting from landslides/fires in the NF		

[1/]Refer to Table 29 for reach description

Spring chinook

Adult passage

Wallowa County and Nez Perce Tribe (1993) and Huntington (1994) identified high stream temperatures in the lower Imnaha to be a potential concern for the success and timing of upstream migrating adult chinook salmon. Mobrand and Lestelle (1997) also noted temperature increases from historic levels in the lower river corridor (below Freezeout Creek, RM 29.4) yet did not specifically identify the change as a factor limiting productivity. The patient-template analysis of the mainstem suggests that the relative productivity (survival) of Imnaha chinook salmon has been reduced due to losses in key life history stages, including pre-spawning adults (Mobrand and Lestelle 1997). Pre-spawning life history stages have been compromised in the mid to lower reaches of the river by losses in habitat diversity and streambed instability (Mobrand and Lestelle 1997). Upon review of the available information, Ashe (et al. 2000) proposes that while high stream temperatures may stress the fish, migration will not be prohibited and rates early season migration as excellent and late season migration conditions to be fair to good.

Wallowa County and the Nez Perce Tribe (1993), Huntington (1994), and Mobrand and Lestelle (1997) identify summer temperatures, flows and sediment loads as potential problems for spring chinook migration into Big Sheep Creek. Upon review of the available information, Ashe (et al. 2000) rates early season migration conditions as “excellent” and late season migration conditions as “fair to poor” (based on temperatures and possible flow concerns).

Spawning and incubation

In their patient-template analysis, Mobrand and Lestelle (1997) found that the quantity of key chinook habitat has declined in certain portions of the subbasin, and specifically that insufficient substrate size in the mid portions and upper reaches of the Imnaha (up to RM 67) was the primary factor limiting chinook spawning and egg incubation success. Losses of appropriate sized substrate have resulted from upstream channel simplification and bank armoring caused by “stream cleaning” and land use activities (Ashe et al. 2000).

Recent improvements, such as livestock exclosures and woody debris reintroduction by the USFS, have improved gravel accrual rates in the mainstem Imnaha River (Ashe et al. 2000). By the mid 1990’s, reaches of the Imnaha upstream of the national forest boundary were considered to have sufficient amounts of woody material, and had gravel bars beginning to form behind logjams. Spawning and incubation conditions were considered to be good to excellent in the upper Imnaha (Ashe et al. 2000).

Spring chinook spawning and incubation life history phases are limited in the upper half of Big Sheep Creek (Mobrand and Lestelle 1997). Although the quantity of spawning and incubation habitat in Big Sheep Creek is comparatively small, losses over time have been substantial (Mobrand and Lestelle 1997). Factors contributing to these declines include changes in water temperature regimes, channel stability, habitat diversity, and, to a lesser extent, flow regimes and sediment load (Mobrand and Lestelle 1997). USDA Forest Service (1998b) found that stream temperatures were slightly below environmental potential (at risk) throughout much of the Big Sheep Creek drainage, although the analysis was focusing on summer steelhead. High water temperatures and low water levels prevent Little Sheep Creek from being suitable chinook spawning habitat (NMFS 2001). Ashe (et al. 2000) summarizes chinook spawning and rearing conditions in the Big Sheep Creek watershed as “fair to excellent in the upper watershed above Coyote Creek (RM 20.4) and fair to poor below Coyote Creek.

Colonization and summer rearing

Spring chinook fry colonization and summer rearing life history stages have been reduced from historic levels in the mid to lower reaches of the Imnaha (Mobrand and Lestelle 1997). Habitat conditions that support these particular stages have been compromised by increased water temperatures, small losses in habitat diversity, and increased channel instability (Mobrand and Lestelle 1997). Ashe (et al. 2000) does not consider these losses to significantly threaten chinook production however, and rates colonization and summer rearing in the Imnaha as "good to excellent".

In Big Sheep Creek, fry colonization and summer rearing life history stages have been reduced through losses of habitat diversity, elevated temperatures, predators, competitors, flows and sediment loads in the lower 35 stream miles (Mobrand and Lestelle 1997). Colonization and summer rearing life history stages in Little Sheep Creek are not identified as limited since chinook production in the drainage has likely never been significant in relation to the rest of the subbasin (Mobrand and Lestelle 1997). Ashe (et al. 2000) rates colonization and summer rearing conditions as "good to excellent above Coyote Creek (RM 20.4) and fair to poor below Coyote Creek".

Fall redistribution and overwintering

Overwintering survival in the upper Imnaha may be reduced due to anchor ice formation or ice floes (refer to Appendix F) (Ashe et al. 2000; NPPC 1990). Ashe (et al. 2000) defines fall redistribution and overwintering life history phases of chinook salmon to range from good to excellent in the lower Imnaha, and fair to good in the upper Imnaha, based on temperatures.

Fall redistribution and overwintering life history stages of chinook may be limited in the lower portion of Big Sheep Creek due to land use activities and the presence of a channel-confining road (Big Sheep Creek Road) (Gaumer 1968). Conditions for fall redistribution and overwintering of spring/summer chinook are considered to be fair to excellent from the 39 Road bridge to the mouth (Ashe et al. 2000).

Smolt migration

The emigration of chinook smolts from the Imnaha subbasin does not appear to be limiting the productivity of the population as a whole (Ashe et al. 2000). This is especially true during the early part of the migration between March and April. Smolts that outmigrate later than April are more likely to encounter elevated temperatures, such as in the lower Imnaha and in lower Big Sheep Creek, which may delay or postpone emigration (Gaumer 1968). Ashe (et al. 2000) summarizes smolt outmigration conditions to be excellent in the early part of the migration and good in the latter part of the migration for both the mainstem and for Big Sheep Creek.

Summer steelhead[2]

Adult passage

Stream temperatures in the lower portion are considered by the Wallowa-Whitman National Forest to be "at environmental potential (properly functioning)" but overall, do not meet PACFISH and NMFS matrix criteria (refer to USDA Forest Service 1998a, pp. 32-33 for PACFISH and NMFS criteria). It is highly unlikely however, that temperatures prohibit steelhead migration into the subbasin, unless fish enter very early in the fall (late summer). Most

[2] Much of the discussion by USDA Forest Service uses rating criteria developed by the NMFS in their Section 7 consultation process. Refer to Appendix E for rating criteria.

adult steelhead migration into the subbasin occurs during the winter and spring months when water temperatures are low. Extremely low water temperatures and icing may limit steelhead migration into the Imnaha in winter months. Most migration occurs during periods of increased streamflow during the months of December through April. Modifications to the floodplain and riparian areas on private land in the lower-middle reaches of the mainstem Imnaha, and riparian removal in the upper-middle reaches (below the Imnaha River Wood Development), are considered to be areas where stream temperatures are “at risk” (Wallowa-Whitman National Forest 1999).

Spawning and incubation

Steelhead spawning and incubation life history phases below Nine Points Creek on the mainstem Imnaha may be limited by unstable cobble and gravel bars, which resulted from excessively high amounts of bedload movement caused by storm events in 1992 and 1997 (USDA Forest Service 1998a). Some perennial headwater streams that feed the upper Imnaha may not be suitable for steelhead spawning and incubation due to high amounts of fine sediment produced through various land management activities and natural erosion patterns (USDA Forest Service 1998a), however the majority of these streams are in a condition that is suitable to support spawning and rearing life history stages. The primary factors considered to affect steelhead spawning and rearing habitat are the livestock allotments and roads in mid-elevation areas on the Forest (B. Knox, ODFW, personal communication, May, 2001).

USDA Forest Service (1998b) suggests that low flows may limit rearing and spawning in Big Sheep Creek, however, due to their spawn timing (April through mid-June), it is likely that flows would be sufficient for steelhead spawning success. Conversely, spawning success in certain reaches of the Big Sheep watershed may be limited by excessively high flows. Modification of upland vegetation through the Canal Fire (1989), Twin Lake Fire (1994), timber harvest, windstorms, and insect outbreaks has changed runoff characteristics in portions of the drainage, based on flow characteristics of the gaging station at the town of Imnaha (USDA Forest Service 1998b). Changes to upland vegetation have also accelerated sheet and rill erosion in five subwatersheds within the Big Sheep Creek drainage, and has caused gully erosion to increase in three subwatersheds (USDA Forest Service 1998b). Although increased sediment deposition in low gradient reaches has been noted, the removal of the hydropower facility on Little Sheep Creek in 1997 is suspected to flush a proportionate amount of stored sediment during spring runoff (NMFS 2001; USDA Forest Service 1998b).

Water temperatures, turbidity/sediment, substrate and peak/base flows are considered to be either at risk or not properly functioning within portions of Little Sheep Creek (NMFS 2001), and may limit steelhead spawning and incubation life history stages. Areas with sufficient amounts of temperature-ameliorating vegetation are present in some portions of Little Sheep Creek, but are limited in others, mainly due to the presence of the adjacent highway and livestock encroachment of the riparian area.

Colonization and summer rearing

Summer steelhead fry colonization and summer rearing life history stages in the mainstem Imnaha have been reduced from historic levels. The reductions have resulted from a decreased amount of suitable habitat caused by reduced water quality and channel/habitat simplification. Excessive stream temperatures, inadequate amounts of large organic material, insufficient pool frequency and quality, and extreme peak/base flows are among the primary constraints to steelhead colonization and summer rearing (USDA Forest Service 1998a). These conditions are most pronounced in stream reaches bordered by private land or inholdings, or in areas where riparian vegetation has been removed or modified (USDA Forest Service 1998a). For example, summer rearing habitat near Nine Point Creek, a reach influenced by the encroachment of a powerline right-of-way, may be periodically unsuitable, as the seven-day moving maximum stream temperatures recorded during July and August of 1994 (71°F and 72°F respectively) were at or near lethal limits (USDA Forest Service 1998a).

Cultivation, farming, and pasturing have further reduced the riparian component, specifically the cottonwood communities, resulting in an "at risk" rating (USDA Forest Service 1998a). The lack of woody material input to the stream channel in these areas has in turn simplified the system both hydraulically and biologically. In an effort to address large organic debris (LOD) deficiencies, the Wallowa-Whitman has completed bioengineering work along three stream miles, in which woody material was anchored to the streambank (i.e. hard structures), and has completed work along 13 stream miles, in which woody material was merely reintroduced to the channel (i.e. soft structures) (Platz, Wallowa-Whitman National Forest, personal communication, May, 2001).

Because steelhead fry colonization and summer rearing life history stages are largely reliant upon diverse, sufficiently deep, cool and productive habitat types (Bjornn and Reiser 1991), the lack of these in the lower portions of the Big and Little Sheep Creek drainages may pose a limiting factor to production. USDA Forest Service (1998b) defines large woody material throughout lower Big Sheep Creek and lower and middle Little Sheep Creek to be below natural potential ("at risk") based on PACFISH guidelines and NMFS habitat matrices. A combination of natural landscape characteristics and riparian habitat modification has contributed to the rating. Similarly, pool quality and frequency were rated as "at risk" and did not meet PACFISH guidelines or NMFS criteria for anadromous habitat; the ratings however, excluded pocket pools, which often comprised up to 30 percent of the channel (USDA Forest Service 1998b). Nevertheless, pool frequency, pool quality, large organic matter, stream flow and stream temperatures, are generally least favorable for summer steelhead colonization and summer rearing life history stages in the lower elevation reaches of the Big Sheep Creek drainage.

Fall redistribution and overwintering

The primary constraints to fall redistribution and overwintering life history stages of steelhead in the mainstem Imnaha are related to habitat availability and flow. Similar to summer rearing life history phases, overwintering juvenile steelhead require relatively complex habitat types, like that often provided by in-channel organic debris (Bjornn and Reiser 1991). In select areas where riparian reserves have been altered such as along private lands bordering some of the lower mainstem reaches, or channels modified through riprapped banks, dredging, and elimination of off-channel refugia. (USDA Forest Service 1998a) the diversity of overwintering habitat has been reduced or eliminated, and hence has constrained the potential productivity of these life history phases. The elimination of riparian reserves and their inherent insolation capacity combined with wintertime base flows may also restrict overwintering success, since stream temperatures may become low enough to freeze and/or for anchor ice to form.

Adult and juvenile steelhead that utilize Big and Little Sheep Creek during winter months--December through February--are subject to a reduction in available habitat due to anchor ice buildup and ice floes (USDA Forest Service 1998b). Icing conditions in the smaller perennial tributaries are prevalent throughout the watershed because of low flow conditions (refer to Appendix G).

Smolt migration

Since juvenile steelhead outmigration timing (early April through mid-June) generally coincides with periods of high flow and reduced temperatures, smolt migration life history stages are for the most part not limiting population persistence.

Bull Trout

Adult passage

The fluvial and resident forms of bull trout that reside in the Imnaha rely on an unobstructed path both to and from spawning, rearing, and overwintering areas. Seasonal migration barriers, including periods of reduced water quality, insufficient flows and/or degraded habitat pose a potential threat to bull trout connectivity between neighboring subpopulations in the Imnaha River and Sheep Creek (USDA Forest Service 2000a). On National Forest Service lands, the Wallowa Valley Improvement Canal blocks upstream migration of bull trout on Big Sheep, McCully, Ferguson, Canal, Redmont and Salt Creeks (USDA Forest Service 2000a). On Little Sheep Creek, the ODFW satellite fish hatchery facility represents a human-made physical barrier during adult bull trout migration; however, all non-target fish species are passed.

In the Little Sheep subwatershed, ODFW biologists believe that the influence of the WVI canal and periodic influx of bull trout from upper Big Sheep Creek are currently maintaining the population in Little Sheep Creek (unpublished ODFW habitat surveys). The resident populations that reside in the steep gradient streams above the canal (refer to section 1B-Fish), are connected via the canal system, but are classified as “Functioning at Risk” due to periodic losses in connectivity (reduced flow during non-irrigation seasons) and small population sizes (USDA Forest Service 2000a). Migration barriers also occur on McCully Creek and Big Sheep Creek, and when combined with downstream losses of migrants through the canal, the current habitat designation also is considered to be “Functioning at Risk” (USDA Forest Service 2000a).

Spawning and incubation

Although the majority of bull trout spawn in areas upstream from those affected by recent storm events, the large quantity of bedload material moved during the 1997 flood is a likely source of fine sediment in the mainstem Imnaha River below Nine Points Creek (USDA Forest Service 2000a), and may influence the quantity and quality of bull trout spawning and incubation habitat occurring in downstream reaches. Bull trout spawning and incubation life history forms may also have been impacted from an August, 1992 event, during which a thunderstorm triggered a debris flow in a tributary to the North Fork Imnaha. A debris fan formed at the confluence of the tributary, causing the thalweg of the North Fork to shift (USDA Forest Service 2000a). The change in the North Fork channel morphology, combined with the material deposited in the fan produced more sediment than the stream could carry, and may have smothered many incubating bull trout in downstream redds. The impacts of the January 1997 flood event on bull trout were likely similar, in that incubating bull trout in many of the Imnaha tributaries were either flushed, smothered, displaced or eliminated by the high flow velocities and excessive bedload movement accompanying the event. The Wallowa-Whitman National Forest rates the upper Imnaha as “Functioning Appropriately” in relation to sediment and embeddedness, while the lower Imnaha is considered to be “Functioning at Risk” (USDA Forest Service 2000a).

Spawning habitat in Big Sheep Creek, below the Wallowa Valley Improvement Canal, has been impacted from excessive sediment produced by the 1989 Canal fire and through a variety of other land use activities (Buchanan et al. 1997), however a relationship between spawning/incubation success of bull trout has not been established. Nutrient additions, once supplied in great abundance through the decomposition of anadromous fish carcasses, are currently considered to be in short supply. The affects of this reduction on newly emerged bull trout fry may be realized in a reduced number of macroinvertebrate prey items that may potentially nourish this particular life history stage (Rieman and McIntyre 1993).

Colonization and summer rearing

Because colonizing and summer rearing life history forms of bull trout are closely associated with large organic debris (Rieman and McIntyre 1993), the presence or absence of woody material provides an effective surrogate for the assessment of this particular life history stage. The Wallowa-Whitman National Forest examined amounts of woody material (>12 inches in diameter and >35 feet in length) throughout the subbasin prior to 1991 and again following the January 1997 flood event (1998). Although survey results were inconclusive for many reaches, the event appears to have had mixed effects. Three of the five reaches, for which comparisons can be made, lost woody material following the storm, while one gained and one remained constant. From an overall rating standpoint, the amounts of wood occurring in the Upper Imnaha and Sheep Creek watersheds are rated as "Functioning Appropriately" while the Lower Imnaha has been rated as functioning at risk (refer to previous discussions in steelhead and spring chinook LF sections).

Woody debris in Lick Creek, a tributary to Big Sheep Creek, has been reduced through logging activities, campground use, road construction, and fire (ODFW 1993 cited in Buchanan et al. 1997).

Overwintering

The upper Imnaha watershed where most resident bull trout reside is in near pristine condition. Fluvial froms overwinter in the lower Imnaha and Snake Rivers where large pools are abundant.

The downward population trend of spring chinook in the Imnaha subbasin may be affecting bull trout abundance since chinook represent a preferred prey item with which bull trout have evolved.

Stream Reach Scale – NPPC Data

Constraints to production of chinook salmon and steelhead trout in the Imnaha subbasin were delineated for individual stream reaches during the earlier subbasin planning process (Nez Perce Tribe et al. 1990). In the Imnaha subbasin, three individual constraints were defined for spring chinook salmon, one constraint was defined for fall chinook salmon, and three for summer steelhead, any of which may inhibit spawning, rearing or migration of these species.

One major weakness of this database is its failure to address constraints in areas not currently being used by anadromous species at the time the data was compiled. For example, it does not address constraints in areas of historical distribution (i.e., Little Sheep Creek for chinook salmon), and does not attempt to delineate potential constraints in areas that might be made accessible to either species in the future. Addressing these issues would require considerable time to replicate the methods and analyses used in developing the original database, and has therefore not been attempted.

Strength(s) of the database include the fact that constraints to chinook salmon and steelhead trout have not likely changed much in the past 10 years, except in very localized areas having had significant restoration effort. The database should therefore still provide a good understanding of current constraints to anadromous production in the Imnaha subbasin.

As defined in the NPPC database, spring chinook salmon production in the Imnaha subbasin is predominantly constrained by ice floes or icing conditions (22 stream miles) in the upper subbasin, and constrained by inadequately screened diversions (12 stream miles) and/or channelization (12 stream miles; Table 32). Constraints to spring chinook salmon production for individual stream reaches throughout the Imnaha subbasin are presented in Appendix F.

The only factor considered by subbasin planners to constrain fall chinook production in the lower Imnaha are excessively low winter water temperatures (22.3 stream miles of 22.3 stream miles are considered to be limiting production; Table 33). Constraints to fall chinook salmon production for individual stream reaches throughout the lower Imnaha subbasin are presented in Appendix H.

The same three factors limiting Imnaha spring chinook production are also considered to be constraining steelhead trout production. Unscreened or poor diversion/channelization (26.7 stream miles), channelization (12.3 stream miles) and ice floes/icing conditions (12.8 stream miles;

Table 34) are considered to be the primary factors affecting summer steelhead. The occurrence of these problems is generally similar to those affecting spring chinook. Constraints to summer steelhead production for individual stream reaches throughout the Imnaha subbasin are presented in Appendix G.

Table 32. Summary of stream miles where spring chinook use is constrained in the Imnaha subbasin (defined by NPPC and downloaded from Streamnet.org). Numbers in parenthesis represent the estimated total stream miles with habitat suitable for spawning, rearing, and/or migration by spring chinook. Numbers in corresponding "constraint" rows represent the estimated number of lineal stream miles affected

	Assessment Unit				
Constraint	Lower Imnaha[1]	Big Sheep Creek[2]	Little Sheep Creek[3]	Upper Imnaha[4]	Total
	(46.0)	(52.8)	(0.0)	(49.1)	147.9
Unscreened or poor diversion/ channelization	0.0	12.4	0.0	0.0	12.4
Channelization	0.0	12.3	0.0	0.0	12.3
Ice floes/icing conditions	0.0	0.0	0.0	22.0	22.0

1/Reach defined from mouth (RM 0.0) to Big Sheep Creek confluence (RM 22.3) and all associated tributaries
2/Reach defined from mouth (RM 0.0) to headwaters and all associated tributaries
3/Reach defined from mouth (RM 0.0) to headwaters and all associated tributaries
4/Reach defined from confluence of Big Sheep Creek (RM 22.3) to headwaters and all associated tributaries

Table 33. Summary of stream miles where fall chinook use is constrained by various factors in the Imnaha subbasin (defined by NPPC and downloaded from Streamnet.org). Numbers in parenthesis represent the estimated total stream miles with habitat suitable for spawning, rearing, and/or migration by spring chinook. Numbers in corresponding "constraint" rows represent the estimated number of lineal stream miles affected

	Assessment Unit[1]				
Constraint	Lower Imnaha	Big Sheep Creek	Little Sheep Creek	Upper Imnaha	Total
	(22.3)	(0.0)	(0.0)	(0.0)	(22.3)
Low winter water temperatures	22.3	0.0	0.0	0.0	22.3

1/Refer to Table 32 for reach delineation

Table 34. Summary of stream miles where steelhead trout use is constrained in the Imnaha subbasin (defined by NPPC and downloaded from Streamnet.org). Numbers in parenthesis represent the estimated total stream miles with habitat suitable for spawning, rearing, and/or migration by steelhead trout. Numbers in corresponding "constraint" rows represent the estimated number of lineal stream miles affected

	Assessment Unit[1]				
Constraint	Lower Imnaha[1]	Big Sheep Creek	Little Sheep Creek	Upper Imnaha	Total
	(130.9)	(92.1)	(51.3)	(121.5)	(395.8)
Unscreened or poor diversion/ channelization	0.0	26.7	0.0	0.0	26.7
Channelization	0.0	12.3	0.0	0.0	12.3
Ice floes/icing conditions	0.0	0.0	0.0	12.8	12.8

1/Refer to Table 32 for reach delineation

Stream Reach Scale - §303(d)

Oregon Department of Environmental Quality (ODEQ) has defined beneficial uses, which include salmonid spawning and/or cold water biota for the majority of streams within the Imnaha subbasin. Pollutants limiting these beneficial uses may have a limiting impact on salmonid or other fish populations throughout the subbasin. The ODEQ maintains the §303(d) list for stream reaches with impaired beneficial uses. Since the affected stream reaches and associated pollutants have already been identified and summarized in the water quality section of this report, the reader is referred to that section for the limiting factors discussion.

Wildlife Limiting Factors

The following list identifies the primary factors in the Imnaha subbasin currently considered to limit the overall production of terrestrial vertebrates. A brief discussion follows.

- Loss of ponderosa pine communities
- Loss of prairie grassland ecosystems
- Loss of classified wetlands
- Noxious weeds

- Loss of legacy resources
- Roads
- Loss of marine derived nutrients

Loss of ponderosa pine

Timber harvest and fire suppression have reduced the prevalence of ponderosa pine forests in the region (Quigley and Arbelbide 1997). Since ponderosa pine is a valuable timber species, large mature stands were among the first to be harvested after European settlement. Fire suppression further reduced the extent of ponderosa pine in the subbasin. The thick bark of ponderosa pine allows it to withstand ground fires better than the thin-barked true firs**.** In areas with a short fire return interval firs never had an opportunity to become established**.** Fire suppression allows the shade-tolerant forest fir species time to establish in the understory of ponderosa pine forest. In the continued absence of fire these species eventually become dominant when the canopy becomes dense enough that the shade-intolerant ponderosa pine seedlings cannot survive (Johnson 1994). This decline has probably reduced the suitability of the subbasin for ponderosa pine dependent wildlife including flammulated owl, white-headed woodpecker, and black-backed woodpecker.

Loss of prairie grasslands

The vast ranges of fescue and Agropyron bunchgrasses that dominated the lowland areas of the subbasin have been altered by a history of heavy grazing. Native grasslands in the Columbia basin are thought to have been less heavily grazed before settlement than those in the Great Plains region of the country; this made them more susceptible to damage when Euro-american settlers introduced large herds of sheep and cattle during the late 1800s and early 1900s. Removal of the original perennial grass cover left the soil vulnerable to erosion by wind and water, altered hydrologic regimes, and aided grassland colonization by annual grasses and noxious weeds (Quigley and Arbelbide 1997; Black et al.1997 updated 2001).

Loss of classified wetlands

Riparian areas contain higher wildlife species diversity and abundance, than any other habitat type. The unique characteristics present in healthy riparian areas that contribute to this diversity include structural complexity, connectivity with other ecosystems, abundance of food and water, and a moderate microclimate (Knutson and Naef 1997). The ability of many riparian zones of the Imnaha subbasin to support wildlife species and to protect aquatic habitats has been reduced. Road construction and livestock grazing have impacted the quality of remaining riparian habitat in the subbasin. Roads are commonly constructed parallel to stream and river courses for scenic reasons and ease of construction. The construction of these roads results in the removal of riparian vegetation and alters the development of meanders, side channels, and attached wetlands that provide important habitat for fish and aquatic wildlife (Knutson and Naef 1997). Cattle spend 20-30% more time in riparian areas than elsewhere on their range, because of the abundant forage, availability of water, and protection from the elements these areas provide, magnifying their impacts on these habitats (Knutson and Naef 1997).

Noxious weeds

The introduction of non-native plant species to the Imnaha subbasin has reduced the subbasin's ability to support its native wildlife and plant species. Introduced plants in the subbasin often outcompete native plant species and alter ecological processes reducing habitat suitability (Quigley and Arbelbide 1997). The designation "noxious" is applied to the most destructive of these invaders. Thirty-two introduced plant species are legally recognized as "noxious" in Wallowa county, many of these species have been documented to occur in the Imnaha subbasin (Table 35). The lower Imnaha subbasin is the most impacted by noxious weeds.

Table 35. Noxious weed species of Wallowa County, Oregon (University of Montana 2001)

Genus	Species	Common Name	Genus	Species	Common Name
Anchusa	officinalis	common bugloss	Equisetum	arvense	field horsetail
Artemisia	absinthium	absinth woodworm	Euphorbia	esula	leafy spurge
Cardaria	draba	hoary cress	Hyoscyamus	niger	black henbane
Carduus	nutans	musk thistle	Hypericum	perforatum	St. Johnswort
Cenchrus	longispinus	longspine sandbur	Kochia	scoparia	Kochia
Centaurea	diffusa	diffuse knapweed	Linaria	dalmatica	dalmatian toadflex
Centaurea	maculosa	spotted knapweed	Linaria	vulgaris	yellow toadflax
Centaurea	solstitialis	yellow starthistle	Onopordum	acanthium	Scotch thistle
Chondrilla	juncea	rush skeletonweed	Polygonum	sachalinense	giant knotweed
Chrysanthemum	leucanthemum	oxeye daisy	Rubus	discolor	Himalaya blackberry
Cirsium		bull thistle	Senecio	jacobaea	tansy ragwort
Cirsium	arvense	Canada thistle	Silene	latifolia	white catchfly
Conium	maculatum	poison hemlock	Solanum	rostratum	Buffalobur
Convolvulus	arvensis	field bindweed	Sonchus	arvensis	perennial sowthistle
Cynoglossum	officinale	houndstongue	Taeniatherum	caput-medusae	Medusahead
Daucus	carota	wild carrot	Tribulus	terrestris	Puncturevine

Loss of late successional

Snags and downed wood are structural elements, common in mature forests, with significant importance to wildlife. The prevalence of these elements has been dramatically reduced through the removal of older trees that might soon die and create snags, fire suppression, and increased access to these elements during salvage harvest or fire wood collection (Wisdom 2000)

Roads

The transportation system of the Imnaha subbasin is a potential limiting factor to wildlife populations. More than 65 species of terrestrial vertebrates in the interior Columbia River basin have been identified as being negatively affected by road-associated factors (Wisdom 2000). Road-associated factors can negatively affect habitats and populations of terrestrial vertebrates both directly and indirectly (Table 36). Motorized access facilitates firewood cutting, and commercial harvest, which can reduce the suitability of habitats surrounding roads to species dependent on large trees, snags, or logs (USDA Forest Service 2000b). Roads aid in the spread of noxious weeds and can facilitate the spread of competitive species into otherwise unsuitable habitat. Roads increase the amount of edge habitat in the landscape increasing habitat suitability for edge dependent species like the brown-headed cowbird. Populations of reptiles which using roads for thermal regulation, wide ranging forest carnivores, and migrating amphibians are particularly vulnerable to the effects of road mortality. Wisdom (2000) identified 13 factors that were consistently associated with roads in a manner deleterious to terrestrial vertebrates.

Table 36. Thirteen road-associated factors with deleterious impacts on wildlife (Wisdom 2000)

Road-associated Factor	Effect of Factor in Relation to Roads
Snag reduction	Reduction in density of snags due to their removal near roads, as facilitated by road access
Down log reduction	Reduction in density of large logs due to their removal near roads, as facilitated by road access
Habitat loss and fragmentation	Loss and resulting fragmentation of habitat due to establishment and maintenance of road and road right-of-way
Negative edge effects	Specific case of fragmentation for species that respond negatively to openings or linear edges created by roads
Over-hunting	Nonsustainable or nondesired legal harvest by hunting as facilitated by road access
Over-trapping	Nonsustainable or nondesired legal harvest by trapping as facilitated by road access
Poaching	Increased illegal take (shooting or trapping) of animals as facilitated by road access
Collection	Collection of live animals for human uses (e.g., amphibians and reptiles collected for use as pets) as facilitated by the physical characteristics of roads or by road access
Harassment or disturbance at specific use sites	Direct interference of life functions at specific use sites due to human or motorized activities, as facilitated by road access (e.g. increased disturbance of nest sites, breeding leks or communal roost sites)
Collisions	Death or injury resulting from a motorized vehicle running over or hitting an animal on the road
Movement Barrier	Preclusion of dispersal, migration or other movements as posed by a road itself or by human activities on or near a road or road network
Displacement or avoidance	Spatial shifts in populations or individual animals away from a road or road network in relation to human activities on or near a road or road network
Chronic negative interaction with humans	Increased mortality of animals due to increased contact with humans, as facilitated by road access

Nutrient Flow Reduction

Spawning salmon populations form an important link between the aquatic, riparian, and terrestrial communities. Anadromous salmon help to maintain ecosystem productivity and may be regarded as a keystone species. Salmon runs input organic matter and nutrients to the trophic system through multiple levels and pathways including direct consumption, excretion, decomposition, and primary production. Direct consumption occurs in the form of predation, parasitism, or scavenging of the live spawner, carcass, egg, or fry life stages. Carcass decomposition and the particulate and dissolved organic matter released by spawning fish deliver nutrients to primary producers (Cederholm et al. 2000). Cederholm identified nine wildlife species that have (or historically had) a strong consistent relationship with salmon; of these the common merganser, harlequin duck, osprey, bald eagle, Caspian tern, black bear, and northern river otter occur in the Imnaha subbasin. Eighty-three other wildlife species were identified as having a recurrent or indirect relationship with salmon, and many of these also occur in the Imnaha subbasin (Cederholm et al. 2000). The golden eagle, bald eagle, peregrine falcon, and bank swallow are among those that are state or federally listed/candidate species.

Artificial Production

Spring Chinook

(*The following discussion is taken from USFWS 2001 where not otherwise specified)*

Historic artificial production of spring chinook in the Imnaha subbasin dates back to 1949 when the Oregon Game Commission initiated a spring chinook egg-take program in an effort to supplement Imnaha chinook into the Umpqua subbasin in southwest Oregon (Ashe et al. 2000). Between July and August 1951, 152 male and 6 female chinook were collected from spawning beds in the mainstem Imnaha and from a weir constructed at Coverdale (Mundy and Witty 1998). Fifteen years later, 119 adult spring chinook collected from Hells Canyon Dam were outplanted into the Imnaha (Neeley et al. 1993). In 1976, Congress authorized the production of hatchery spring chinook under the auspices of the Lower Snake River Compensation Plan (Ashe et al. 2000). The LSRCP was initiated in the Imnaha subbasin in 1982. The first releases of hatchery produced juvenile spring chinook occurred in 1984.

The LSRCP supplementation program was initiated using only adult salmon returning to the Imnaha River and each year naturally-produced fish are incorporated into the hatchery broodstock (NPT et al. 1990). Until recently, two facilities were used for the chinook production program; the Imnaha River satellite facility (located near Gumboot Creek) for adult collection, adult holding, and smolt acclimation, and Lookingglass FH for incubation and rearing of juveniles. Adults collected at the Imnaha weir are held or transported to Lookingglass FH, where they are held and spawned. LFH was designed to serve as the incubation and rearing facility. Currently, however, due to facility limitations, equipment failure and malfunction at Lookingglass Hatchery all eggs are shipped to Oxbow Hatchery (near Bonneville Dam) or Irrigon Hatchery for incubation and early rearing of juveniles. Following rearing for about five months, juveniles are transported back to LFH for another 9 months before smolts are transported back to the acclimation facility where they are held for one month prior to release in April. Exceptions to releases of fish from the acclimation facility or directly into the mainstem Imnaha, were in 1987 when Imnaha smolts were released at Lookingglass Hatchery because of disease concerns, 1990 when smolts were also released in Big Sheep Creek, and 1994 when presmolts were released in Big Sheep Creek, Little Sheep Creek, and the Imnaha River (Beamesderfer et al. 1997).

Artificial production of Imnaha River chinook salmon began as a mitigation as a program, however, beginning in the early 1990s, the co-managers recognized that the Imnaha population was at imminent risk of extirpation and immediate action was necessary. As a result, the NPT and ODFW cooperatively developed a program redirecting existing production occurring under LSRCP from mitigation to conservation and restoration. The current program is operated under Section 10 ESA permit authorization and Nez Perce Tribe/ODFW co-management agreement. The program is focused on natural population recovery and genetic conservation. Wild chinook adults were initially collected for broodstock beginning in 1982. Wild fish comprised the majority of the broodstock until 1989 when significant numbers of hatchery fish began to return. Currently, hatchery and natural fish are used for broodstock each year. Broodstock management is guided by a sliding scale management plan that places emphasis on minimizing demographic risk at escapement levels below a minimum adult spawner escapement (threshold) and minimizing genetic risk of the hatchery program at escapement levels above threshold. The proportion of natural fish that are retained for broodstock, the proportion of natural spawners that are hatchery origin, and the proportion of broodstock that must be natural origin varies depending on escapement levels.

Smolt production levels have been highly variable and typically well below the goal of 490,000 because of the abundance of natural fish and broodstock management criteria. Currently smolt production has been reduced by 25% due to the facility limitations at Lookingglass FH. Smolt-to-adult survival rates have been below the goal of 0.65% with a maximum value of 0.58% for the 1988 broodyear. Substantial smolt mortality occurs from release through the mainstem river corridor, which is a major constraint on smolt-to-adult survival. Life history and genetic characteristics are similar for hatchery and natural fish, with the exception of age composition at return. Hatchery fish return a greater proportion of age 3 males and fewer age 5 fish. Progeny-to-parent ratios for natural fish have been below replacement (1.0) since the 1983 broodyear and have averaged 0.5. In contrast, the ratio for hatchery fish has been above 1.0 in most years and has averaged 4.0. Model results indicated that presently a greater number of total fish and natural spawners in the basin, attributable to the hatchery program. ODFW has made a substantial number of adaptive management changes to improve the program including reduced emphasis on smolt production goals and increased emphasis on genetic conservation, gene banking, implementation of sliding scale management plan, aggressive fish health protection, low density rearing, and more natural smolt size-at-release (25/lb.).

Future Plans (refer to Appendix I for ODFW HGMP)

Co-managers plan to continue managing the chinook salmon hatchery program as a conservation/restoration tool to prevent extinction, enhance natural production, and assess supplementation as a tool for recovery. The program will be operated under ESA authorization and future decisions resulting from CRFMP negotiations will, in part, determine changes in future direction. Co-managers also plan to place increased emphasis on conservation hatchery management, genetic analysis (DNA), continued gene banking, improved rearing (possibly in the Imnaha River subbasin), and rearing natural size smolts in a natural environment. The Northeast Oregon Hatchery project is designing new facilities and identifying modifications to Lookingglass FH necessary to meet program requirements and conservation objectives.

Steelhead

Steelhead supplementation efforts in the Imnaha subbasin have occurred through the Lower Snake River Compensation Plan (LSRCP) since 1982. The preferred stock for hatchery use is Imnaha River Stock and no outside introductions are planned (NPT et al. 1990).

Three facilities are used for the steelhead production program. The adult collection/smolt acclimation facility is located in the Imnaha River subbasin on the Little Sheep Creek, a tributary to the Big Sheep Creek. Adults are collected and spawned at Little Sheep Creek, embryos are initially incubated at Wallowa Hatchery and then transported to Irrigon Hatchery. Final incubation and rearing to the smolt stage occurs at Irrigon FH. Following 10 – 13 months of rearing, smolts are transferred back to the acclimation facility for 30 days of acclimation prior to release in April and May.

Wild summer steelhead were initially collected from Little Sheep Creek for broodstock beginning in 1982. The goal of the program was to incorporate naturally-produced fish into the broodstock on an annual basis, so that an adequate escapement of natural fish to Little Sheep Creek would be reestablished. Since 1987, returns of naturally produced adult steelhead to Little Sheep Creek have amounted to less than 20% of the total return in spite of substantial supplementation with hatchery produced adults. Smolt production goals have, however, generally been achieved in all years except 1997. Prior to 1998, releases had only occurred at the Little Sheep Creek facility and in the mainstem Imnaha River. In 1998, fry were planted in other tributaries, and since 1999, adults have been outplanted in Big Sheep Creek. Smolts have also been released in Big Sheep Creek since 2000. Smolt-to-adult survival rates have varied, but have typically been below the goal of 0.61%. Life history and genetic characteristics of adult hatchery and natural fish have remained similar.

A consumptive steelhead recreational fishery was re-opened in 1986 after being closed since 1974. Catch rates in the Imnaha River are high and better than historic values. Imnaha hatchery steelhead contribute to fisheries throughout the Columbia Basin. Despite meeting many production goals, the following obstacles to achieving management objectives remain: low smolt-to-adult survival, apparently low carrying capacity of Little Sheep Creek, low abundance of natural fish in the Little Sheep Creek and lack of information on steelhead population dynamics in the Imnaha River.

Evaluation of stock status of wild steelhead in the Imnaha River subbasin were initiated in 2000 with operation of an adult escapement weir in Lightning Creek. This effort has been expanded to Cow Creek in 2001. Efforts to identify population structure through genetic information for O. mykiss are underway. A sample collection strategy was developed and initiated in 1999 to allow DNA genetic analysis of stock structure for steelhead in Imnaha and Grande Ronde subbasins. Twenty areas were targeted for sample collections. These sample collections are scheduled to continue for at least four years (through 2002). A long-term genetics monitoring (perhaps with reduced effort) is expected to occur as long as supplementation of steelhead populations in the system occurs.

Future Plans (refer to Appendix I for ODFW HGMP)

The steelhead program will continue to be managed to mitigate for lost sport and tribal harvest resulting from construction of lower Snake River dams. Co managers will continue to monitor the success of the program at meeting LSRCP goals and the success of supplementing Little Sheep Creek with hatchery steelhead.

Existing and Past Efforts

Records for the BPA Columbia River Basin Fish and Wildlife Program date back to 1996, covering planning, outplanting, law enforcement, and fish habitat improvements as implemented by a variety of local, state, tribal, and federal agencies (1998 to present) (Columbia Basin Fish and Wildlife Authority 1999). Specifics are listed in Table 37. Non-BPA funded projects and activities are shown in Table 38.

Table 37. BPA-funded Columbia River Basin Fish and Wildlife Program activities within the Imnaha River subbasin (Bonneville Power Administration and Northwest Power Planning Council 1999)

Agency	BPA Project #	Project Duration	Project Title	Project Description and Results
NPT	USFWS	1989 to present	Lower Snake River Compensation Plan Hatchery Evaluations	The Nez Perce Tribe LSRCP evaluations program is structured to monitor aspects of LSRCP hatchery production performance, natural production status and performance, interactions of hatchery and natural juveniles, promote genetic conservation, and to contribute to the co-management of the LSRCP program. Adult escapement of both natural and hatchery origin chinook salmon and steelhead in several key spawning aggregates, pre-release sampling of LSRCP hatchery produced fish, monitoring of life stage survival of naturally and hatchery produced fish, and identification of the genetic stock structure are monitored.
NPT	199701500	1994 to present	Imnaha River Smolt Monitoring Program Project	Provide information and indices on spring emigration timing, estimated smolt survival, smolt performance and health of wild and hatchery steelhead smolts captured in the Imnaha River to Snake and Columbia River dams. This information is used to assist with in-season shaping of water budgets, evaluating spill requests, and monitoring general fish health as part of the Fish Passage Center Smolt Monitoring program. Our goals are to document migration trends of chinook salmon and steelhead smolts emigrating out of the Imnaha River and to estimate survival of steelhead smolts from the Imnaha River emigration traps, to the Snake and Columbia River dams.
NPT	199703800	1997 to present	Preserve Salmonid Gametes	Preserve male salmonid gametes through cryogenic techniques in order to maintain genetic diversity in populations with low levels of abundance and at high risk of localized extinction. Strives to ensure availability of a genetic sample of the existing male population through preservation in a salmonid germplasm repository. Our approach is to sample and cryopreserve gametes thereby preserving salmonid genetic diversity within the major subbasins in the Snake River basin.

Agency	BPA Project #	Project Duration	Project Title	Project Description and Results
NPT	198805301	1989-1993 and 1997 to present	Northeast Oregon Hatchery Master Plan	Plan and develop conservation production facilities in the Imnaha and Grande Ronde rivers necessary to implement salmon recovery programs for native, ESA listed salmon. Development of a comprehensive monitoring and evaluation program that allows adaptive management to optimize hatchery and natural production, sustain harvest, and minimize ecological impacts. Complete activities and sub-activities designed to provide data for resolving management questions and critical uncertainties relating to supplementation of chinook salmon.
NPT	199403900	1994 to present	Wallowa County Restoration Planner	Develops project proposals for Wallowa County's Public Works Department and private landowners that go to the Grande Ronde Model Watershed Program and Oregon Watershed Enhancement Board for funding. Writes BA's and NEPA compliance for county and private landowner projects. Facilitates coordination of watershed restoration efforts in Wallowa County and provides the linkage to efforts in Union County.
NPT	199702500	1997 to present	Implementation of the County/Tribe Plan	Provides funds for small habitat projects that miss the normal funding cycles for the Grande Ronde Model Watershed Program and Oregon Watershed Enhancement Board. Provides upfront money for surveying and preliminary design for Wallowa County's Public Works Department and private landowners when other money is not available.
GRMWP	199202601	1992 to present	Grande Ronde Model Watershed Project	Selected in 1992 by the NPPC as the model watershed project in Oregon (includes the Grande Ronde and Imnaha subbasins). Completed a basin wide assessment in 1993. Completed an Operations-Action Plan in 1994. The 14 member Board represents a broad constituency. Subcommittees include a Standing Committee and a Technical Commmittee (which reviews all project proposals). The Program provides coordination of efforts in the Grande Ronde and Imnaha subbasins. The planner associated with the program writes project proposals and completes BA's and NEPA for the projects.
WWNF	9604900	1996-1997		Riparian planting, campground protection, livestock watering improvements, livestock and vehicle access limitations
SWCD	9607400	1996-1997		Instream structures and bank construction
SWCD	9607401	1996-1998		Instream structures and bank construction

In addition to the projects listed in this section, ODFW is implementing Chinook salmon and steelhead hatchery programs under LSRCP for conservation, supplementation and fisheries enhancement. ODFW has ongoing chinook salmon and steelhead research and monitoring projects the evaluate hatchery effectiveness, life history, genetics, supplementation, hatchery/wild interactions, natural escapement, smolt migration and survival, production and productivity and fisheries restoration. Details of these efforts are described in other sections of this document.

Table 38. Non BPA-funded Fish and Wildlife Program activities within the Imnaha (from Ashe et al. 2000)

Project Name	Project Description	Location	Project Lead	Project Funding
Aspen by Hart Butte Lookout Riparian Enhancement	Wetland/riparian exclosure	Wetland in Needham Creek subwatershed	USFS	USFS
Big Sheep Creek Riparian Enhancement	Streambank rock structures and riparian/upland exclosure fencing	Big Sheep Creek at confluence with Little Sheep Creek	OWHP	GWEB
Big Sheep Creek Riparian Enhancement	Riparian planting	Big Sheep Creek & small portion of Lick Creek	USFS	USFS
Big Sheep Creek Riparian Fence	Riparian exclosure fencing and planting	Lower Big Sheep Creek above confluence with Little Sheep Creek	NRCS/SWCD	NRCS OWHP Private landowners
Big Sheep Riparian Fence – Buhler	Riparian exclosure fence	Lower end of Big Sheep Creek, RM 4-6	NRCS/SWCD	GWEB Private landowners
Big Sheep Riparian Fence and revegetation – Suarez	Riparian pasture fencing	Big Sheep Creek	SWCD	OWHP Private landowners
Big Sheep riparian pasture fencing & trough replacement	Riparian pasture fencing	Big Sheep Creek	SWCD	OWHP Private landowners
Divide Riparian Pasture Fencing	Riparian pasture fencing w/cattle guard	Big Sheep Creek, RM 26-36; Lick Creek, RM 0-4	USFS	OWHP Permittee USFS
Gumboot Creek Instream Rehabilitation	Rehabilitate stream habitat altered in 1997 flood, instream placement of large woody debris, boulders, log weirs & floodplain restoration	Gumboot Creek	USFS	USFS
Imnaha Riparian Fence	Riparian exclosure fence	Imnaha River	NRCS/SWCD	FCS Private landowners
Imnaha River Riparian Enhancement	Large woody material additions	Imnaha River	USFS	USFS
Lightning Creek Road – Phase I	Relocate road out of creek bottom and construct stream crossing fords along	Lightning Creek Road	NPT	NPT/BPA Private landowners

Project Name	Project Description	Location	Project Lead	Project Funding
	Lightning Creek			
Little Sheep Creek – Streambank Stabilization	Streambank rip rap, log/barb vegetative planting, rock weirs	Little Sheep Creek	NRCS/SWCD	FSA Private landowners
Little Sheep Creek Fence	Riparian exclosure fence	Little Sheep Creek	NRCS/SWCD	FSA Private landowners
Little Sheep Creek Fencing	Riparian exclosure fencing and planting	Little Sheep Creek near junction of Imnaha Hwy & Wallowa Loop Rd.	SWCD	OWHP Private landowners
Marr Flat/ Big Sheep Riparian Pasture Fencing	Riparian pasture fencing	Big Sheep Creek, RM 26-34; Lick Creek, RM 0-1	USFS	OWHP Permittee USFS
Road Canyon Headwaters	Spring/ pond/ gully exclosure fence	Road Canyon	USFS	USFS
Skookum Creek Large Woody Debris Placement	Instream placement of large woody debris	Skookum Creek	USFS	USFS
Upper Imnaha Fish & Recreation Enhancement	Campground riparian plantings, interpretive signs, road closures	Upper Imnaha River, RM 58.5-64.5; Coverdale CG & dispersed campsite	USFS	Misc. USFS
Upper Imnaha Fish & Recreation Enhancement	Campground riparian plantings, interpretive signs, road closures	Upper Imnaha River, RM 59-66; Evergreen CG; Coverdale CG & O65 Campsite dispersed	USFS	BPA Misc. USFS
Upper Imnaha Recreation & Fish Enhancement	Campground riparian planting and road closures	Imnaha River at Indian Crossing; Evergreen and Coverdale CG's	USFS	USFS Volunteers
Whiskey Riparian Corridor Fencing and Trough Replacement	Riparian corridor exclosure fence & trough improvements	Big Sheep Creek, RM 17-20.5	USFS	OWHP Private landowners USFS

Present Subbasin Management

Existing Plans, Policies and Guidelines

Multiple agencies and entities are involved in management and protection of fish and wildlife populations and their habitats in the Imnaha subbasin. Federal, state, and local regulations, plans, policies, initiatives, and guidelines are followed in this effort. The NPT and ODFW share co-management authority over the fisheries resource. Federal involvement in this arena stems from Endangered Species Act responsibilities. Numerous federal, state, and local land managers are responsible for multipurpose land and water use management, including the protection and restoration of fish and wildlife habitat. Management entities and their associated legal and regulatory underpinnings for resource management and protection and species recovery are outlined below.

Federal Government

As a result of the federal government's significant role in the Columbia Basin, not only through the development of the federal hydropower system, but as a land manager, and its responsibilities under Section 7(a) of the Endangered Species Act (ESA), several important documents have been published in the last year that will guide federal involvement in the Imnaha subbasin and Blue Mountain Province. These documents provide opportunities for states, tribes, local governments, and private parties to strengthen existing projects, pursue new or additional restoration actions, and develop the institutional infrastructure for comprehensive fish and wildlife protection. The key documents include the Federal Columbia River Power System (FCRPS) Biological Opinion, the federal All-H paper entitled, *Conservation of Columbia Basin Salmon: A Coordinated Federal Strategy for the Recovery of the Columbia-Snake River Basin Salmon*, and the Interior Columbia Basin Ecosystem Management Project (ICBEMP). All are briefly outlined below.

Federal Columbia River Power System (FCRPS) BiOp (http://www.nwr.noaa.gov/1hydrop/hydroweb/docs/Final/2000Biop.html)

This is a biological opinion written by NMFS and the Fish and Wildlife Service (FWS) regarding the operation of the federal hydropower system on the Columbia River, and fulfills consultation requirements with the U.S. Army Corps of Engineers (USACE), the Bureau of Reclamation (USBR), and the Bonneville Power Administration (BPA) under Section 7 of the ESA. Significantly for this report, the BiOp concluded that off-site mitigation in tributaries is necessary to continue to operate the hydropower system.

Federal Caucus All-H Paper (http://www.salmonrecovery.gov/)

This document is a framework for basin-wide salmon recovery and identifies strategies for harvest management, hatchery reform, habitat restoration, and hydropower system operations. Significantly for this report, the Imnaha subbasin is identified as a priority subbasin for initial early actions to support and enhance salmon recovery.

ICBEMP (http//:www.icbemp.gov)

This document is a framework for land management for federal lands in the interior Columbia Basin, and was produced by the primary federal land management agencies, including the Forest Service (USFS) and the Bureau of Land Management (BLM). Significantly for this report, this document (if approved) will affect how these federal agencies prioritize actions and undertake and fund restoration activities.

By understanding the priorities outlined in these documents, significant opportunities for federally funded restoration activities can be refined and further identified for the Imnaha subbasin.

Bonneville Power Administration (http://www.bpa.gov/indexmain.shtmlhttp://www.bpa.gov/indexmain.shtml)

The Bonneville Power Administration has mitigation responsibility for fish and wildlife restoration under the Fish and Wildlife Program of the Northwest Power Planning Council as related to hydropower development. It is also accountable and responsible for mitigation related to federal Biological Opinions and Assessments for recovery of threatened, endangered, and sensitive species. The recently released FCRPS Biological Opinion calls for the BPA to expand habitat protection measures on non-federal lands. BPA plans to rely on the Council's program as its primary implementation tool for the FCRPS BiOp off-site mitigation requirements.

Columbia Basin Fish and Wildlife Authority (http://www.cbfwf.org/)

The CBFWA is made up of Columbia basin fish and wildlife agencies (state and federal) and the Columbia basin tribes. CBFWA's intent is to coordinate management among the various agencies and agree on goals, objectives, and strategies for restoring fish and wildlife in the Columbia basin.

Environmental Protection Agency (http://www.epa.gov/)

The EPA was formed in 1970 and administers the federal Air, Water, and Pesticide Acts. EPA sets national air quality standards that require states to prevent deterioration of air quality in rural areas below the national standards for that particular area (depending on its EPA classification). The EPA also sets national water quality standards (total maximum daily load or TMDL) for waterbodies that the states must enforce. These standards are segregated into "point" and "nonpoint" source water pollution, with point sources requiring permitting. Although controversial, most farming, ranching, and forestry practices are considered nonpoint sources and do not currently require permitting by the EPA, although there has been moves in this direction. The EPA provides funding through Section 319 of the CWA for TMDL implementation projects. Section 319 funds are administered in Oregon by the ODEQ.

Farm Services Agency (http://www.fsa.usda.gov/pas/)

The FSA was set up when the USDA was reorganized in 1994 to incorporate programs from several agencies. Functions similar to the FSA have been part of USDA programs since the 1930s. Federal farm programs are administered through local FSA offices. Farmers eligible to participate in these programs elect a committee of three to five representatives to review county office operations and make decisions on federal farm program applications. Conservation program payments that FSA administers include Conservation Reserve Program (CRP) and the Environmental Quality Incentives Program. NRCS provide technical assistance for these programs..

National Marine Fisheries Service (http://www.nwr.noaa.gov/)

The National Marine Fisheries Service administers the ESA as it pertains to anadromous fish only. NMFS has jurisdiction over actions pertaining to Snake River summer steelhead and spring chinook, which are widespread in the subbasin. Under the ESA's 4(d) rule, "take" of listed species is prohibited and permits are required for handling. Tribal harvest is covered under the 4-d rule. Special permit applications have been pursued for research and management activities in the Imnaha subbasin. Harvest management plans for Snake River summer steelhead fisheries in the Snake River basin also require a Fisheries Management and Evaluation Plan. The Oregon Department of Fish and Wildlife have completed two: "Summer Steelhead and Trout Sport Fisheries in Grande Ronde Basin, Imnaha Basin and Snake River" (March 2001), and "Snake, Grande Ronde and Imnaha Rivers Warmwater and Sturgeon Recreational Fisheries" (March 2001). Biological Opinions, recovery plans, and habitat conservation plans for federally listed fish and aquatic species help target and identify appropriate watershed protection and restoration measures. Included is the Imnaha Hatchery Genetics Management Plan, which is attached as Appendix I in this document.

The recent Federal Columbia River Power System (FCRPS) Biological Opinion and the Basinwide Salmon Recovery Strategy (All-H Paper) contain actions and strategies specific to the Imnaha subbasin for habitat restoration and protection targeted the Imnaha subbasin as a priority subbasin. Other aspects of hatchery and harvest apply as well. Action Agencies (USBR, USACE, BPA) are identified to potentially lead fast-start efforts in specific aspects of restoration on non-federal lands. Federal land management will be implemented by current programs that protect important aquatic habitats (PACFISH, ICBEMP). Actions within the FCRPS BiOp are intended to be consistent with or complement the NWPPC's amended Fish and Wildlife Program, the Clean Water Action Plan, the Unified Federal Policy for a Watershed Approach to Federal Land and Resource Management, the Inter-Governmental Task Force for Monitoring Principles (Oregon Plan), and state and local watershed planning efforts.

Natural Resource Conservation Service (http://www.nrcs.usda.gov/)

Within the U.S. Department of Agriculture (USDA), the Natural Resource Conservation Service (NRCS) oversees the implementation of conservation programs to help solve natural resource concerns. The Environmental Quality Incentives Program (EQIP), established in the 1996 Farm Bill, provides a voluntary conservation program for farmers and ranchers who face serious threats to soil, water, and related natural resources. The Conservation Reserve Program (CRP) puts sensitive croplands under permanent vegetative cover. The Conservation Reserve Enhancement Program (CREP) helps to establish forested riparian buffers. The NRCS assists landowners to develop farm conservation plans and provides engineering and other support for habitat protection and restoration (PL 566). The Farm Services Administration provides funds.

US Army Corps of Engineers (https://www.nwp.usace.army.mil/)

The USACE has responsibility for river and harbor development. The Federal Water Pollution Control Act of 1972 gave the USACE authority to enforce section 404 of the Act dealing with discharge of dredged or fill material into waters of the U. S., including wetlands. Amendments to the Act in 1977 exempted most farming, ranching, and forestry activities from 404 permit requirements. The USACE is also responsible for flood protection under the Federal Emergency Management Authority, by such means as building and maintaining levies, channelization of streams and rivers (also for navigation), and regulating flows and reservoir levels.

US Bureau of Reclamation (http://www.usbr.gov/main/)

As a water management agency, the Bureau of Reclamation has responsibility for certain hydropower and irrigation projects in the Columbia River basin. Though none of these projects occur in the Imnaha subbasin, Reclamation has used its technical assistance programs for work in the Imnaha basin addressing water conservation, fish passage, and water quality issues.

U. S. Fish and Wildlife Service (http://www.fws.gov/r1srbo/)

The USFWS administers the ESA for resident fish, wildlife, and plant species. The USFWS is also responsible for enforcing the North American Migratory Bird Treaty Act (1913) and the Lacey Act (1900) to prevent interstate commerce in wildlife taken illegally. The USFWS distributes monies to state fish and wildlife departments raised through federal taxes on the sale of hunting and fishing equipment under the authority of the Pitman-Robertson Federal Aid in Fish and Wildlife Restoration Act (1937) and the Dingle-Johnson Act. The USFWS also manages a national system of wildlife refuges and provides funding that emphasizes restoration of riparian areas, wetlands, and native plant communities through the Partners in Wildlife Program. The research functions of the USFWS were transferred to the USGS in 1993.

The USFWS administers the Lower Snake River Fish and Wildlife Compensation Plan (LSRCP) authorized by the Water Resources Development Act of 1976, Public Law (P.L.) 94-587, to mitigate and compensate for fish and wildlife resource losses caused by the construction and operation of the four lower Snake River dams and navigation lock projects. The fishery resource compensation plan identified the need to replace adult salmon and steelhead and resident trout fishing opportunities, and the size of the anadromous program was based on estimates of salmon and steelhead adult returns to the Snake River basin prior to the construction of the four lower Snake River dams.

US Forest Service and Bureau of Land Management (http://www.fs.fed.us/r6/) (http://www.or.blm.gov/)

The current national forest system began with the Forest Reserve Act of 1891. The Organic Act of 1897 established the statutory authority of today's U.S. Forest Service to manage the National Forests. Today, the U.S. Forest Service is required to manage habitat to maintain viable populations of anadromous fish and other native and desirable non-native vertebrate species. A Land and Resource Management Plan (Forest Plan) was developed for the Wallowa-Whitman National Forest (USDA 1990). This plan guides all natural resource management activities, establishes forest-wide multiple-use goals and objectives, and establishes management standards and guidelines for the National Forest.

The Bureau of Land Management, Vale District, in accordance with the Federal Land Policy and Management Act of 1976, is required to manage public lands to protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values. Both the USFS and BLM are required by the Clean Water Act to ensure that activities on administered lands comply with requirements concerning the discharge or run-off of pollutants.

In the Columbia River Basin, the Forest Service and the Bureau of Land Management manage salmonid habitat under the direction of PACFISH (USDA and USDI 1994) and INFISH (Inland Native Fish Strategy USDA 1995). These interim management strategies aim to protect areas that contribute to salmonid recovery and improve riparian habitat and water quality throughout the Basin, including the Imnaha subbasin. These strategies have also facilitated the ability of the federal land managers to meet requirements of the ESA and avoid jeopardy. PACFISH guidelines are used in areas east of the Cascade Crest for anadromous fish. INFISH is for the protection of habitat and populations of resident fishes outside anadromous fish habitat. To meet recovery objectives, these strategies:

- ♦Establish watershed and riparian goals to maintain or restore all fish habitat.
- ♦Establish aquatic and riparian habitat management objectives.
- ♦Delineate riparian management areas.
- ♦Provide specific standards and guidelines for timber harvest, grazing, fire suppression and mining in riparian areas.
- ♦Provide a mechanism to delineate a system of key watersheds to protect and restore important fish habitats.
- ♦Use watershed analyses and subbasin reviews to set priorities and provide guidance on priorities for watershed restoration.
- ♦Provide general guidance on implementation and effectiveness monitoring.
- ♦Emphasize habitat restoration through such activities as closing and rehabilitating roads, replacing culverts, changing grazing and logging practices, and replanting native vegetation along streams and rivers.

The Interior Columbia Basin Ecosystem Management Project (ICBEMP) is a regional-scale land-use plan that covers 63 million acres of federal lands in Oregon, Washington, Idaho, and Montana (www.icbemp.gov). The BLM and USFS released a Supplemental Draft Environmental Impact Statement for the ICBEMP Project in March 2000. The EIS focuses on the critical broad scale issues related to landscape health; aquatic and terrestrial habitats; human needs; and products and services. If approved, ICBEMP will replace the interim management strategies, providing for longer-term management of lands east of the Cascades. As ICBEMP is implemented, subbasin and watershed assessments and plans will target further habitat work (NMFS 2000).

Both the USFS and BLM are developing Biological Assessments for Snake River bull trout, steelhead proposed critical habitat, and Snake River chinook salmon proposed critical habitat.

United States Geological Survey (http://www.usgs.gov/)

The USGS monitors hydrology and maps soil, geological, and geomorphologic features. In the Imnaha, the geological survey currently maintains and collects data recorded from a gaging station located near the town of Imnaha (gage #13292000). The USGS also conducts fish and wildlife research formerly done by the USFWS. This gage is funded equally by USGS, NPT, and OWRD.

United States *v.* Oregon

The November 9, 1987 Columbia River Fish Management Plan was an agreement entered into by the parties pursuant to the September 1, 1983 Order of the United States District Court for the District of Oregon (Court) in the case of United States et al. v, Oregon, Washington et al., (Case No. 68-513). The purpose of the management plan was to provide a framework within which the parties could exercise their sovereign powers in a coordinated and systematic manner in order to protect, rebuild, and enhance upper Columbia River fish runs while providing harvests for both treaty Indian and non-Indian fisheries. The agreement established goals (rebuild weak runs and fairly share harvest), means (habitat protection, enhancement, artificial production and harvest management), and procedures (facilitate communication and resolve disputes) to implement the plan.

The 1987 agreement was in effect until December 31, 1998, when it expired. The parties have agreed to continue meeting to address harvest and production issues until a new process has been developed for negotiating a long-term agreement.

Tribal Government

By treaty with the United States in 1855, the Nez Perce Tribe reserved certain rights within the Imnaha subbasin in compensation for ceding lands to the federal government. These reserved rights provide part of the basis for a wide range of rights and interests for the protection, enhancement, management, and harvest of anadromous fish, wildlife and plants in the subbasin.

Nez Perce Tribe (http://www.nezperce.org/)

Since time immemorial, the Nez Perce Tribe has used and occupied much of northeastern Oregon and a portion of southeastern Washington. Archaeological sites and artifacts spanning thousands of years have been documented throughout the area. Major highways now follow the ancient routes. Trails into the high mountains and deep canyons follow prehistoric pathways. The towns of Joseph, Enterprise, Lostine, Wallowa, and Imnaha are located near significant Indian camps. County maps are filled with names such as Chesnimnus, Minam, Powwatka, and Imnaha – words of Nez Perce origin.

By virtue of the Treaty of 1855, the Nez Perce Tribe reserved as a homeland vast areas of northeast Oregon, southeast Washington, and central Idaho. In this treaty, the Tribe reserved the rights to fish, hunt, and gather roots and berries and to graze domestic livestock. The subsequent Treaty of 1863 removed the areas in northeast Oregon and southeast Washington from the Nez Perce Reservation but did not diminish any of these reserved rights.

The Nez Perce Tribe is responsible for managing, protecting, and enhancing treaty fish and wildlife resources and habitats for present and future generations in the Imnaha River subbasin. Tribal government headquarters are located in Lapwai, Idaho with regional offices in Kamiah, Orofino, and McCall, Idaho and Enterprise, Oregon. The Nez Perce Tribe co-manages fish and wildlife resources with state fish and wildlife managers and individually or jointly implements restoration and mitigation activities through out their areas of interest and influence. These lands include but are not limited to the Imnaha River subbasin. General policies and plans applicable to subbasin management include Nez Perce Tribal Executive Committee resolutions, the Nez Perce Fish and Wildlife Code, the Wallowa County/Nez Perce Tribe Salmon Habitat Recovery Plan with Multi-Species Strategy (Wallowa County and Nez Perce Tribe, 1993) and *Wy-Kan-Ush-Mi Wa-Kish-Wit: Spirit of the Salmon* (Columbia River Inter-tribal Fish Commission 1996a, 1996b). The trust responsibility of the federal government to the Tribe makes the federal government and its agencies (e.g. USFS, BLM) ultimately responsible for protection of the Tribe’s fish and wildlife resources and their habitats.

Columbia River Inter-tribal Fish Commission (http://www.critfc.org/)

The tribal Columbia River Anadromous Fish Restoration Plan, or *Wy-Kan-Ush-Mi Wa-Kish-Wit* (CRITFC 1995) was developed by the Nez Perce, Umatilla, Warm Springs and Yakama tribes. Recommendations set forth in this plan for salmon recovery address three types of actions: institutional, technical, and watershed, with the over-riding goal of simply putting fish back in the river (gravel to gravel management).

Oregon State Government

Oregon Department of Environmental Quality (http://www.deq.state.or.us/)

The ODEQ is responsible for implementing the CWA and enforcing state water quality standards to protect aquatic life and other beneficial uses. The mission of the ODEQ is to lead in the restoration and maintenance of Oregon's quality of air, water and other environmental media. With regard to watershed restoration, the Department is guided by Section 303(d) of the CWA and Oregon statute to establish TMDLs of pollutants and implement water quality standards as outlined in Oregon Administrative Rules 340-041. The ODEQ focuses on stream conditions and inputs and advocates for other measures in support of fish populations (Don Butcher, ODEQ, personal communication February 2, 2001).

Oregon Department of Agriculture (http://www.oda.state.or.us/default.lasso)

The Department of Agriculture oversees several programs in the Natural Resource Division that address soil, water, and plant conservation in the Imnaha Subbasin. Soil and Water Conservation Districts, Watershed Councils, the Environmental Quality Incentives Program (EQIP), and Coordinated Resource Management Planning (CRMP) are under the jurisdiction of the Department of Agriculture. The Coordinated Resource Management Planning (CRMP) group addresses watershed management issues within specific subbasins and develops stream restoration goals and objectives.

Oregon Senate Bill 1010

Under this plan, which was developed by the Oregon Department of Agriculture and the public ad-hoc committee, county-specific agricultural water quality issues are identified and addressed through a committee process. Landowners are encouraged to develop a farm plan to meet the intent of the strategy. Efforts will reduce water pollution from agricultural sources and protect beneficial uses of watersheds. These plans are then incorporated in the Total Maximum Daily Load (TMDL) as a section of the Water Quality Management Plan (WQMP).

Oregon Department of Forestry (http://www.odf.state.or.us/default.htm)

The Oregon Department of Forestry enforces the Oregon Forest Practices Act (OAR 629-Division 600 to 680 and ORS 527) regulating commercial timber production and harvest on state and private lands. The OFPA contains guidelines to protect fish bearing streams during logging and other forest management activities, which address stream buffers, riparian management, and road maintenance. The ODF is a partner in the Oregon Plan and uses its guidelines for watershed work and assessments in the Imnaha Subbasin. The Department is responsible under the State Forestry Act for the forestry portion of the WQMP in the TMDL assessment. Oregon Department of Forestry also provides input to the Conservation Reserve Enhancement Program.

Oregon Department of Fish and Wildlife (http://chinook.dfw.state.or.us/index.html)

Oregon Department of Fish and Wildlife is responsible for protecting and enhancing Oregon fish and wildlife and their habitats for present and future generations. ODFW co-manages fishery resources with the NPT. Management of the fish and wildlife and their habitats in and along the Imnaha Subbasin is guided by ODFW policies, collaborative efforts with affected tribes, and federal and state legislation. Direction for ODFW fish and wildlife management and habitat protection is based on the amendments and statutes passed by the Oregon Legislature through the 2001 session. For example, Oregon Administrative Rule (OAR) 635 Division 07 – *Fish Management and Hatchery Operation* sets forth policies on general fish management goals, the Natural Production Policy, the Wild Fish Management Policy, and other fish management policies. OAR 635 Division 008 – *Department of Wildlife Lands* sets forth management goals for each State Wildlife Area, OAR Divisions 068-071 set deer and elk seasons, and OAR Division 100 – *Wildlife Diversity Plan* sets outlines wildlife diversity program goals and objectives, identifies species listings, establishes survival guidelines, and creates other wildlife diversity policy. OAR Division 400 – *Instream Water Rights Rules* provides guidelines for inflow measurement methodologies, establishes processes for applying for instream water rights, and sets forth other instream water rights policies. OAR Division 415 - *Fish and Wildlife Habitat Mitigation Policy* establishes mitigation requirements and recommendations, outlines mitigation goals and standards, and provides other mitigation guidelines. Another pertinent ODFW policy is the Oregon Guidelines for Timing of In-Water Work to Protect Fish and Wildlife Resources (ODFW 1997b). *Vision 2006* is a six-year strategic operational plan providing guidance for the Department in the next six years. In addition to these OAR's, ODFW has a variety of species-specific plans (discussed below).

♦Oregon Trout Plan

The trout plan ("Oregon's Trout Plan") describes a series of management alternatives that provide guidelines and criteria for protecting wild fish and providing angling in a variety of circumstances. In basin plans, these alternatives provide a context for specific angling regulations. Management objectives are focused on the protection of wild fish and their habitats, providing diverse angling opportunities, making hatchery programs effective and diminishing dependence on hatchery releases, and making the public more aware of trout resources and management issues.

♦Oregon Steelhead Plan

The steelhead plan ("Comprehensive Plan for Production and Management of Oregon's Anadromous Salmon and Trout, Part III: Steelhead Plan") is focused on conservation of wild steelhead; providing public benefits that include angling, tribal uses, and others; and engaging the public, tribes, and agencies in management processes. The conservation approach describes habitat, harvest, and hatchery fish considerations intended to maintain healthy and abundant wild populations.

♦Oregon Warmwater Plan

The warmwater plan ("Warmwater Fish Plan") categorizes management into alternatives that frame regulations. Because warmwater fishes are non-native, the focus is not on species conservation but on providing diverse angling opportunities reflecting the wide distribution of the many species that are classified as "warmwater". Where biological and physical conditions are suitable, the plan directs management to increase the quality of angling. Management of these species is constrained by conservation needs of native fishes.

These species plans, along with basin plans, are a primary means of implementing ODFW fish management policies. They provide a general framework for basin planning and subsequent management of individual populations by management approaches and defining allowable activities. The planning process allows the public and other agencies to participate in developing ODFW management programs.

♦Mule Deer Management Plan

The goal of ODFW's Mule Deer Management Plan (ODFW 1990) is to manage mule deer population to provide optimum recreational benefits to the public, and to be compatible with habitat capability and primary land uses. The plan summarizes the life history of mule deer and their management in Oregon, lists concerns and the strategies to be used in addressing identified problems, and provides management direction to inform the interested public of how mule deer will be managed.

♦ Elk Management Plan

The goal of ODFW's Elk Management Plan (ODFW 1992b) is to protect and enhance elk populations in Oregon to provide optimum recreational benefits to the public and to be compatible with habitat capability and primary land uses. The plan summarizes the life history of elk and their management in Oregon. The plan also lists concerns and the strategies to be used in addressing identified problems and provide management direction to inform the interested public of how elk will be managed.

♦ Bighorn Sheep Management Plan

ODFW's Bighorn Sheep Management Plan (ODFW 1992c) summarizes the history and status of Oregon's bighorn sheep and presents a means by which they will be restored to remaining suitable habitat. The plan serves as a guide for transplanting efforts, assists concerned resource management agencies with wildlife planning efforts, and provides management direction for Oregon's bighorn sheep program. The plan describes 16 bighorn sheep management concerns and recommends strategies to address these concerns.

♦ Cougar Management Plan

The three goals of ODFW's Cougar Management Plan (ODFW 1993b) are 1) recognize the cougar as an important part of Oregon's wildlife fauna, valued by many Oregonians, 2) maintain healthy cougar populations within the state and into the future, and 3) conduct a management program that maintains healthy populations of cougar and recognizes the desires of the public and the statutory obligations of the Department. The plan summarizes the life history of cougar and their management in Oregon. The plan also lists concerns and the strategies to be used in addressing identified problems. Management direction is provided to inform the interested public of how cougar will be managed.

♦ Black Bear Management Plan

The three goals of ODFW's Black Bear Management Plan (ODFW 1993a) are 1) recognize the black bear as an important part of Oregon's wildlife fauna, valued by many Oregonians, 2) maintain healthy black bear populations within the state and into the future, and 3) conduct a management program that maintains healthy populations of black bear and recognizes the desires of the public and the statutory obligations of ODFW. The plan summarizes the life history of black bear and their management in Oregon. The plan lists concerns and the strategies to be used in addressing identified problems and provides management direction to inform the interested public of how black bear will be managed.

♦ Migratory Game Bird Program Strategic Management Plan

The mission of ODFW's Migratory Game Bird Program Strategic Management Plan (ODFW 1993) is to protect and enhance populations and habitats of native migratory game birds and associated species at prescribed levels as determined by national, state, and flyway plans) throughout natural geographic ranges in Oregon and the Pacific Flyway to contribute to Oregon's wildlife diversity and the uses of those resources. Strategies are described that assist in the development of specific operational plans to achieve the program mission and integrate with other state and federal agencies and private organizations. The plan mandates the formation and implementation of more specific operational plans, especially in regard to habitat programs and biological surveys.

♦ Oregon Wildlife Diversity Plan

ODFW's Oregon Wildlife Diversity Plan (ODFW 1993) provides policy direction for the maintenance and enhancement of the vertebrate wildlife resources in Oregon. The plan identifies goals and objectives for maintaining a diversity of non-game wildlife species in Oregon, and provides for coordination of game and non-game activities for the benefit of all species.

♦ Streamflow Restoration Prioritization

ODFW has established the priorities for streamflow restoration needs in the Imnaha Basin (refer to Figure 8), as well as all other basins in the state. Priorities are based on individual rankings of several biological and physical factors, water use patterns and restoration optimism. Biological and physical factors included the number of native anadromous species, presence of a designated "Core Area", fish related ecological benefits, other types of ecological benefits, physical habitat condition, the extent of human influence, water quality, current status or proposed as sensitive, threatened, or endangered, presence of instream flow protection (Instream Water Rights), and natural low flow problems. Water use pattern factors included the estimated amount of consumptive use and the frequency that an existing Instream Water Right is not satisfied. The final factor in the ranking of restoration need was an optimism factor of how well the fish resources would respond if flow were restored. Many of these factors were derived from existing data sources while others were ranked by ODFW's District Fish Biologists, based on local knowledge and professional judgment. Extensive use was made of Geographic Information Systems (GIS) and relational database analytical methods. Flow restoration priorities project was funded by the Oregon Watershed Enhancement Board, through a grant to the Oregon Water Resources Department.

Oregon Department of Transportation (http://www.odot.state.or.us/)

The Oregon Department of Transportation (ODT) maintains highways that cross streams in the subbasin. Under the initiative of the Oregon Plan for Salmon and Watersheds, efforts to improve protection and remediation of fish habitat impacted by state highways are ongoing.

Oregon Division of State Lands (http://statelands.dsl.state.or.us/)

The Oregon Division of State Lands (ODSL) regulates fill and/or removal of material from the bed or banks of streams (ORS 196.800 – 196.990) through the issuance of permits. Permit applications are reviewed by ODFW, U.S. Army Corps of Engineers, DEQ, the counties, and adjoining landowners, and may be modified or denied based on project impacts to fish populations or significant comments received during the review process.

Oregon House Bill 3609

This legislation directs the development of plans for sustainable production of natural anadromous fish runs in Oregon river subbasins above Bonneville Dam, including the Imnaha subbasin, through consultation among state and tribal entities. Adopted plans will be based on sound science and adaptive management, incorporate M&E and objectives and outcomes benefiting fish and wildlife, be consistent with State of Oregon efforts to recover salmonid populations under the federal ESA and include a risk/benefit analysis to wild fish..

Oregon Plan (http//:www.oregon-plan.org)

Passed into law in 1997 by Executive Order, the *Oregon Plan for Salmon and Watersheds* and the *Steelhead Supplement to the Oregon Plan* outlines a statewide approach to ESA concerns based on watershed restoration and ecosystem management to protect and improve salmon and steelhead habitat in Oregon. The Oregon Plan Monitoring Program, successfully implemented in coastal watersheds, provides the necessary approach for rigorous sampling design to answer key monitoring questions, which will be applied to the Imnaha Subbasin. The Oregon Watershed Enhancement Board (OWEB) facilitates and promotes coordination among state agencies, administers a grant program, and provides technical assistance to local Watershed Councils and others to implement the Oregon Plan through watershed assessments and restoration action plans. OWEB funded ODFW and WRD, through a grant to OWRD, to determine streamflow restoration priorities in Columbia River basin tributaries.

Oregon Land Conservation and Development Commission (http://www.lcd.state.or.us/)

The Land Conservation and Development Commission in Oregon regulate land use on a statewide level. County land use plans must comply with statewide land use goals, but enforcement against negligent counties appears minimal. Effective land use plans and policies are essential tools to protect against permanent fish and wildlife habitat losses and degradation, particularly excessive development along streams, wetlands, floodplains, and sensitive wildlife areas.

Oregon State Police (http://www.osp.state.or.us/)

The Fish and Wildlife Division of the Oregon State Police (OSP) is responsible for enforcement of fish and wildlife regulations in the State of Oregon. The Coordinated Enforcement Program (CEP) ensures effective enforcement by coordinating enforcement priorities and plans by and between OSP officers and ODFW biologists. OSP develops yearly Actions Plans to guide protection efforts for critical species and their habitats. Action Plans are implemented through enforcement patrols, public education, and agency coordination. Voluntary and informed compliance is cornerstone with the Oregon Plan concept. The need for continued fish protection is a priority in accordance with Governors Executive Order 99-01.

Oregon Water Resource Department (http://www.wrd.state.or.us/)

The Oregon Water Resources Department (OWRD) regulates water use in the subbasin in accordance with Oregon Water Law. Statutes for water appropriation (ORS 537) govern the use of public waters; Water Right Certificates appurtenant to the different lands within the subbasin specify the maximum rate and/or volume of water that can be legally diverted. Oregon water law is based on the prior appropriation doctrine, which results in water being distributed to senior water right holders over junior water right holders during times of deficiency. The law also requires the diverted water be put to beneficial use without waste. WRD acts as trustee for in-stream water rights issued by the state of Oregon and held in trust for the people of the state. The Water Allocation Policy (1992) tailors future appropriations to the capacity of the resource, and considers water to be “over-appropriated” if there is not enough water to meet all demands at least 80% of the time (80% exceedence). The OWRD is a partner in the Oregon Plan and has developed streamflow restoration priorities for fish.

In conjunction with ODFW, WRD established priorities for streamflow restoration in the Imnaha subbasin. WRD ranked the opportunities and optimism for achieving meaningful streamflow restoration in each subbasin, based on the availability and perceived effectiveness of several flow restoration measures. These included transfers and leases to instream uses, cancelled water rights, enforcement and monitoring, improved diversion methods, stream inventories, conservation planning, improved efficiencies, and measurement and reporting of use. By overlaying the identified need and opportunities for restoration, the State of Oregon has identified the sub watersheds where it will apply its resources toward achieving streamflow restoration.

County and Local Government

Grande Ronde Model Watershed Program

The Grande Ronde Model Watershed Program (GRMWP) is a public citizens' advisory group, designated by the Northwest Power Planning council, the Governor's Strategic Water Management Group and the Union and Wallowa County governments to be the central entity for resource coordination, planning and management in the Grande Ronde and Imnaha subbasins. The GRMWP represents the interests of the basin's residents to local, state and federal agencies and other public and private interests. The Model Watershed mission statement is:

> *"To develop and oversee the implementation, maintenance, and monitoring of coordinated resource management that will enhance the natural resources of the Grande Ronde River Basin."*

Wallowa Soil and Water Conservation Districts (http://www.swcs.org/)

The purpose of the Wallowa Soil and Water Conservation District is to maintain or enhance natural resources within Wallowa County for the benefit of the flora and fauna that depends on healthy ecosystems and for the economic and environmental benefits of the people as authorized by the Oregon State Legislative Assembly in ORS 568.225.

Wallowa County (http://www.co.wallowa.or.us/)

Wallowa County is located in the extreme northeast corner of Oregon State and was established February 11, 1887. The County's population is slightly over 7,000. Elevations range from 975 feet at the mouth of the Imnaha River to 10,000 feet in the Eagle Cap Wilderness. The county's river valleys, deeply incised canyons, prairies, high plateaus, and Wallowa Lake plus numerous high mountain lakes provide a large variety of habitats for fish and wildlife. The economy is based primarily on farming, ranching and timber harvest and milling. Government employment, tourism, services, and bronze foundries and other arts make up the balance of the employment. Sixty-five percent of the county is in public ownership (USFS, BLM, state).

In 1993 Wallowa County, the Nez Perce Tribe, and a public ad hoc committee completed the Wallowa County/Nez Perce Tribe Salmon Habitat Recovery Plan (Plan) as a response to the listing of Snake River spring and summer chinook by the National Marine Fisheries Service under the Endangered Species Act in 1992. All streams in Wallowa County with known chinook populations were analyzed for a variety of habitat conditions relating to salmon survival. A section of the Plan contained a list of solutions relating to specific identified problems as an aid to landowners. The 16-person public ad hoc committee included members from Federal and State agencies, private landowners, timber, ranching, and business interests, the environmental community, and the County and Tribe. The Plan was appended to the County's

Comprehensive Land Use Plan making it State law in Wallowa County. The mission statement for the Plan is:

> "*To develop a management plan and a multi-species strategy to assure that watershed conditions in Wallowa County provide habitat necessary for salmonids and other vertebrate species occurring in Wallowa County by protecting and enhancing conditions as needed. The plan will provide the best watershed conditions available consistent with the needs of the people of Wallowa County, the Nez Perce Tribe, and the rest of the United States and is made an integral part of the Wallowa County Comprehensive Land Use Plan*."

It was understood at the beginning of the Plan development that Wallowa County could not save the salmon in the Snake River. Most of the major problems, such as mainstem dams, fishing, and estuary and ocean conditions, were outside of the County's purview. The best Wallowa County could do was to provide quality habitat within the county.

A grant from the Regional Strategies Economic Development Department of the State of Oregon in 1998 provided funds to expand the Plan into a multi-species plan. All terrestrial vertebrate species known or thought to exist in Wallowa County were identified from the Interior Columbia Basin Ecosystem Management Project (ICBEMP) species lists. A matrix was constructed that listed the vertebrate species with their associated cover types and habitat types (which were also taken from ICBEMP). The expanded Plan was completed in 1999 and is now called The Wallowa County/Nez Perce Tribe Salmon Habitat Recovery Plan and Multi-Species Strategy (Wallowa County and Nez Perce Tribe 1999). The matrix will be expanded in the next phase to include time and type of use and a similar matrix will be developed for all fish species.

As part of the implementation of the Plan, Wallowa County established a Natural Resource Advisory Committee (NRAC) in 1996. The mission of the NRAC is

> *"To review implementation of agricultural, forest, and natural resource provisions of Wallowa County's Comprehensive Land Use Plan."*

The NRAC meets quarterly and its twenty members represent the same constituencies as in the original ad hoc committee. NRAC Standing and Technical Committees were also established which meet monthly. The Standing Committee advises the County Commissioners on natural resource issues. The Technical Committee reviews all on-the-ground projects from the County Planning Department and all project proposals from Wallowa County being presented to the Grande Ronde Model Watershed Program (GRMWP) or the Oregon Watershed Enhancement Board (OWEB) for funding. The Technical Committee does not determine if a project should or shouldn't be funded but instead makes recommendations on how to improve projects, either in location or technique. These recommendations are passed back to the individual that proposed the project and to the County Planning Department or the GRMWP or OWEB.

Wallowa County Road Department

The Wallowa County Road Department maintains all non-Forest Service roads in the Imnaha subbasin.

Wallowa County Weed Control District

The mission of the Wallowa County Weed Control District is to "Work cooperatively to promote and implement noxious weed control in Wallowa County; to contain existing weed populations and eradicate new invaders; to raise the value of the land economically and biologically; to improve the health of the community, promote stewardship, preserve natural resources, and provide examples and leadership for other counties in effective vegetation management." The District is supervised by the Wallowa County Weed Board whose purpose is "to act as the advisory board to the Wallowa County Court on issues and decisions regarding the control of noxious weeds." Some of the actions conducted by the District include county weed inventory, reviewing yearly herbicide application records, prioritize weed control efforts, coordinating control efforts, seek funding for weed control efforts, road shoulder weed control, weed control education, and conduct an annual weed tour (Wallowa County Weed Control District Strategic Plan 1999).

Watershed Councils

Watershed Councils are used as a vehicle for implementing the Oregon Plan. They conduct watershed assessments, monitoring, and determine actions necessary to meet state water quality standards. The Grande Ronde Model Watershed serves the Imnaha subbasin.

Other Entities and Organizations

Oregon Water Trust (http://www.owt.org/)

Oregon Water Trust (OWT), a private, non-profit group, negotiates voluntary donations, leases or permanent purchases of out-of-stream water rights to convert to instream water rights in those streams where acquisition will provide the greatest potential benefits for fish and water quality. Added responsibility for water brokerage contracts to restore instream flow is implied in the FRCPS BiOp.

The Nature Conservancy (http://nature.org/)

The Nature Conservancy protects the lands and waters, which plant and animals species need to survive. The conservancy is instrumental in purchasing lands for habitat protection, working with agencies with similar objectives, and has been involved in the Imnaha subbasin. Areas currently managed by the Conservancy include the Zumwalt and Clear Lake Ridge wildlife preserves.

Northwest Power Planning Council – NWPPC (http://www.nwcouncil.org/)

Formed under the Pacific Northwest Electric Power Planning and Conservation Act of 1980, the NWPPC is directed to develop a program to "protect, mitigate, and enhance fish and wildlife, included related spawning grounds and habitat, in the Columbia River and its tributaries… affected by the development, operation, and management of [hydroelectric project]…" The BPA funds the Council's program.

Columbia River Basin Forum (http://www.crbforum.org/crbforum/start.htm)

Formerly called The Three Sovereigns, the Columbia River Basin Forum is designed to improve management of fish and wildlife resources in the Columbia River Basin. The process is an effort to create a new forum where the federal government, Northwest states and tribes could better discuss, coordinate, and resolve basinwide fish and wildlife issues under the authority of existing laws. The Forum is included as a vehicle for implementation of the Basinwide Salmon Recovery Strategy.

Existing Goals, Objectives, and Strategies

The Imnaha Subbasin has diverse populations of fish and wildlife and unique areas of habitat that are of economic and ecological significance to the people of the State of Oregon and the Northwest, and of special cultural significance to members of the Nez Perce Tribes. The overall goal for the Imnaha subbasin is to restore and/or maintain the health and function of the ecosystem to ensure continued viability of these important populations.

Numerous federal, state, and local entities are charged with maintenance and protection of the natural resources of the Imnaha Subbasin.

Federal

National Marine Fisheries Service and Federal Caucus

The goal of the NMFS with respect to the Imnaha Subbasin is to achieve the recovery of the salmon resource. This requires the development of watershed-wide properly functioning habitat conditions and a population level that is viable according to standards and criteria identified by NMFS in two key documents [Matrix of Pathways and Indicators (1996); Viable Salmonid Populations (2000)]. Actions which contribute to these objectives include moisture retention on crop lands, development of riparian vegetation, restoration of streamflow and appropriate hydrologic peak flow conditions, passage improvements and screening, and many other activities. By virtue of Section 7 responsibilities, any federal action requires consultation with NMFS. The recovery planning framework and effort will build upon existing conservation measures and develop additional critical information useful to fish and wildlife managers.

The federal Basinwide Strategy for salmon recovery developed by the federal caucus identifies immediate and long-term actions in the hydropower, hatchery, harvest, and habitat arenas. Importantly for this summary, it commits federal assistance to local efforts in these areas and is quite specific to the Imnaha watershed. These goals are outlined below.

Habitat Goal

The habitat goals of the Basinwide Salmon Recovery Strategy are: the existence of high quality habitats that are protected, degraded habitats that are restored and connected to other functioning habitats, and a system where further degradation of tributary and estuary habitat and water quality is prevented. Near-term (5- 10 year) objectives for tributary habitat within the Imnaha subbasin include:

Objective 1. Restore and increase tributary flows to improve fish spawning, rearing, and migration.

Objective 2. Screen diversions, combine diversions, and rescreen existing diversions to comply with NMFS criteria to reduce overall mortality.

Objective 3. Reduce passage obstructions to provide immediate benefit to migration, spawning, and rearing.

- Strategy 1. Federal agencies, state, and other to address all flow, passage, and screening problems over the next 10 years in the Imnaha Subbasin.
  - Action 1.1. USBR to implement actions in the Upper Imnaha Subbasin in 2001
  - Action 1.2. BPA to expand on measures under the NWPPC program to complement USBR's actions.
  - Action 1.3. NMFS to provide USBR with passage and screening criteria and methodologies for determining instream flows that satisfy ESA requirements.

Strategy 2. BPA funds protection of currently productive non-federal habitat, especially if at risk of being degraded.

- Action 2.1. BPA and NMFS will develop criteria and priorities by June 2001.
- Action 2.2. Protect habitats through conservation easements, acquisitions, or other means.
- Action 2.3. BPA works with non-profit land conservation organizations and others to achieve habitat protection objectives.

Strategy 3. Increase tributary flows through innovation actions.

- Action 3.1. Establish a water brokerage as a transactional strategy for securing flows.
- Action 3.2. Develop a methodology acceptable to NMFS for ascertaining instream flows that meet ESA requirements.

Strategy 4. Action Agencies to coordinate efforts and support off-site habitat enhancement measures undertaken by others

- Action 4.1. Support development of state/tribal 303(d) lists and TMDLs by sharing water quality and biological monitoring information.
- Action 4.2. Participate in TMDL coordination or consultation meetings
- Action 4.3. Build on and use existing data management structures to improve data sharing.
- Action 4.4. Share technical expertise and training with federal, state, tribal, regional, and local entities.
- Action 4.5. Leverage funding resources through cooperative projects, agreements, and policy development

The program for tributary habitat is premised on the idea that securing the health of these habitats will boost productivity of listed stocks.

Hatchery Goal

The overarching goal for hatchery reform is reduced genetic, ecological, and management effects of artificial production that are adverse on the natural population. Objectives that are relevant to the Imnaha Subbasin include:

- Objective 1. Manage the number of hatchery-produced fish that escape to spawn naturally.
- Objective 2. Employ hatchery practices that reduce unwanted straying of hatchery fish into the Imnaha Subbasin (i.e. appropriate acclimation in target streams). For naturally spawning populations in critical ESU habitats, non-ESU hatchery-origin fish do not exceed 5%; ESU hatchery fish do not exceed 5%-30%.
- Objective 3. Mark hatchery-produced fish to distinguish natural from hatchery fish on spawning grounds and in fisheries.
- Objective 4. Design and conduct fishery programs so fish can be harvested without undue impacts on weaker stocks.

Research Monitoring and Evaluation Goal

Identified trends in abundance and productivity in populations of listed anadromous salmonids.

- Objective 1. Conduct population status monitoring to determine juvenile and adult distribution, population status, and trends.
- Objective 2. Monitor the status of environmental attributes potentially affecting salmonid populations, their trends, and associations with salmonid population status.

Objective 3. Monitor the effectiveness of intended management actions on aquatic systems, and the response of salmonid populations to those actions.

Objective 4. Assess quality of available regional databases, in terms of accuracy and completeness, which represent habitat quality throughout the basin.

Objective 5. Monitor compliance of management actions toward proper implementation and maintenance.

- Strategy 1. Conduct Tier 1 sampling to monitor broad-scale population status and habitat conditions.
- Strategy 2. Conduct Tier 2 monitoring to obtain detailed population assessments and assessments of relationships between environmental characteristics and salmonid population trends.
- Strategy 3. Conduct Tier 3 monitoring to establish mechanistic links between management actions and fish population response.

US Bureau of Reclamation

Reclamation plans to work with willing private landowners through the existing local infrastructure to improve conditions related to instream flow, barriers, and habitat for anadromous fish. Reclamation plans to continue to work to meet these objectives in the subbasin as long as necessary.

Objective 1. Restore and increase main stem and tributary flows to improve fish spawning, rearing, and migration.

- Strategy 1. Plan and design pipelines, canal lining, diversion automation, and other water conservation measures to provide water to meet irrigation demands and retain residual flow in the stream.
- Strategy 2. Plan and design stream restoration modifications to enhance natural stream function.
- Strategy 3. Continue participation in water exchange proposals associated with Wallowa Dam rehabilitation project.

Objective 2. Eliminate barriers to fish passage.

- Strategy 1. Provide planning and engineering design assistance to replace barriers with permanent structures that will freely pass fish.

Objective 3. Improve habitat for migrating, spawning, and rearing anadromous fish

- Strategy 1. Plan and design structures and other features to improve habitat.

US Fish and Wildlife Service

The Fish and Wildlife Service, LSRCP Office administers and funds the operation, maintenance, and evaluation of all LSRCP facilities in the Imnaha River Basin through cooperative agreements with the agencies and tribes. As the agency that markets Columbia River generated power, the Bonneville Power Administration (BPA) reimburses the FWS for all power-related LSRCP costs. The basis for the development of the LSRCP was derived from the Special Report, Lower Snake River Fish and Wildlife Compensation Plan, Lower Snake River, Washington and Idaho, June 1975 . (USACE 1975) and further described in “A Review of the Lower Snake River

Compensation Plan Hatchery Program" (Herrig 1990). The USFWS is also required to comply with the Endangered Species Act, to meet tribal trust responsibilities, to adhere to various federal laws, agreements, and court orders, and to pursue the USFWS Mission and Vision (USFWS 1998).

The LSRCP spring/summer chinook program in the Imnaha River Basin consists of one hatchery and associated satellite facility (Lookingglass FH and Imnaha SF). The LSRCP goal is to return 3,210 spring/summer chinook adults to the Snake River basin above Lower Granite Dam (USFWS 2001). The hatchery and associated satellite facility are operated by Oregon Department of Fish and Wildlife.

The LSRCP steelhead program in the Imnaha River consists of two hatcheries and associated satellite facilities that rear and acclimate steelhead (Irrigon FH, Wallowa FH, Big Canyon SF, and Little Sheep SF). The LSRCP goal is to return 2,000 steelhead adults to the Snake River Basin above Lower Granite Dam. Irrigon FH, Wallowa FH, Big Canyon SF, and Little Sheep SF are operated by Oregon Department of Fish and Wildlife.

As LSRCP cooperators, the Nez Perce Tribe also participates in operation and management decisions in all LSRCP spring/summer chinook and summer steelhead programs in the Imnaha River Basin. All cooperators are funded to conduct monitoring and evaluation studies and fish health.

Goal:

Return 3,210 spring/summer chinook and 2,000-summer steelhead to the Snake River Basin above Lower Granite Dam.

Objective 1. Provide harvest for sport anglers and tribes.
Objective 2. Provide brood stock for hatchery programs.
Objective 3. Provide some natural spawning escapement where appropriate.
Objective 4. Comply with the Endangered Species Act.
Objective 5. Meet tribal trust responsibilities.
Objective 6. Adhere to federal laws, agreements, and court orders.
Objective 7. Pursue the USFWS Mission and Vision.

USFS and BLM (PACFISH)

Fish and Fish Habitat Goals

1. Restored water quality that provides for stable and productive riparian and aquatic ecosystems.
2. Restored stream channel integrity, channel processes, and sediment regimes under which riparian and aquatic ecosystems developed.
3. Restored instream flows supporting healthy riparian and aquatic habitats, stable and effectively functioning stream channels, and rerouted flood discharges.
4. Restored natural timing and variability of the water table elevation in meadows and wetlands.
5. Restored diversity and productivity of native and desired non-native plant communities in riparian zones.
6. Restored riparian vegetation a) providing large woody debris characteristic of natural aquatic and riparian ecosystems, b) providing adequate summer and winter thermal regulation within the riparian and aquatic zones, c) achieving rates of surface erosion,

bank erosion, and channel migration characteristic of those under which the communities developed.

7. Restored riparian and aquatic habitats necessary to foster the unique genetic fish stocks that evolved within the specific geo-climatic region.
8. Restored habitat to support populations of well-distributed native and desire non-native plant, vertebrate, and invertebrate populations that contribute to the viability of riparian-dependent communities.

Fish and Fish Habitat Objectives (Riparian Management Objectives - RMO)

Objective 1. Establish Pool Frequencies (#pools/mi) dependent on width of wetted stream

Width	10	20	25	50	75	100	125	150	200
# pools	96	56	47	26	23	18	14	12	9

Objective 2. Comply with state water quality standards in all systems (max < 68°F)

Objective 3. Establish large woody debris in all forested systems (> 20 pieces/mi, > 12 in diameter, > 35 ft length).

Objective 4. Ensure > 80% bank stability in non-forested systems

Objective 5. Reduce bank angles (undercuts) in non-forested systems (> 75% of banks with < 90% angle).

Objective 6. Establish appropriate width/depth ratios in all systems (< 10, mean wetted width divided by mean depth).

General Riparian Area Management

Objective 1. Identify and cooperate with federal, Tribal, and state and local governments to secure instream flows needed to maintain riparian resources, channel conditions, and aquatic habitat

Objective 2. Fell trees in Riparian Habitat Conservation Areas when they pose a safety risk. Keep felled trees on site when needed to meet woody debris objectives.

Objective 3. Apply herbicides, pesticides, and other toxicants/chemicals in a manner to avoid impacts that are inconsistent with attainment of RMOs.

Objective 4. Locate water-drafting sites to minimize adverse effects on stream channel stability, sedimentation, and in-stream flows.

Watershed and Habitat Restoration

Objective 1. Design and implement watershed restoration projects in a manner that promotes the long-term ecological integrity of ecosystems, conserve the genetic integrity of native species, and contributes to attainment of RMOs.

Objective 2. Cooperate with federal, state, and tribal agencies, and private landowners to develop watershed-based CRMPs or other cooperative agreements to meet RMOs.

Fisheries and Wildlife Restoration

Objective 1. Design and implement fish and wildlife habitat restoration and enhancement activities in a manner that contributes to attainment of the RMOs.

Objective 2. Design, construct, and operate fish and wildlife interpretive and other use-enhancement facilities in a manner that is consistent with attainment of RMOs.

Objective 3. Cooperate with federal, state, and tribal wildlife management agencies to identify and eliminate wild ungulate impacts that are inconsistent with attainment of RMOs.

Objective 4. Cooperate with federal, state, and tribal fish management agencies to identify and eliminate impacts associated with habitat manipulation, fish stocking, fish harvest, and poaching that threaten the continued existence and distribution of native fish stocks inhabiting federal lands.

Nez Perce Tribe Department of Fisheries Resources Management

Goal 1. Restore anadromous fishes to the rivers and streams that support the historical, cultural and economic practices of the Nez Perce Tribe (CRITFC 1995).

Goal 2. Emphasize restoration strategies that rely on natural production and healthy river systems (CRITFC 1995).

Goal 3. Protect Tribal sovereignty and treaty rights (CRITFC 1995).

Goal 4. Reclaim the anadromous fish resource and the environment upon which it depends for future generations (CRITFC 1995).

Goal 5. Conserve, restore and recover native resident fish populations (NPT DFRM 2000).

Management Objectives

Objective 1. Restore and recover historically present fish species.

Objective 2. Provide for harvestable, self-sustaining populations of anadromous and resident fish species in their native habitat.

Objective 3. Manage salmon and steelhead for long-term population persistence.

Objective 4. Manage aquatic resources for healthy ecosystem function and rich species biodiversity.

Objective 5. Implement and enforce existing federal laws for protection of water quality, habitat and aquatic resources.

Objective 6. Protect and enhance treaty fishing rights and fishing opportunities.

Objective 7. Provide optimum tributary stream flows to meet life stage specific habitat requirements of resident and anadromous fish species and all other aquatic species.

Objective 8. Provide optimum mainstem river flows for anadromous fish passage and water spill at mainstem dams to maximize fish survival.

Objective 9. Integrate aquatic habitat and species management with terrestrial species management.

Objective 10. Maintain a natural smolt-to-adult survival rate of 2 to 6% for salmon and steelhead.

Objective 11. Meet federal fisheries mitigation responsibilities for LSRCP program.

Objective 12. Provide for Tribal hatchery production needs in federal and state managed facilities.

Objective 13. Address key limiting survival factors at mainstem hydroelectric facilities.

Objective 14. Coordinate with the National Marine Fisheries Service and U.S. Fish and Wildlife Service to fund and implement actions identified in the Biological Opinions, and to implement other emergency actions that address imminent risk to listed salmon, steelhead, and bull trout populations.

Objective 15. Develop conservation hatcheries for supplementation of ESA listed fish populations.

Management Strategies

Strategy 1. Implement natural river drawdown strategy, for recovery of anadromous fish stocks, with necessary investments in community infrastructure.
Strategy 2. Implement a no-net decline management criteria for anadromous fish stocks.
Strategy 3. Implement Northeast Oregon Hatchery production releases.
Strategy 4. Monitor steelhead in key tributary streams.
Strategy 5. Implement native steelhead broodstock development in conservation hatcheries.
Strategy 6. Implement effective monitoring and evaluation of supplementation and habitat enhancement programs on project-specific and reference stream (control) locations.
Strategy 7. Conduct necessary planning activities.
Strategy 8. Restore the natural production potential of anadromous and resident fish species.

Research Monitoring and Evaluation

Objective 1. Conduct Lower Snake River Compensation Plan (LSRCP) hatchery evaluations (NPT DFRM 2000, Hesse and Kucera 2000).

Strategy 1. Cooperatively conduct salmon spawning ground surveys.
Strategy 2. Monitor the density and selected life history characteristics of juvenile chinook salmon and steelhead in tributary streams of the Imnaha River.
Strategy 3. Determine the emigration timing of natural and hatchery reared chinook salmon smolts.
Strategy 4. Estimate the post-release survival of hatchery reared chinook salmon smolts in the Imnaha River.
Strategy 5. Determine and compare the emigration timing, travel time, and survival of natural and hatchery reared chinook salmon and steelhead smolts from the Imnaha River to Snake River and Columbia River dams.
Strategy 6. Determine the smolt-to-adult survival of natural chinook salmon.
Strategy 7. Determine adult steelhead abundance, spatial structure, and genetic diversity.
Strategy 8. Cooperatively conduct marking and mark efficiency evaluation studies of LSRCP hatchery production.
Strategy 9. Collect adult male chinook salmon and steelhead gametes from LSRCP hatcheries and from selected tributary streams for gene conservation efforts (cryopreservation).
Strategy 10. Provide effective communication and dissemination of project results.

Objective 2. Provide smolt-monitoring information to the Fish Passage Center (NPT DFRM 2000, NPT 1994, Kucera 1994).

Strategy 1. Determine the emigration timing of natural and hatchery steelhead smolts.
Strategy 2. Determine the emigration timing and travel time of previously PIT tagged hatchery steelhead smolts.
Strategy 3. Determine the emigration timing, travel time, and recovery rate of natural and hatchery steelhead from the Imnaha River to Snake River and Columbia River dams.
Strategy 4. Provide weekly smolt monitoring information to the Fish Passage Center for in-season shaping of the water budget and spill requests.
Strategy 5. Provide a final report summarizing results of smolt monitoring activities.

Objective 3. Preserve the genetic diversity of salmonid populations at high risk of extirpation through application of cryogenic techniques (NPT DFRM 2000; NPT 1997; Armstrong 2000).

- Strategy 1. Coordinate salmonid gamete preservation with management agencies in the Snake River basin.
- Strategy 2. Refine gene bank cryopreservation project goals for salmonid spawning aggregates at high risk of extirpation.
- Strategy 3. Collect gametes from ESA-listed chinook salmon and steelhead for application of cryopreservation techniques and conduct genetic analysis of fish represented in the germplasm repository for salmonid conservation units at low levels of abundance and high risk of extirpation.
- Strategy 4. Technology transfer through annual reports.
- Strategy 5. Operation and maintenance of germplasm repository.

Objective 4. Develop a comprehensive monitoring and evaluation plan including a summary of existing information on chinook and steelhead population status, including base line genetic stock structure (NPT DFRM 2000).

- Strategy 1. Synthesize existing data on chinook and steelhead adult abundance, spawning distribution and timing.
- Strategy 2. Synthesize existing data on steelhead juvenile density, early-life history, and survival.
- Strategy 3. Promote the genetic analysis of tissue samples collected from juvenile steelhead under the Lower Snake River Compensation Program. Assist with the acquiring of funding and assure comparable and transferable analysis methods are used.
- Strategy 4. Summarize spawning distribution and timing, juvenile emigration and survival, juvenile(hatchery) releases, life history, ecological interactions, genetics, and fish health.
- Strategy 5. Identify critical uncertainties regarding the condition stocks in the Snake River Basin and associated with supplementation of those stocks.
- Strategy 6. Develop an annotated bibliography of steelhead supplementation research and management actions.
- Strategy 7. Develop a monitoring and evaluation plan for collection of baseline data in appropriate subbasin tributaries.
- Strategy 8. Evaluate the feasibility of conducting juvenile production monitoring, including the engineering design of trapping facilities to support year-round sampling.
- Strategy 9. Develop a conservation biology assessment of adult escapement goals.

Artificial Production

Objective 1. Complete planning and development of spring chinook conservation facilities as proposed in the spring chinook master plan.

- Strategy 1. Complete preliminary and final design of proposed facilities on the Imnaha River and modifications to Lookingglass Fish Hatchery.
- Strategy 2. Complete NEPA analysis of proposed alternative for facilities on the Imnaha River.

Strategy 3. Construct proposed production facilities on the Imnaha River to implement the conservation hatchery program.
Strategy 4. Coordinate planning and development of NEOH facilities and programs with appropriate entities.

Objective 2. Develop a master plan for the development of a native broodstock for steelhead conservation and transition of steelhead production in the Imnaha subbasin from mitigation to conservation and restoration.
Strategy 1. Determine critical uncertainties regarding the condition of steelhead populations in the Imnaha River subbasin and develop a plan for collection of baseline data in appropriate subbasin tributaries.
Strategy 2. Collect and summarize existing information on population status.
Strategy 3. Conduct review of existing production facilities and the potential for modification to meet restoration program needs.
Strategy 4. Identify potential options for new supplementation programs and/or modification of existing LSRCP production programs to implement restoration program.
Strategy 5. Identify potential site locations for adult trapping facilities, incubation and rearing facilities, stream-side incubators, acclimation and release facilities.

Objective 3. Restore fall chinook salmon in the Imnaha River subbasin.
Strategy 1. Complete the comprehensive Snake River fall chinook recovery plan.
Strategy 2. Identify facilities necessary for implementation of the program

Watershed

Goals:

1. Implement the Wallowa County/Nez Perce Tribe Salmon Habitat Recovery Plan and Multi-Species Strategy.
2. Provide habitat for the restoration and enhancement of anadromous salmonids and other native fish species.
3. Develop recommendations for management and utilization of water by agriculture and other industries.
4. Conduct a public involvement program to address concerns of landowners, land managers and resource users.
5. Provide recommendations for management of resources which will enhance the quality and quantity of stream flows.
6. Recommend resource management and research activities.
7. Assure that watershed restoration activities implemented in the Basin are adequately monitored and evaluated.
8. Restore upland habitat and the native wildlife populations that depend on it.

Objective 1. Coordinate watershed restoration activities.
Strategy 1.1. Facilitate inter-agency coordination of program activities and projects.
Strategy 1.2. Coordinate planning, prioritization, design and implementation of restoration projects.
Strategy 1.3. Provide technical support for project planning, design and implementation.

Strategy 1.4. Maintain basin-wide restoration activity database.
Strategy 1.5. Prepare watershed assessments/updates and NEPA documentation.
Strategy 1.6. Conduct educational outreach.
Strategy 1.7. Coordinate project effectiveness and basin-wide water quality monitoring.

Objective 2. Improve in-stream habitat diversity for salmonid spawning and rearing.
Strategy 2.1. Add large wood component to mainstem streams and tributaries.
Strategy 2.2. Rock and log structure placements.
Strategy 2.3. Install grade control structures.
Strategy 2.4. Reconstruct channel meanders.
Strategy 2.5. Construct off-channel rearing habitat.
Strategy 2.6. Implement riparian tree planting

Objective 3. Enhance riparian condition (vegetation, function, etc.)
Strategy 3.1. Construct riparian livestock fencing
Strategy 3.2. Restore wet meadows
Strategy 3.3. Develop off-stream livestock water sources
Strategy 3.4. Close/obliterate draw-bottom roads where possible.
Strategy 3.5. Revegetate streambanks and riparian zones.

Objective 4. Reduce stream sedimentation.
Strategy 4.1. Revegetate streambanks.
Strategy 4.2. Construct rock barbs with embedded wood or use other structures as appropriate to the site (e.g., J-hooks, W-weirs).
Strategy 4.3. Use bio-engineering where hard structures are not appropriate or possible.
Strategy 4.4. Determine the source of the problem (e.g., land use, changed hydrograph) and correct if possible.

Objective 5. Increase late-season streamflows.
Strategy 5.1. Improve water conveyance efficiency in irrigation ditches.
Strategy 5.2. Improve water application efficiency on irrigated lands.
Strategy 5.3. Acquire in-stream water rights.
Strategy 5.4. Lease water rights.

Objective 6. Improve upland watershed condition and function.
Strategy 6.1. Treat and contain noxious weeds.
Strategy 6.2. Construct livestock pasture fencing.
Strategy 6.3. Manipulate tree density.
Strategy 6.4. Enhance vegetative cover (seeding).
Strategy 6.5. Reduce risk of catastrophic fire.
Strategy 6.6. Develop an assessment of upland habitat conditions and prioritize restoration actions.
Strategy 6.7. Develop a habitat type/cover type GIS overlay with condition factor.

Objective 7. Improve adult and juvenile salmonid fish passage.

Strategy 7.1. Prioritize replacement/modification of inadequate culverts based on an accepted culvert inventory methodology (e.g. U.S. Forest Service, Region 6).
Strategy 7.2. Replace/modify culverts based on the prioritization.
Strategy 7.3. Repair inadequate crossings (fords) by hardening the entrances and stream bottom or by replacing them with culverts or bridges as appropriate.
Strategy 7.4. Replace push-up gravel irrigation diversions.
Strategy 7.5. Modify impassable irrigation diversion structures.

Objective 8. Improve water quality.
Strategies: All tasks under Obj's 3, 4, 5, 6.

Tribal and State (Nez Perce Tribe and Oregon Department of Fish and Wildlife)

The vision of the Oregon Department of Fish and Wildlife is that "Oregon's fish and wildlife are thriving in healthy habitats due to cooperative efforts and support by all Oregonians" (ODFW 2000). The vision for the Imnaha subbasin among state and tribal resource managers is improved basin habitat for the enhancement and productivity of wild spring chinook salmon, summer steelhead, native resident trout, and numerous wildlife species (NPT et al. 1990). ODFW and Nez Perce Tribe developed the following objectives and strategies cooperatively in 1990 as part of the System Planning effort for the NWPPC (i.e., Imnaha Subbasin Plan).

Habitat Goals

1. Restore, maintain or enhance instream habitat to levels necessary to support and/or recover anadromous and resident fish to harvestable levels in Wallowa County.
2. Restore, maintain or enhance terrestrial habitat to conditions necessary to support and/or recover terrestrial vertebrates in Wallowa County.

Habitat Objectives

Objective 1: Protect existing anadromous fish habitat by preventing further watershed degradation in the form of water quality, quantity, and instream habitat.
Objective 2: Restore optimum habitat (temperature, flows) for all life history stages of anadromous salmonids.
Objective 3: Protect, restore, and maintain suitable habitat conditions for all bull trout life history stages.
Objective 4. Protect and maintain remaining high quality riparian and upland habitats.
Objective 5. Maintain or increase wildlife species diversity.
Objective 6: Pursue habitat protection through local, state, and federal agency coordination.

Habitat Strategies

Strategy 1. Grazing: Develop livestock control measures to include limited grazing periods, reduced stocking rates, temporary or permanent stream corridor fencing, and management of riparian pasture systems.
Strategy 2. Mining: Require mining and dredging operations to meet county, state, and federal regulations. Ensure that the Department of Environmental Quality, Environmental Protection Agency, and Oregon Division of State Lands jointly develop guidelines, standards, and enforcement procedures for protection of streambed conditions under provisions of the 1987 amendments to the Clean

Water Act, Title III – Standards and Enforcement, Sections 301-310, and 404. Prevent mining activities in or near critical fish habitat.

Strategy 3. Road Building: Enforce Forest Service Practices Rules requiring adequate maintenance or closure and rehabilitation of roads. Social, economic, wildlife, fisheries, and recreation factors must be considered and positive road management plans developed to close unnecessary roads and return them into resource production where possible. Examine alternative road construction sites in areas classified as having high erosion and slope failure potential.

Strategy 4. Timber Harvest: Develop a system for classifying and mapping forestlands susceptible to erosion, including slope failures, streamside landslides, gully erosion, and surface erosion. Such a system should take into account the potential for damage to downstream resources in addition to the potential for on-site erosion.

Strategy 5. Timber Harvest: Require the USFS, BLM, and ODF to increase monitoring of timber harvest activities for compliance with rules, guidelines, and recommendations for habitat protection.

Strategy 6. Pesticide and Herbicide Use: Encourage that chemical treatments from federal, state, and private individuals for plant and insect control adjacent to waters in the Imnaha River Subbasin will not endanger fish life and aquatic organisms or damage watershed and riparian systems.

Strategy 7. Water Quality and Quantity: Require the EPA, ODEQ, BLM, and USFS to establish monitoring programs required by the Clean Water Act (Sections 301-310), the National Forest Management Act, and the National Environmental Protection Act (NEPA).

Strategy 8. Encourage the ODEQ, EPA, and DSL to enforce guidelines, standards, and procedures for protection of streambed conditions under provisions of the Clean Water Act (1987 amended)

Strategy 9. Continue landowner involvement and cooperation in protecting, restoring, and enhancing riparian systems and watersheds.

Strategy 10. Encourage the DSL to develop procedures and provide manpower to monitor compliance with fill and removal permit conditions

Strategy 11. Develop acceptable methods of erosion control for necessary bank protection, through agency and landowner cooperation.

Strategy 12. Apply for instream water rights or recommend additional sites for adoption of minimum streamflow by the Water Resources Commission.

Strategy 13. Require all diversion inlets be properly screened and maintained as required by the Fish Screen Law (1987) and ORS 509.615.

Strategy 14. Monitor irrigators to ensure all diversion structures minimally provide adult and juvenile passage as required by state law

Strategy 15. Obtain funding for landowners through state and federal agencies to implement more efficient irrigation methods and develop water conservation practices benefiting landowners and instream flows.

Strategy 16. Promote, purchase, lease, exchange, or seasonally rent water rights for selected fish habitat during critical low flow periods

Strategy 17. Support purchase, lease, or easement of habitat areas from willing landowners.

Strategy 18. Develop a comprehensive plan for reintroduction, regulation, and management of beaver in suitable sites in the Imnaha subbasin for the specific purpose of using beaver to restore streamflows, improve fish habitat, and improve watersheds

Strategy 19. Support and expand existing watershed programs

Strategy 20. Develop a system of riparian natural areas associated with critical fish habitat throughout the basin

Strategy 21. Protect, enhance, and restore wildlife habitat in the subbasin.

- Action 21.1. Determine and monitor abundance and distribution of wildlife species to identify and prioritize wildlife habitat restoration needs in the subbasin.
- Action 21.2 Conduct periodic comprehensive habitat and biological surveys to identify and prioritize wildlife habitat restoration needs in the subbasin.
- Action 21.3. Implement wildlife habitat restoration projects in the subbasin.
- Action 21.4. Acquire or lease lands with priority habitats to permanently protect wildlife habitats in the subbasin.
- Action 21.5. More actively manage lands set aside for wildlife, such as CRP and CREP, to increase species diversity on those lands.
- Action 21.6. Decommission unnecessary roads to reduce harassment of wildlife and encourage more uniform use of available wildlife habitat
- Action 21.7. Manage habitat to meet state management guidelines for upland birds and game mammals.

Strategy 22. Protect federal and state threatened, endangered, and sensitive wildlife species.

- Action 22.1. Increase enforcement of laws pertaining to wildlife.
- Action 22.2. Provide protection for federal and state threatened, endangered, and sensitive wildlife species in all resource management plans.
- Action 22.3. Enforce state and local land use regulations designed to protect wildlife habitats.

Bull Trout Recovery Team (State, Federal, and Tribal)

The *Goal* for recovery of bull trout in the Imnaha/Snake Recovery Unit is to increase population stability and likelihood of long-term persistence. Objectives to achieve this goal are as follows:

Objective 1: Current distribution of bull trout is maintained or expanded within their current range in the Imnaha/Snake recovery unit;

Objective 2: Stable or increasing trends in abundance of bull trout are maintained;

Objective 3: Suitable habitat conditions for all bull trout life history stages and strategies are restored and maintained;

Objective 4: Opportunities for genetic exchange between local populations are provided.

State of Oregon

Oregon Department of Forestry

The goal of the Oregon Department of Forestry is to protect, manage and promote a healthy forest environment, which will enhance Oregon's livability and economy for today and tomorrow.

Oregon Department of Agriculture

Oregon Noxious Weeds Strategic Program

The primary goal of the noxious weeds program is to develop a heightened awareness among Oregon's citizens, the legislature, local governments, tribal governments, conservation organizations and land managers of the impact of noxious weeds and the need for effective noxious weed management. To accomplish this goal, the following objectives and strategies are recommended:

Objective 1: Leadership and Organization
- Strategy 1.1: Provide consistent statewide and local leadership and organization

Objective 2. Establish cooperative partnerships
- Strategy 2.1: Develop and expand partnerships

Objective 3. Planning and Prioritizing
- Strategy 3.1: Develop and maintain noxious weed lists and plans all levels

Objective 4. Education and Awareness
- Strategy 4.1: Provide education and awareness

Objective 5. Integrated Weed Management (IWM)
- Strategy 5.1: Continue to support and advocate the principles of IWM

Objective 6. Early Detection and Control of New Invaders
- Strategy 6.1: Implement early detection and control

Objective 7. Noxious Weed Information System and Data Collection
- Strategy 7.1: Upgrade Noxious Weed Information System

Objective 8. Monitoring and Evaluation
- Strategy 8.1: Monitor noxious weed projects to evaluate effectiveness

Objective 9. Policy, Mandates, Law Compliance and Enforcement
- Strategy 9.1: Use mandates, policy and law to encourage effective weed management

Objective 10. Funding and Resources
- Strategy 10.1: Increase base level funding for state, county local, and federal noxious weed control programs to address priorities and to assist private land managers.
- Strategy 10.2: Additional funding sources for weed control

Oregon Department of Environmental Quality

The primary goal of the Oregon Department of Environmental Quality is to Restore, maintain and enhance the quality of Oregon's air, water and land.

Oregon Parks and Recreation Department

The primary goal of the Oregon Parks and Recreation Department is to provide and protect outstanding natural, scenic, cultural, historic, and recreational sites for the enjoyment and education of present and future generations.

Oregon Division of State Lands

The Oregon Division of State Lands has two overriding goals. These are:

1. Manage and protect state trust lands for the maximum long-term benefit of the public schools, consistent with sound stewardship, conservation and business management principles.
2. Manage non-trust lands for the greatest benefit of all the people of the state.

Oregon State Police

The overriding goal of the Oregon State Police is to develop, promote and maintain protection of the people, property, and natural resources of the state.

Department of Land Conservation and Development

The Department of Land Conservation and Development goals are as follow:

1. Establish a framework for all land use decisions and actions.
2. Preserve and maintain all agricultural lands.
3. Conserve forestlands in a manner consistent with sound management of soil, air, water, and fish and wildlife resources, and to provide for recreational opportunities and agriculture.
4. Protect natural resources and conserve scenic and historic areas and open spaces.
5. Maintain and improve the quality of the air, water, and land resources of the state.
6. Protect life and property from natural disasters and hazards.

Oregon Water Resources Department

The Oregon Water Resources Department overriding goal is to serve the public by practicing and promoting wise long-term water management.

Oregon Revised Statute - ORS 496.012

Oregon Revised Statutes are laws passed by the legislative bodies (House and Senate) of Oregon, giving guidance to ODFW for management of fish and wildlife resources. ORS 496.012 refers specifically to wildlife, but fish are included as part of wildlife. The goals of these laws are designed to:

1. Maintain species of wildlife at optimum levels.
2. Ensure that the developed lands and waters of Oregon are managed to enhance the production and public enjoyment of wildlife.
3. Promote the utilization of wildlife that is orderly and equitable.
4. Provide public access to lands and waters of the state, and the wildlife resources thereon, that are developed and maintained.
5. Ensure that wildlife populations and public enjoyment of wildlife are regulated compatibly with primary uses of the lands and waters of the state.
6. Provide a provision of optimal recreational benefits.

Oregon Department of Fish and Wildlife

ODFW's vision is that "Oregon's fish and wildlife are thriving in healthy habitats due to cooperative efforts and support by all Oregonians" (ODFW 2000). The vision for the Imnaha subbasin is to improve habitat health and function for the enhancement and productivity of wild spring chinook salmon, summer steelhead, native resident trout, and numerous wildlife species (ODFW 1990).

Oregon Wildlife Diversity Plan (1993)

The goal of the Oregon Wildlife Diversity Plan is to maintain Oregon's wildlife diversity by protecting and enhancing populations and habitats of native non-game wildlife at self-sustaining levels throughout natural geographic ranges. To accomplish this goal, the Plan relies upon the following objectives and strategies:

Objective 1. Protect and enhance populations of all existing native non-game species at self-sustaining levels throughout their natural geographic ranges by supporting the maintenance, improvement or expansion of habitats and by conducting other conservation actions.

- Strategy 1.1: Maintain existing funding sources and develop new sources of public, long-term funding required to conserve the wildlife diversity of Oregon.
- Strategy 1.2: Identify and assist in the preservation, restoration and enhancement of habitats needed to maintain Oregon's wildlife diversity and non-consumptive recreational opportunities.
- Strategy 1.3: Monitor the status of non-game populations on a continuous basis as needed for appraising the need for management actions, the results of actions, and for evaluating habitat and other environmental changes.

Objective 2. Restore and maintain self-sustaining populations of non-game species extirpated from the state or regions within the state, consistent with habitat availability, public acceptance, and other uses of the lands and waters of the state.

- Strategy 2.1: Identify, establish standards and implement management measures required for restoring threatened and endangered species, preventing sensitive species from having to be listed as threatened or endangered, and maintaining or enhancing other species requiring special attention.
- Strategy 2.2: Reintroduce species or populations where they have been extirpated as may be feasible.

Objective 3. Provide recreational, educational, aesthetic, scientific, economic and cultural benefits derived from Oregon's diversity of wildlife.

- Strategy 3.1: Develop broad public awareness and understanding of the wildlife benefits and conservation needs in Oregon.
- Strategy 3.2: Increase or enhance opportunities for the public to enjoy and learn about wildlife in their natural habitats.
- Strategy 3.3: Seek outside opportunities, resources and authorities and cooperate with other agencies, private conservation organizations, scientific and educational institutions, industry and the general public in meeting Program Objectives.
- Strategy 3.4: Maintain and enhance intra-agency coordination through dissemination of Program information, development of shared databases and coordination of

activities that affect other Department divisions and programs; identify activities within other programs, which affect the Wildlife Diversity program, and develop mutual goals.

Objective 4. Address conflicts between non-game wildlife and people to minimize adverse economic, social, and biological impacts.

- Strategy 4.1: Assist with non-game property damage and nuisance problems without compromising wildlife objectives, using education and self-help in place of landowner assistance wherever possible.
- Strategy 4.2: Administer the Wildlife Rehabilitation Program.
- Strategy 4.3: Administer the Scientific Taking Permits Program.
- Strategy 4.4: Administer Wildlife Holding and other miscellaneous permits.
- Strategy 4.5: Provide biological input to the Falconry Program for the establishment of raptor-capture regulations.
- Strategy 4.6: Update the Wildlife Diversity Plan every five years.

Oregon Black Bear Management Plan (ODFW 1987)

The overriding goal of the Oregon Black Bear Management Plan is to protect and enhance black bear populations in Oregon to provide optimum recreational benefits to the public and to be compatible with habitat capability and primary land uses. To accomplish this goal, the plan relies upon the following objectives and strategies:

Objective 1. Determine black bear population characteristics.

- Strategy 1.1: Implement or cooperate in research to learn more about black bear ecology in Oregon, develop accurate populations estimates and provide a measurement of population trend.

Objective 2. Determine black bear harvest levels.

- Strategy 2.1: Obtain improved harvest information through use of combination report card/tooth envelope.
- Strategy 2.2: Monitor black bear harvest and implement harvest restrictions if necessary.
- Strategy 2.3: Develop an educational program to alert black bear hunters of the need for improved black bear population information.
- Strategy 2.4: If necessary, initiate mandatory check of harvested black bear.

Objective 3. Continue current practice of allowing private and public landowners to take damage causing black bear without a permit.

- Strategy 3.1: The Department will not seek any changes in current statutes.
- Strategy 3.2: Continue to work with other agencies and private landowners in solving black bear depredation problems.
- Strategy 3.3: Explore the possibility of using sport hunters for damage control.

Oregon's Cougar Management Plan (ODFW 1993a)

The goals of Oregon's Cougar Management Plan are to:

1. Recognize the cougar as an important part of Oregon's wildlife fauna, valued by many Oregonians.
2. Maintain healthy cougar populations within the state into the future.

3. Conduct a management program that maintains healthy populations of cougar and recognizes the desires of the public and the statutory obligations of the Department.

These goals will be accomplished through the following objectives and strategies:

Objective 1. Continue to gather information on which to base cougar management.

- Strategy 1.1: Continue to authorize controlled cougar hunting seasons conducted in a manner that meets the statutory mandates to maintain the species and provide consumptive and non-consumptive recreational opportunities.
- Strategy 1.2: Continue to study cougar population characteristics as well as the impact of hunting on cougar populations.
- Strategy 1.3: Continue to update and apply population modeling to track the overall cougar population status.
- Strategy 1.4: Continue mandatory check of all hunter-harvested cougar and evaluate the information collected on population characteristics for use in setting harvest seasons.
- Strategy 1.5: Continue development of a tooth aging (cementum annuli) technique.

Objective 2. Continue to enforce cougar harvest regulations.

- Strategy 2.1: Continue to work with OSP to monitor the level of illegal cougar hunting activity.
- Strategy 2.2: Implement appropriate enforcement actions and make the necessary changes in regulations to reduce illegal cougar hunting.
- Strategy 2.3: Continue to inspect taxidermist facilities and records to discourage and document the processing of cougar hides lacking Department seals.

Objective 3. Document and attempt to eliminate potential future human-cougar conflicts.

- Strategy 3.1: Provide information to the public about cougar distribution, management needs, behavior, etc.
- Strategy 3.2: Attempt to solve human-cougar conflicts by non-lethal methods.
- Strategy 3.3: Consider additional hunting seasons or increased hunter numbers in areas where human-cougar conflicts develop.
- Strategy 3.4: Manage for lower cougar population densities in areas of high human occupancy.

Objective 4. Manage cougar populations through controlled hunting seasons.

- Strategy 4.1: Base regulation modifications on population trends, as annual fluctuations in the weather can greatly influence recreational cougar harvest.
- Strategy 4.2: Continue to regulate cougar hunting through controlled permit seasons.

Objective 5. Continue to allow private and public landowners to take damage-causing cougar without a permit.

- Strategy 5.1: No changes will be sought to existing damage control statutes.
- Strategy 5.2: Continue to work with landowners to encourage reporting of potential damage before it occurs, with the goal of solving complaints by other than lethal means.
- Strategy 5.3: Continue to emphasize that damage must occur before landowners or agents of the Department may remove an offending animal.

Strategy 5.4: Encourage improved livestock husbandry practices as a means of reducing cougar damage on domestic livestock.

Strategy 5.5: Continue to work with other agencies to solve cougar depredation problems.

Objective 6. Manage deer and elk populations to maintain the primary prey source for cougar.

Strategy 6.1: Work with landowners and public land managers to maintain satisfactory deer, elk and cougar habitat.

Strategy 6.2: Evaluate the effects of human activities and human disturbance on cougar.

Strategy 6.3: Take action to correct problems in areas where human access is detrimental to the welfare of cougar or their prey base.

Mule Deer Management Plan (ODFW 1990)

The goals of the Oregon Department of Fish and Wildlife Mule Deer Management Plan are:

1. Increase deer numbers in units that are below management objectives and attempt to determine what factors are contributing to long term depressed mule deer populations.
2. Maintain population levels where herds are at management objectives.
3. Reduce populations in the areas where deer numbers exceed population management objectives.

Population objectives were set by Oregon Department of Fish and Wildlife Commission action in 1982 and are to be considered maximums.

Objective 1. Set management objectives for buck ratio, population level/density and fawn:doe ratio benchmark for each hunt unit and adjust as necessary.

Strategy 1.1: Antlerless harvest will be used to reduce populations which exceed management objectives over a two or three year period or to address damage situations.

Strategy 1.2: Harvest tag numbers are adjusted to meet or exceed objectives within 2-3 bucks/100 does.

Strategy 1.3: Population trends will be measured with trend counts and harvest data and may include population modeling.

Strategy 1.4: Update Mule Deer Plan every five years.

Objective 2. Hunter opportunity will not be maintained at the expense of meeting population and buck ratio management objectives.

Oregon's Elk Management Plan (ODFW 1992)

The primary goal of Oregon's Elk Management Plan is to protect and enhance elk populations in Oregon to provide optimum recreational benefits to the public and to be compatible with habitat capability and primary land uses. This goal will be accomplished through the following objectives and strategies:

Objective 1. Maximize recruitment into elk populations and maintain bull ratios at Management Objective levels. Establish Management Objectives for population size in all herds, and maintain populations at or near those objectives.

Strategy 1.1: Maintain bull ratios at management objectives.

Strategy 1.2: Protect Oregon's wild elk from diseases, genetic degradation, and increased poaching, which could result from transport and uncontrolled introduction of cervid species.
Strategy 1.3: Determine causes of calf elk mortality.
Strategy 1.4 Monitor elk populations for significant disease outbreaks, and take action when and were possible to alleviate the problem.
Strategy 1.5: Establish population models for aiding in herd or unit management decisions.
Strategy 1.6: Adequately inventory elk populations in all units with significant number of elk.

Objective 2. Coordinate with landowners to maintain, enhance and restore elk habitat.
Strategy 2.1: Ensure both adequate quantity and quality of forage to achieve elk population management objectives in each management unit.
Strategy 2.2: Ensure habitat conditions necessary to meet population management objectives are met on critical elk ranges.
Strategy 2.3: Minimize elk damage to private land where little or no natural winter range remains.
Strategy 2.4: Maintain public rangeland in a condition that will allow elk populations to meet and sustain management objectives in each unit.
Strategy 2.5: Reduce wildlife damage to private land.

Objective 3. Enhance consumptive and non-consumptive recreational uses of Oregon's elk resource.
Strategy 3.1: Develop a policy that outlines direction for addressing the issues of tag allocation to private landowners and public access to private lands in exchange for compensation to private landowners.
Strategy 3.2 Increase bull age structure and reduce illegal kill of bulls while maintaining recreational opportunities.
Strategy 3.3 Adjust levels of hunter recreation in all units commensurate with management objectives.
Strategy 3.4 Identify, better publicize, and increase the number of elk viewing opportunities in Oregon.

Oregon's Bighorn Sheep Management Plan (ODFW 1992)

The primary goal of Oregon's Bighorn Sheep Management Plan is to restore bighorn sheep into as much suitable unoccupied habitat as possible. The following objectives and strategies have been developed to accomplish this goal:

Objective 1. Maintain geographical separation of California and Rocky Mountain subspecies.
Strategy 1.1: California bighorn will be used in all sites in central and southeast Oregon
Strategy 1.2: Coordinate transplant activities with adjacent states.
Strategy 1.3: Continue to use in-state sources of transplant stock while seeking transplant stock from out of state.
Strategy 1.4: Historic areas of bighorn sheep range containing suitable habitat will be identified and factors restricting reintroduction will be clearly explained for public review.

Objective 2. Maintain healthy bighorn sheep populations.

- Strategy 2.1: Bighorn sheep will not be introduced into locations where they may be reasonably expected to come into contact with domestic or exotic sheep.
- Strategy 2.2: Work with land management agencies and private individuals to minimize contact between established bighorn sheep herds and domestic or exotic sheep.
- Strategy 2.3: Work with land management agencies to locate domestic sheep grazing allotments away from identified present and proposed bighorn sheep ranges.
- Strategy 2.4: Maintain sufficient herd observations to ensure timely detection of disease and parasite problems.
- Strategy 2.5: Promote and support aggressive research aimed at reducing bighorn vulnerability to diseases and parasites.
- Strategy 2.6: Bighorn individuals that have known contact with domestic or exotic sheep will be captured, quarantined, and tested for disease. If capture is impossible, the bighorn will be destroyed before it has a chance to return to a herd and possibly transmit disease organisms to others in the herd.
- Strategy 2.7: Bighorns of questionable health status will not be released in Oregon.

Objective 3. Improve bighorn sheep habitat as needed and as funding becomes available.

- Strategy 3.1: Monitor range condition and use along with population characteristics.

Objective 4. Provide recreational ram harvest opportunities when bighorn sheep population levels reach 60 to 90 animals.

- Strategy 4.1: To reduce possibility of black-market activity, all hunter-harvested horns will be permanently marked by the Department.
- Strategy 4.2: Do not transplant bighorns on those areas where some reasonable amount of public access is not possible.
- Strategy 4.3: Consider land purchase in order to put such land into public ownership.

Objective 5. Conduct annual herd composition, lamb production, summer lamb survival, habitat use and condition, and general herd health surveys.

- Strategy 5.1: Maintain sufficient herd observations so as to ensure timely detection of disease and parasite problems. This will include mid- to late-summer, early winter, and later winter herd surveys.
- Strategy 5.2: Initiate needed sampling and collections when problems are reported to verify the extent of the problem. Utilize the best veterinary assistance.
- Strategy 5.3: Promote and support an aggressive research program aimed at reducing bighorn vulnerability to disease and parasites.
- Strategy 5.4: Continue to test bighorns for presence of diseases of importance to both bighorn sheep and livestock.
- Strategy 5.5: Monitor range condition and use along with population characteristics.
- Strategy 5.6: Conduct population modeling of all herds.
- Strategy 5.7: Determine herd carrying capacity after consultation with the land manager.
- Strategy 5.8: Investigate lamb production and survival as an indication of a population at carrying capacity.

Oregon Migratory Game Bird Program Strategic Management Plan (ODFW 1993)

The primary goal of the Oregon Migratory Game Bird Program Strategic Management Plan is to protect and enhance populations and habitats of native migratory game birds and associated species at prescribed levels throughout natural geographic ranges in Oregon and the Pacific flyway to contribute to Oregon's wildlife diversity and the uses of those resources. The following objectives and strategies are designed to accomplish this goal:

Objective 1. Integrate state, federal, and local programs to coordinate biological surveys, research, and habitat development to obtain improved population information and secure habitats for the benefit of migratory game birds and other associated species.

- Strategy 1.1: Establish an Oregon Migratory Game Bird Committee to provide management recommendations on all facets of the migratory game bird program.
- Strategy 1.2: Use population and management objectives identified in Pacific Flyway Management Plans and Programs.
- Strategy 1.3: Develop a statewide migratory game bird habitat acquisition, development, and enhancement plan based on flyway management plans, ODFW Regional recommendations, and other state, federal, and local agency programs.
- Strategy 1.4: Implement a statewide migratory game bird biological monitoring program, including banding, breeding, production, migration, and wintering area surveys based on population information needs of the flyway and state.
- Strategy 1.5: Develop a statewide program for the collection of harvest statistics.
- Strategy 1.6: Prepare a priority plan for research needs based on flyway management programs.
- Strategy 1.7: Annually prepare and review work plans for wildlife areas that are consistent with policies and strategies of this plan.
- Strategy 1.8: Develop a migratory game bird disease contingency plan to address responsibilities and procedure to be taken in the case of disease outbreaks in the state. It will also address policies concerning "park ducks", captive-reared, and exotic game bird releases in Oregon.

Objective 2. Assist in the development and implementation of the migratory game bird management program through information exchange and training.

- Strategy 2.1: Provide training for appropriate personnel on biological survey methodology, banding techniques, waterfowl identification, habitat development, disease problems, etc.

Objective 3. Provide recreational, aesthetic, educational, and cultural benefits from migratory game birds, other associated wildlife species, and their habitats.

- Strategy 3.1: Provide migratory game bird harvest opportunity.
- Strategy 3.2: Regulate harvest and other uses of migratory game birds at levels compatible with maintaining prescribed population levels.
- Strategy 3.3: Eliminate impacts to endangered or threatened species.
- Strategy 3.4: Reduce impacts to protected or sensitive species.
- Strategy 3.5: Provide a variety of recreational opportunities and access, including viewing opportunities, throughout the state.
- Strategy 3.6: Provide assistance in resolving migratory game bird damage complaints.

Strategy 3.7: Develop opportunities for private, public, tribal, and industry participation inmigratory game bird programs including, but not limited to, conservation, educational, and scientific activities.

Strategy 3.8: Disseminate information to interested parties through periodic program activity reports, media releases, hunter education training, and other appropriate means.

Objective 4. Seek sufficient funds to accomplish programs consistent with the objectives outlined in the plan and allocate funds to programs based on management priorities.

Strategy 4.1: Use funds obtained through the sale of waterfowl stamps and art to fund all aspects of the waterfowl management program as allowable under ORS 497.151.

Strategy 4.2: Develop annual priorities and seek funding through the Federal Aid in Wildlife Restoration Act.

Strategy 4.3: Solicit funds from “Partners in Wildlife” as appropriate.

Strategy 4.4: Seek funds from a variety of conservation groups such as Ducks Unlimited and the Oregon Duck Hunter’s Association.

Strategy 4.5: Solicit funds form the Access and Habitat Board as appropriate and based on criteria developed by the Board and the Fish and Wildlife Commission.

Strategy 4.6: Pursue funds from other new and traditional sources, such as corporate sponsors and private grants.

ODFW’s Fish Goals, Objectives and Strategies

ODFW uses plans that provide statewide direction for approaches to trout, steelhead, warmwater fish, coastal chinook, and coho salmon management to frame strategies subsequently proposed in basin-specific fish management plans. These plans contain broad guidelines and statewide directions. In the Blue Mountains Province, the trout, steelhead, and warmwater plans are pertinent.

Steelhead and Spring Chinook Salmon

Fish managers have agreed to the following fisheries goal and objectives through the *U.S. v. Oregon,* the NWPPC planning process and the Lower Snake River Compensation Program. The Imnaha River will be managed for production of wild anadromous fish. Increased production from the basin will be attained by protecting high quality habitat, by improving degraded habitat, and hatchery production through conventional broodstock programs. *Goal*: productive, healthy, and sustainable wild populations of anadromous spring chinook salmon and summer steelhead, and resident trout populations and protected habitat for their continued viability. Species-specific goals and objectives for the Imnaha are below (USFWS 2001).

Objectives for Steelhead and Spring Chinook Salmon

Objective 1: Achieve NMFS delisting criteria for spawner numbers and productivity of Imnaha Basin spring chinook salmon by restoring and maintaining natural spawning populations.

Objective 2: Reduce the demographic risks associated with the low productivity and decline of native spring chinook salmon populations in Imnaha River.

Objective 3: Maintain artificial production programs for spring chinook salmon and steelhead, based on locally-adapted broodstocks, to mitigate for fish losses associated with construction and operation of lower Snake River dams.

Objective 4: Establish an annual supply of steelhead and spring chinook salmon brood fish capable of meeting annual production goals.

Objective 5: Maintain sport and tribal fisheries for steelhead and reestablish fisheries for spring chinook salmon, consistent with protection of endemic, naturally-produced stocks. Determine the number of summer steelhead and spring chinook salmon harvested annually and angler effort in recreational fisheries on the Imnaha River.

Objective 6: Identify, conserve, and monitor the life history characteristics of chinook salmon and resident and anadromous forms of *Oncorhynchus mykiss* in Northeast Oregon.

Objective 7: Maintain genetic diversity of indigenous, artificially-propagated summer steelhead and spring chinook salmon populations in the Imnaha River Basin.

Objective 8: Determine relative reproductive success of naturally-spawning hatchery and wild steelhead and chinook salmon in the Imnaha River Basin.

Objective 8: Minimize impacts of hatchery programs on resident and naturally produced spring chinook salmon and summer steelhead.

Objective 9: Modify facilities at Lookingglass Fish Hatchery to provide capability to implement Conventional Broodstock Program.

Objective 9: Determine optimum program operational criteria to ensure success of achieving objectives.

Objective 10: Assess utility of Conventional Broodstock Program for use in recovering salmonid populations.

Objective 11: Develop facilities and operations to improve safety and productivity of the hatchery environment.

Objective 12: Collect information to allow implementation of adaptive management process to evaluate management practices in the Imnaha Basin.

Strategies for Spring Chinook Salmon

Strategy 1. Use artificial propagation to enhance natural production and fisheries in the Imnaha Basin.

- Action 1.1. Improve existing hatchery facilities and construct additional facilities to increase the effectiveness of programs conducted at these sites and their potential to achieve their goals.
- Action 1.2. Provide for a regulated tribal and sport harvest of spring chinook salmon in the Imnaha River. Conduct creel surveys to estimate catch rates and record marks and collect coded wire tags to estimate catch and harvest of hatchery and wild salmon.
- Action 1.3. Collect returning adult spring chinook salmon at weir Imnaha River.
- Action 1.4. Monitor health of adult and juvenile spring chinook salmon, providing prophylactic treatments and treat for disease outbreaks, as necessary.
- Action 1.5. Spawn fish using matrices to maximize genetic diversity of offspring.
- Action 1.6. Rear juveniles, with segregation (where possible) by BKD status, to produce smolts similar to wild smolts.
- Action 1.7. Acclimate juveniles at acclimation site on Imnaha River and release as smolts.

Action 1.8. Develop and maintain a database for Conventional Broodstock Program.

Action 1.9. Develop Annual Operations Plan for Conventional Broodstock Program.

Action 1.10. Evaluate programs at each life history stage: spawning, incubation and parr-smolt rearing, smolt release and adult returns.

Action 1.11. Coordinate ESA permit activities and participate in program planning and oversight.

Action 1.12. Summarize data and prepare and submit annual reports.

Strategy 2: Implement monitoring and evaluation to assess health, status and productivity of natural populations.

Action 2.1. Conduct spawning ground surveys of streams within the Imnaha River Basin. Count number of redds, live and dead adult salmon, examine carcasses for marks and collect coded wire tags, collect scales and determine age of maturity, prespawn mortality, spawner distribution and hatchery:wild ratio.

Action 2.2. Capture and enumerate returning adult fish at weir on Imnaha River. Mark all fish released above the weir for population estimate.

Action 2.3. Develop and maintain a database for spawning ground surveys.

Action 2.4. Monitor run size and develop run size estimate models based on previous years escapement, spawning ground information and other available data (e.g., smolt indices, dam passage counts) to make sound harvest allocation decisions.

Action 2.5. Evaluate ability to estimate escapement and straying and to characterize the spawning populations in the system.

Action 2.6. Determine progeny:parent ratios (productivity) based on spawner and recruit information.

Action 2.7. Estimate and compare smolt detection rates at mainstem Columbia and Snake River dams for spring chinook salmon migrants from the Imnaha subbasin.

Action 2.8. Document the annual migration patterns for spring chinook salmon juveniles from the Imnaha subbasin.

Strategy 3: Implement monitoring and evaluation to assess health, status and productivity of hatchery fish and effectiveness of hatcheries to accomplish objectives.

Action 3.1. Monitor and evaluate various experimental hatchery protocols (e.g., size at release, diet, exercise, rearing density, acclimated vs. direct release).

Action 3.2. Implement new treatments and prophylactic treatments for bacterial kidney disease under Investigational New Animal Drug protocols.

Action 3.3. Evaluate fish culture practices and fish handling for situations that may contribute to impaired fish health or exacerbate disease.

Action 3.4. Evaluate performance and life history characteristics of hatchery and wild fish in the wild, including smolt and adult migration characteristics, smolt-to-adult survival, age and size at maturity, run timing, progeny:parent ratio.

Action 3.5. Evaluate effectiveness of Conventional Broodstock Program to restore endemic stocks of spring chinook salmon in Imnaha River and maintain their genetic diversity. Examine various indices (e.g., egg-to-fry and fry-to-smolt survival, growth and health, fecundity, progeny:parent ratio) at specific life stages (incubation, fry-smolt rearing, post-smolt rearing and maturation) of all fish raised at hatcheries.

Action 3.6. Develop and maintain a database for Conventional Broodstock Program.

Strategies for Summer Steelhead

Strategy 1. Implement monitoring and evaluation to assess health, status and productivity of hatchery fish and effectiveness of hatcheries to accomplish objectives.

Action 1.1. Document fish cultural and hatchery operational practices at each Lower Snake River Compensation Plan facility.

Action 1.2. Develop rearing and release strategies that best achieve program objectives for hatchery-produced summer steelhead smolts using tag evaluation groups, monitor and evaluate indices of survival, growth, health, and productivity (Carmichael and Ruzycki 2000).

Action 1.3. Determine total production of summer steelhead adults, index annual smolt survival and adult returns to Lower Granite Dam for production groups, summarize fishery recovery and escapement information, and determine exploitation rates for each stock.

Action 1.4. Conduct creel surveys to estimate catch rates by interviewing anglers and collect coded-wire-tagged fish to estimate number of fish harvested.

Action 1.5. Using DNA typing methods, establish parentage of juvenile steelhead reared from areas above the Little Sheep collection weir and measure performance and life-history characteristics of hatchery fish in the wild. (Moran 1999).

Strategy 2. Implement monitoring and evaluation to assess health, status and productivity of natural populations.

Action 2.1. Determine genetic diversity, using DNA analysis, of natural steelhead stocks in the Imnaha River basin by sampling 5 representative tributary basins for four consecutive years.

Action 2.2. Monitor natural escapement and characterize spawning populations.

Action 2.3. Evaluate ability to estimate escapement and straying and ability to characterize spawning populations.

Action 2.4. Capture and enumerate returning adult fish at weirs on the Imnaha River and tributaries.

Action 2.5. Determine the relationship between anadromous and resident forms of *O. mykiss* in NE Oregon using otolith microchemistry analysis and known-parentage, hatchery crosses.

Action 2.6. Determine phenotypic plasticity of life-history traits among and between anadromous and resident *O. mykiss* by conducting controlled, breeding experiments between life-history forms and monitoring traits of their progeny.

Action 2.7. Monitor trend in spawner escapement in Imnaha basin streams by conducting annual spawning surveys in selected spawning areas.

Strategy 3. Use artificial propagation to enhance fisheries in the Imnaha Basin.

Action 3.1. Improve existing hatchery facilities, increase the effectiveness of programs conducted at these sites, and their potential to achieve their goals.

Action 3.2. Provide for a regulated tribal and sport harvest for steelhead in the Imnaha River.

Action 3.3. Collect returning adult steelhead at weir on Little Sheep Creek.

Action 3.4. Monitor health of adult and juvenile steelhead.

Action 3.5. Develop Annual Operations Plan for hatchery programs.

Action 3.6. Evaluate programs at each life history stage: spawning, incubation and parr-smolt rearing, smolt release, and adult returns.

Action 3.7. Coordinate ESA permit activities and participate in program planning and oversight.

Action 3.8. Summarize data and prepare and submit annual reports.

Oregon's Trout Plan

The primary goal identified in Oregon's Trout Plan is to Achieve and maintain optimum populations and production of trout to maximize benefits and to insure a wide diversity of opportunity for present and future citizens. To achieve this goal, the following objectives and strategies have been developed:

Objective 1. Maintain the genetic diversity and integrity of wild trout stocks throughout Oregon.

Strategy 1.1: Identify wild trout stocks in the state.

Strategy 1.2: Minimize the adverse effects of hatchery trout on biological characteristics, genetic fitness, and production of wild stocks .

Strategy 1.3: Establish priorities for the protection of stocks of wild trout in the state.

Strategy 1.4: Evaluate the effectiveness of trout management programs in providing the populations of wild trout necessary to meet the desires of the public.

Objective 2. Protect, restore and enhance trout habitat.

Strategy 2.1: Continue to strongly advocate habitat protection with land and water management agencies and private landowners.

Objective 3. Provide a diversity of trout angling opportunities.

Strategy 3.1: Determine the desires and needs of anglers.

Strategy 3.2: Use management alternatives for classifying wild trout waters to provide diverse fisheries.

Strategy 3.3: Conduct an inventory of public access presently available to trout waters in the state.

Objective 4. Determine the statewide management needs for hatchery trout.

Strategy 4.1: Summarize information on the current hatchery program and determine necessary changes.

Strategy 4.2: Increase the involvement of the STEP program in the enhancement of trout.

Strategy 4.3: Publicize Oregon's trout management program through the ODFW office of Information and Education.

Oregon’s Steelhead Plan

The first goal of Oregon’s Steelhead Plan is to sustain healthy and abundant wild populations of steelhead. The following objectives will be used to achieve this goal:

Objective 1. Protect and restore spawning and rearing habitat.
Objective 2. Provide safe migration corridors .
Objective 3. Protect wild populations of steelhead from overharvest.
Objective 4. Protect wild populations of steelhead from detrimental interactions with hatchery fish .
Objective 5. Monitor the status of wild steelhead populations so that long-term trends in populations can be determined.

The second goal of Oregon’s Steelhead Plan is to provide recreational, economic, cultural and aesthetic benefits from fishing and non-fishing uses of steelhead. The following objectives will be used to achieve this goal:

Objective 6. Provide for harvest by Treaty Tribes without overharvesting wild fish.
Objective 7. Provide recreational angling opportunities reflecting the desires of the public while minimizing impacts on wild fish.
Objective 8. Increase non-angling uses of steelhead that provide recreation.

The third goal of Oregon’s Steelhead Plan is to involve the public in steelhead management and coordinate ODFW actions with Tribes and other agencies. The following objectives will be used to achieve this goal:

Objective 9. Increase awareness of issues facing steelhead management and ODFW's management programs.
Objective 10. Provide a forum for public input on steelhead management.
Objective 11. Coordinate ODFW steelhead management activities with other habitat and fisheries managers.

Oregon’s Warmwater Game Fish Plan

The primary goal of Oregon’s Warmwater Game Fish Plan is to provide optimum recreational benefits to the people of Oregon by managing warmwater game fishes and their habitats. The following objective and strategies were developed by ODFW to achieve this goal:

Objective 1. Provide diversity of angling opportunity

Strategy 1.1: Identify the public's needs and expectation for angling opportunity.

Strategy 1.2: Choose management alternatives for individual waters of groups of waters, and incorporate the alternatives in management plans subject to periodic public review.
Strategy 1.3: Design management approaches to attain the chosen alternative.
Strategy 1.4: Constantly remind the public of the consequences of unlawful transfers of fishes in order to reduce the incidence of the introductions.
Strategy 1.5: Inform the public as to why ODFW chooses particular management strategies, in order to establish a positive perception of warmwater game fish.
Strategy 1.6: Use existing state and federal laws and regulations to deal with illegal introductions.

County and Local Government

Grande Ronde Model Watershed

The goals, objectives, and strategies listed below are accomplished through: coordination, education, technical assistance (project development, NEPA, ESA consultation), and funding assistance (primarily with Bonneville Power Administration funds).

Goals:

Provide habitat for the restoration and enhancement of anadromous salmonids and other native fish species.
Develop recommendations for management and utilization of water by agriculture and other industries.
Conduct a public involvement program to address concerns of landowners, land managers and resource users.
Provide recommendations for management of resources which will enhance the quality and quantity of stream flows.
Recommend resource management and research activities which meet the Program mission.
Promote the mission, goals and objectives of the Program to regional, state and national entities.
Assure that watershed restoration activities implemented in the Basin are adequately monitored and evaluated.
Protect the customs, culture, and economic stability of the citizens of the Basin, the Nez Perce Tribe and Confederated Tribes of the Umatilla Indian Reservation, and the citizens of the United States of America.

Objective 1. Coordinate program administration and watershed restoration activities.
Strategy 1.1. Facilitate inter-agency coordination of program activities and projects.
Strategy 1.2. Coordinate planning, prioritization, design and implementation of restoration projects.
Strategy 1.3. Provide technical support for project planning, design and implementation.
Strategy 1.4. Maintain basin-wide restoration activity database.
Strategy 1.5. Prepare watershed assessments/updates and NEPA documentation.
Strategy 1.6. Conduct educational outreach.
Strategy 1.7. Coordinate project effectiveness and basin-wide water quality monitoring.

Objective 2. Improve in-stream habitat diversity for salmonid spawning and rearing.
Strategy 2.1. Add large wood component to mainstem streams and tributaries.
Strategy 2.2. Rock and log structure placements.
Strategy 2.3. Install grade control structures.

Strategy 2.4. Reconstruct channel meanders.
Strategy 2.5. Construct off-channel rearing habitat.
Strategy 2.6. Implement riparian tree planting

Objective 3. Enhance riparian condition (vegetation, function, etc.)
Strategy 3.1. Construct riparian livestock fencing
Strategy 3.2. Restore wet meadows
Strategy 3.3. Develop off-stream livestock water sources
Strategy 3.4. Close/obliterate draw-bottom roads.
Strategy 3.5. Revegetate streambanks and riparian zones.

Objective 4. Reduce stream sedimentation and bank erosion.
Strategy 4.1. Revegetate streambanks.
Strategy 4.2. Construct rock barbs with embedded wood or use other structures as deemed appropriate to the site (e.g. J-hooks, W-weirs).
Strategy 4.3. Use bio-engineering where hard structures are not appropriate or possible.
Strategy 4.4. Determine the source of the problem (e.g. land use, changed hydrograph) and correct if possible.

Objective 5. Increase late-season streamflows.
Strategy 5.1. Improve water conveyance efficiency in irrigation ditches.
Strategy 5.2. Improve water application efficiency on irrigated lands.
Strategy 5.3. Acquire in-stream water rights.
Strategy 5.4 Lease water rights.

Objective 6. Improve upland watershed condition and function.
Strategy 6.1 Treat and contain noxious weeds.
Strategy 6.2. Construct livestock pasture fencing.
Strategy 6.3. Manipulate tree density.
Strategy 6.4. Enhance vegetative cover (seeding).

Objective 7. Improve adult and juvenile salmonid fish passage.
Strategy 7.1. Replace/modify inadequate culverts.
Strategy 7.2. Fix inadequate crossings (fords) by hardening the entrances and stream bottom or by replacing them with culverts or bridges (depending on use).
Strategy 7.3. Replace push-up gravel irrigation diversions.
Strategy 7.4. Modify impassable irrigation diversion structures.

Objective 8. Improve water quality.
Strategies: All tasks under Obj's 3, 4, 5, 6.

Grande Ronde Water Quality Committee

Goal: To meet the necessary load allocations and achieve the water quality standards primarily by implementing management measures that will improve stream temperature, dissolved oxygen and pH.Protect the beneficial uses of the waters of the subbasin by implementing management measures to protect existing high quality waters and to improve water quality of impaired waters to the point that state water quality standards are met.

Objective 1. Eliminate point source discharges of nutrients during the summer.

Objective 2. Reduce NPS pollution contributions from transportation sources.

Strategy 2.1 Indentify and inventory road related problems, prioritize them and implement solutions including use of Oregon Department of Transportation Habitat Guide.

Objective 3. Reduce NPS pollution contributions form residential and commercial sources.

Strategy 3.1 Review and revise relevant city and county ordinances and implement management measures.

Objective 4. Reduce NPS pollution contributions from forest sources.

Strategy 4.1 Implement PACFISH Riparian Conservation Areas and Standards and Guides for Key Watersheds on Public Lands. Continue to implement forest practice regulations on private lands and review for practices for adequacy to meet standards.

Objective 5. Reduce non-point pollution contributions from agricultural sources.

Strategy 5.1 Implement the Agricultural Water Quality Management Area Plan and review it for adequacy to meet water quality standards.

Wallowa County

Goals:

1. Wallowa County is part of the Grande Ronde Model Watershed Program (above) and supports their goals, objectives, and strategies as well as the goals, objectives, and strategies of the Wallowa SWCD.
2. Provide quality habitat for native wildlife found in the county.

Strategy 1.1. Implement the Wallowa County/Nez Perce Tribe Salmon Habitat Recovery Plan with Multi-Species Strategy.

Wallowa Resources

Goal: To catalyze and facilitate community based stewardship in Wallowa County.

Objective 1. Promote community, forest and watershed health.

Objective 2. Create and maintain family-wage job and business opportunities.

Objective 3. Broaden understanding of the links between community well-being and ecosystem health.

Wallowa Soil and Water Conservation District

Goals:

- Healthy economy and desirable quality of life in Wallowa County.
- Productive and healthy watersheds in Wallowa County.

- Habitat quality and quantity for sustainable populations of native and anadromous fish species and native wildlife.

Objective 1. Continue to assist landowners/cooperators in meeting local, state, and federal natural resource goals.

- Strategy 1.1. Maintain well-qualified technical and planning staff.
- Strategy 1.2 Maintain partnerships to fund program implementation.
- Strategy 1.3 Participate with the NRCS and FSA in their programs (e.g. EQUIP, CREP, CRP) and serve on local action groups and basin work groups.
- Strategy 1.4 Enhance and restore watersheds in conjunction with SB1010, the TMDL process, and implementation of the Wallowa County/Nez Perce Tribe Salmon Habitat Recovery Plan with Multi-Species Strategy.

Objective 2. Continue to promote efficient management and ranch planning for resource conservation and economic viability.

- Strategy 2.1. Maintain well-qualified technical and planning staff.
- Strategy 2.2 Maintain partnerships to fund program implementation.
- Strategy 2.3 Promote Coordinated Resource Management Planning (CRMP).

Objective 3. Continue to address fish passage issues related to irrigation diversions.

- Strategy 3.1. Design and install fish friendly diversion structures or infiltration galleries.
- Strategy 3.2 Maintain partnerships to fund program implementation.

Objective 4. Continue to address irrigation tailwater returns.

- Strategy 4.1. Design and install collection systems which return cleaner, cooler water to streams and rivers.
- Strategy 4.2. Maintain partnerships to fund program implementation.

Objective 5. Continue to address water conservation and efficient use of irrigation water.

- Strategy 5.1. Design and install pump stations, sprinkler systems and/or gated pipe systems where feasible and desirable.
- Strategy 5.2. Maintain partnerships to fund program implementation.

Objective 6. Continue to address riparian ecosystem restoration and enhancement.

- Strategy 6.1. Install practices which may include: juniper riprap, root wads, rock weirs (e.g. J-hooks, W-weirs, vortex weirs), rock barbs, or rock riprap, if appropriate, to reduce erosive water velocities on stream banks to levels which allow vegetative recruitment.
- Strategy 6.2. Install riparian buffers to filter sediments and nutrients before they can reach the stream.
- Strategy 6.3. Install riparian fence corridor projects (riparian pasture or exclusion) where desirable.
- Strategy 6.4. Assist land managers with grazing and farm management planning.
- Strategy 6.5. Control noxious weed populations in riparian areas.
- Strategy 6.6. Maintain partnerships to fund program implementation.

Objective 7. Continue to address upland restoration and enhancement.

Strategy 7.1 Promote the development of off-stream watering systems for livestock (often in conjunction with riparian fencing projects).

Strategy 7.2. Assist land managers with grazing and farm management planning.

Strategy 7.3. Promote the reseeding of areas affected by natural processes (e.g. mass wasting, rain on snow, forest fires) to accelerate the regeneration of ground cover to minimize the potential for erosion and noxious weed invasions.

Strategy 7.4. Control noxious weeds on range and forest lands.

Strategy 7.5. Maintain partnerships to fund program implementation.

Objective 8. Continue to promote the implementation of the Wallowa County/Nez Perce Tribe Salmon Habitat Recovery Plan With Multi-Species Strategy.

Strategy 8.1. Take all project proposals to the Natural Advisory Committee's Technical Committee for review.

Strategy 8.2 Assist the Natural Resource Advisory Committee in educating the county residents on what the County/Tribe Plan is and how to use it.

Strategy 8.3 Maintain partnerships to fund program implementation.

Research, Monitoring, and Evaluation Activities

A comprehensive research, m monitoring and evaluation program through the Lower Snake River Compensation Program has been underway in the Imnaha subbasin since 1984 (USFWS 2001).

Project Descriptions

Comparative Survival Rate Study of Hatchery PIT-Tagged Chinook Salmon (PSMFC, FPC, ODFW: BPA Project No. 8712702) - PIT-Tag Marking Spring and Summer Chinook Salmon at Lookingglass Hatchery

The Comparative Survival Study is a long term PIT tag study to develop smolt-to-adult survival indices for spring and summer stream type chinook originating above Lower Granite Dam to evaluate smolt migration mitigation measures and actions (such as flow augmentation, spill, and transportation) for the recovery of listed salmon stocks.

Lower Snake River Compensation Plan Steelhead and Chinook Salmon Evaluations (ODFW)

This research project meets the needs for evaluation of steelhead and chinook salmon hatchery production in the Imnaha River subbasin. The LSRCP was designed to establish and maintain artificial production programs for steelhead and chinook salmon to mitigate for fish losses associated with construction and operation of Lower Snake River Dams. A long-term evaluation and monitoring process is envisioned for the duration of operation of the hatcheries to develop and maintain fish runs, which meet recovery and compensation goals at minimum costs. ODFW is conducting an ongoing comprehensive evaluation of LSRCP activities in Oregon that address the following general guidelines:

1. Develop and evaluate operational procedures that will meet recovery and compensation goals as well as management objectives by priority.
2. Monitor operational practices to document hatchery production capabilities and challenges.
3. Monitor fish-rearing activities and results to document accomplishment of goals.

4. Coordinate research and management programs with hatchery capabilities.
5. Recommend hatchery production strategies that are consistent with endangered species recovery efforts.
6. Develop knowledge and information to guide recovery actions and to monitor recovery in Imnaha river basin.
7. Investigate characteristics of endemic stocks that may be influenced by hatchery production.

The RM&E program is designed to:

1. Estimate annual adult returns and smolt-to-adult survival
2. Evaluate the influence of various release strategies on survival and life history
3. Evaluate natural and hatchery chinook smolt performance and survival within the subbasin and through the Snake River
4. Compare life history and genetic characteristics of natural and hatchery fish
5. Determine and compare progeny-to-parent ratios of natural and hatchery fish
6. Determine success of restoring recreational fisheries

Other research, monitoring, and evaluation activities within the Imnaha subbasin that are used to compliment fish and wildlife projects are provided in Table 39.

Table 39. BPA-funded Columbia River Basin Fish and Wildlife Program research, monitoring, and evaluation activities within the Imnaha River subbasin (Bonneville Power Administration and Northwest Power Planning Council 1999)

Activity	Watershed Location	Agency	BPA #	Dates
Compilation of existing and potential sites for anadromous fish hatcheries	Basin-wide	USSBA	8405100	1984-1986
Standardization of fish health monitoring	Basin-wide	ODFW	8711800	1987-1991
Smolt monitoring	Imnaha River	PSMFC	8712700	1987-1998
Habitat study	Imnaha River	NPT	8801500	1987-1993
Hatchery site feasibility and conceptual design	Imnaha River	Montgomery Watson	8805300	1991-1997
Outplanting facilities plan	Imnaha River	NPT	8805301	1989-1999
Evaluation of re-establishment actions	Basin-wide	ODFW	8805304	1989-1999
NE OR artificial production study	Basin-wide	ODFW	8805305	1997-1999
Genetic evaluations of hatchery and natural fish populations	Camp Creek	NMFS	8909600	1989-1999
Genetic evaluations of hatchery and natural fish populations	Imnaha Pond Hatchery	NMFS	8909600	1989-1999
Genetic evaluations of hatchery and natural fish populations	Grouse Creek	NMFS	8909600	1989-1999
Genetic evaluations of hatchery and natural fish populations	Little Sheep Creek	NMFS	8909600	1989-1999
Genetic evaluations of hatchery and natural fish populations	Imnaha River	NMFS	8909600	1989-1999
Genetic evaluations of hatchery and natural fish populations	Lick Creek	NMFS	8909600	1989-1999

Activity	Watershed Location	Agency	BPA #	Dates
Evaluate supplementing summer steelhead	Little Sheep Creek	ODFW	8909700	1989, 1991-1993
Evaluate supplementing summer steelhead	Imnaha River	ODFW	8909700	1989, 1991-1993
Evaluate supplementing summer steelhead	Deer Creek	ODFW	8909700	1989, 1991-1993
Pit tagging wild chinook	Imnaha River	NMFS	9102800	1991-1999
Fish passage evaluation	Imnaha River	USACE	9204100	1992-1995
Fish passage evaluation	Imnaha River	USACE	9204101	1996
Genetics, population, and passage of natural fall chinook	Imnaha River	WDFW	9204600	1992-1996
Telemetry tracking	Basin-wide	USFS	9307000	1993-1996
Bull trout life history	Indian Creek	ODFW, OS Systems	9405400	1994-1997
Bull trout life history	Imnaha River	ODFW, OS Systems	9405400	1994-1997
Bull trout life history	McCully Creek	ODFW, OS Systems	9405400	1994-1997
Bull trout life history	Big Sheep Creek	ODFW, OS Systems	9405400	1994-1997
Audit Columbia basin anadromous hatcheries	Little Sheep Creek Pond	Montgomery Watson	9500200	1995
Audit Columbia basin anadromous hatcheries	Imnaha Pond Hatchery	Montgomery Watson	9500200	1995
Pit tagging hatchery chinook	Imnaha Pond Hatchery	ODFW	9602001	1996

Statement of Fish and Wildlife Needs

The following list(s) include specific immediate or critical needs defined collectively by fish and wildlife resource managers within the Imnaha River subbasin. Needs have been defined to address limiting factors to fish and wildlife, ensure that gaps in current data or knowledge are addressed, enable continuation of existing programs critical to successful management of fish and wildlife resources, and to guide development of new programs to facilitate or enhance fish and wildlife management. The needs have been drafted in a manner designed to streamline agency policies aimed at improving habitat restoration efforts.

Needs have been grouped into three broad categories. Both aquatic and terrestrial needs have been identified, as well as general needs which apply equally to both aquatic and terrestrial resources. The order in which needs are listed in no way implies priority. It is important to note that aquatic and terrestrial needs are separated here for organizational purposes, and are not perceived to be mutually exclusive. Restoration efforts directed at either aquatic or terrestrial resources are likely to impact the ecosystem as a whole. One overriding need, to achieve the various goals, objectives and strategies listed above, is the need for adequate funding.

General Needs

1. Coordinate implementation and M&E activities within the subbasin to maximize effectiveness and minimize redundancy. Look for ways to improve consistency among projects.
2. Ensure aquatic and terrestrial subbasin databases are compatible and accessible to all parties.
3. Continue and improve enforcement by state, federal and tribal entities of laws and codes related to protection of fish and wildlife and their habitats, including increased efforts for in and out-of-season poaching and in road closure areas.
4. Continue to educate the public and persons or agencies with resource protection obligations regarding natural resource laws, compliance and enforcement.
5. Development of Federal Recovery Plans for threatened and endangered species to provide recovery guidance for state, tribal and local entities.
6. Reduce the risk of catastrophic wildfire in the subbasin.
7. Ensure natural river drawdown strategy alternative is implemented for recovery of listed species.

Aquatic Habitat

Enhancement

1. Replace culverts that present passage barriers and sediment sources based on a prioritized assessment of existing installations.
2. Implement restoration efforts designed to achieve the site potential shade and other temperature surrogates identified in the appropriate TMDLs for the subbasin.
3. Reduce nutrient pollution to achieve the percent reduction targets identified in the appropriate TMDLs for the subbasin.
4. Using existing assessments, seek out opportunities for cooperative habitat restoration and enhancement projects on public and private land.
5. Restore, protect, and create riparian, wetland, and floodplain areas within the subbasin and establish connectivity.
6. Restore in-stream habitat to natural conditions and protect as much as possible to provide suitable holding, spawning, and rearing areas for anadromous and resident fish.
7. Reduce stream temperature to levels meeting appropriate state standards.
8. Restore and augment streamflows at critical times using (but not limited to) water right leases, transfers, or purchases, and improved irrigation efficiency.
9. Reduce stream temperatures where appropriate and when feasible.
10. Consider additional gauging stations to monitor improvement in flows and temperatures as habitat improvement projects are completed.
11. Upgrade existing gauging stations to improve access to real-time streamflow and water temperature data.
12. Reduce sediment, fertilizer and pesticide loading from agricultural practices.
13. Reduce the impacts of confined animals with regard to waste and sediment production.
14. Reduce stormwater, road, and urban/suburban sewage impacts to aquatic resources.
15. Address streambank instability issues where they are defined or can be shown to be a potential problem.
16. Acquire water rights when opportunities arise to help restore more natural flows to streams within the subbasin.

17. Reduce road densities and their associated impacts to watershed functions by supporting planned road closures on public land and encouraging closure of other roads.
18. Implement management plans designed to meet established TMDLs and achieve water quality standards.
19. Periodically conduct longitudinal water temperature surveys such as with Forward Looking Infrared Radar (FLIR).
20. Continue long-term water temperature monitoring throughout the subbasin.
21. Continue compliance and effectiveness monitoring on federal and private land use activities (e.g., mining, grazing, logging, and pollution sources).
22. Improve understanding of the interaction between ground and surface water sources, especially as it pertains to switching irrigation from surface water to wells.
23. Need to characterize rearing and spawning habitats and monitor changes in amount and distribution.
24. Need to evaluate the improvements to adult and juvenile habitat capacity to evaluate success of fish habitat projects.

Planning

1. Continue to develop and update watershed assessments at multiple scales (i.e. transect, reach, watershed) to facilitate integrated resource management and planning efforts. Ensure that databases used for the development of assessments are sufficiently maintained and available to relevant entities.

Summer Steelhead

Hatchery

1. Complete genetic profiling within the subbasin to determine population structure, gene flow and genetic diversity within the subbasin.
2. Continue gene conservation efforts (cryopreservation) for steelhead to preserve genetic diversity within the subbasin.
3. Redevelop hatchery broodstocks as necessary to meet conservation and harvest augmentation goals.
4. Need to develop new methods to minimize the impact of hatchery production activities on endemic stocks.
5. Need to evaluate hatchery production programs to assure that they meet LSRCP compensation goals.
6. Need to develop Annual Operating Plans and write annual reports for all projects.

Monitoring & Evaluation

1. Continue and expand efforts to quantify juvenile abundance and smolt-to-adult return rates (SAR) of wild/natural and hatchery reared steelhead.
2. Continue and expand monitoring of hatchery supplementation and interactions with natural fish.
3. Need to determine genetic population structure to define steelhead sub-populations within the subbasin.
4. Use improved statistical sampling techniques to ensure current spawning ground surveys are an appropriate measure of productivity. Using these techniques, reassess escapement and spawner/recruitment goals.

5. Need to calculate returns per spawner from index surveys to determine if this relationship is improving as smolt passage facilities are modified at Columbia and Snake River dams. Consider alternative approaches to assess population status.
6. Need to determine life history and movement patterns of steelhead including assessment of adult holding areas, juvenile rearing areas, and juvenile migration patterns.
7. Need to determine smolt-to-adult survival and survival factors throughout the entire life cycle of summer steelhead, including separating freshwater from ocean survival.
8. Need to determine extent of hatchery straying within the subbasin to control potentially adverse genetic effects on the endemic population(s).
9. Need to monitor harvest of steelhead stocks.
10. Need to determine extent of summer steelhead distribution within the subbasin at various life history stages.
11. Need to monitor summer steelhead by examining drainage escapements and population trends.
12. Need to determine life history composition of *Oncorhynchus mykiss* including the role of resident and anadromous forms to basin-wide production.
13. Need to evaluate the success of artificial production programs for restoring fisheries and increasing natural spawning populations.

Chinook Salmon (Includes all races unless specifically noted)

Hatchery

1. Periodically conduct genetic profiling (i.e., population structure, gene flow and genetic similarity) to monitor influence of hatchery stocks on recovery/conservation of natural populations.
2. Continue gene conservation efforts (cryopreservation) for spring and summer chinook salmon in the subbasin.
3. Complete NEOH planning and implementation of facility needs in Imnaha subbasin to meet production changes resulting from ESA listings and to meet basin goals.
4. Develop and implement, if appropriate, a plan to supplement fall chinook populations in the lower Imnaha River and reintroduce fall chinook into historic habitat.
5. Need to finalize and implement Conventional Broodstock and Captive Broodstock program sliding scales for the management of these programs.
6. Need to continue to participate in planning, consultation and ESA permitting activities pertaining to Imnaha Basin chinook salmon populations.
7. Need to collect sufficient numbers of parr and adults for the Imnaha Captive and Conventional Broodstock Programs, respectively.
8. Need to monitor health of chinook salmon in captivity and develop new treatments and preventative measures for bacterial kidney disease.
9. Need to develop Annual Operating Plans and write annual reports for all projects.
10. Need to improve existing acclimation facilities to meet program goals.
11. Need to modify existing and/or construct additional hatchery facilities to remove current facility limitations to meeting Imnaha hatchery production goals.

Monitoring & Evaluation

1. Continue and expand efforts to monitor the effectiveness of the chinook salmon captive broodstock and LSRCP and NEOH artificial production programs.

2. Quantify mortality rates and straying of adult chinook salmon from Lower Granite Dam to natural production areas.
3. Need to determine smolt-to-adult survival, survival factors, spawning escapement and life history characteristics of natural and hatchery origin spawning populations.
4. Need to monitor smolt and adult survival and migration characteristics and calculate number of returns per spawner to determine if productivity of natural and hatchery populations is affected by modifications of dams on Columbia and Snake rivers.
5. Need to monitor spring chinook salmon status by examining population trends and develop modeling and monitoring "tools" to determine stray rates and impacts of hatchery-produced chinook salmon to chinook salmon populations in the Imnaha River.
6. Need to determine life history and movement patterns of spring chinook salmon within the Imnaha Subbasin, including assessment of adult holding areas, juvenile rearing areas, and juvenile migration patterns.
7. Need to evaluate effectiveness of experimental hatchery rearing and release treatments.
8. Need to evaluate the success of Captive and Conventional broodstock programs for restoring fisheries and increasing endemic stocks of spring chinook salmon in Big Sheep and the mainstem Imnaha River. Use continued spawning ground surveys, life history monitoring, fisheries monitoring and other techniques.
9. Need to monitor and determine success of restoring recreational and tribal fisheries in Imnaha Basin.
10. Need to determine relative reproductive success of hatchery fish spawning in nature.
11. Need to monitor spawning distribution and recolonization of vacant habitat.
12. Need to investigate the development of run size estimate models for harvest allocation decisions.
13. Need to continue to participate in planning, consultation and ESA permitting activities pertaining to Imnaha Basin chinook salmon populations.
14. Need to determine seasonal and reach specific survival of smolts in the subbasin.

Coho Salmon

1. Develop and implement, if appropriate, a plan to reintroduce coho salmon to the Imnaha River subbasin.

Sockeye Salmon

1. Develop and implement, if appropriate, a plan to reintroduce sockeye salmon to the Imnaha River subbasin.

Bull Trout

1. Collect life history, distribution, and homing behavior information of bull trout within the subbasin and in relevant core areas.
2. Evaluate connectivity and the degree of interchange between populations throughout the subbasin. Reestablish connectivity of populations affected by water diversions if feasible.
3. Monitor core populations to establish trends and measure population response to recovery and restoration activities.
4. Determine the extent and magnitude of nonnative species interaction and hybridization to better define treatment options.
5. Continue presence/absence surveys to locate bull trout populations throughout the subbasin.

6. Assess the relationship between resident and migratory life history forms.
7. Evaluate ecological interactions between bull trout and anadromous salmonids.
8. Determine survival rates of bull trout between life stages and assess productivity.
9. Determine water temperature associations of migratory bull trout.

Redband Trout

1. Investigate potential existence of redband trout in the subbasin.

Lamprey (brook and Pacific)

~~1.~~ Conduct presence/absence surveys for lamprey in the Imnaha subbasin
2. Develop and implement a plan to reintroduce lamprey to the Imnaha River subbasin.
3. Determine habitat requirements and limiting factors for Pacific lamprey production in the subbasin.
4. Assess the rehabilitation potential of Pacific lamprey in the subbasin.
5. Assess the rehabilitation process for Pacific lamprey in the subbasin.

Mountain Whitefish

1. Assess abundance, distribution, population dynamics, life history, and genetic characteristics.
2. Evaluate ecological interactions between mountain whitefish and anadromous salmonids.
3. Determine water temperature associations of resident and migratory life history forms.

Exotic Species

1. Determine distribution of introduced non-native species and their effects on native salmonids.
2. Assess overall predation on salmonids by exotic species.

Nutrient Cycling

1. Implement cooperative programs to reintroduce anadromous fish carcasses to the ecosystem.
2. Support cooperative efforts to benefit anadromous fish runs.

Wildlife / Terrestrial Needs

- Acquire lands when opportunities arise for improved habitat protection, restoration, and connectivity and for mitigation of lost wildlife habitat (land purchases, land trusts, conservation easements, landowner cooperative agreements, exchanges).
- Implement and (where applicable) continue noxious weed control programs.
- Assist landowners with land holdings and easements for restoration and enhancement of wildlife habitat.
- Mitigate hydropower impacts on loss of wildlife and wildlife habitats, including indirect impacts caused by the introduction of cheap power and water to the subbasin.
- Participate in threatened, endangered, and sensitive species recovery or conservation strategy efforts in the subbasin.

Ponderosa pine communities

- Acquire lands when opportunities arise for improved habitat protection, restoration, and connectivity for ponderosa pine communities and for mitigation of lost wildlife habitat for ponderosa pine associated species (land purchases, land trusts, conservation easements, landowner cooperative agreements, exchanges).
- Work with landowners and managers to restore ponderosa pine communities
- Create and maintain large diameter snags in ponderosa pine communities.
- Participate in a cooperative stewardship program to foster ponderosa pine protection.

Native prairie ecosystems

- Acquire lands when opportunities arise for improved habitat protection, restoration, and connectivity for native prairie ecosystems and for mitigation of lost wildlife habitat for native prairie ecosystem associated species (land purchases, land trusts, conservation easements, landowner cooperative agreements, exchanges).
- Work with landowners and managers to restore native prairie ecosystems
- Support native plant nurseries and seedbanks
- Support continued restoration of native prairie flora (i.e. sharp-tail grouse) and fauna (Spalding's catch fly).

Classified Wetlands

- Acquire lands when opportunities arise for improved habitat protection, restoration, and connectivity for classified wetlands and for mitigation of lost wildlife habitat for classified wetland associated species (land purchases, land trusts, conservation easements, landowner cooperative agreements, exchanges).
- Protect, restore and create wetland and riparian habitat particularly in lower elevation riparian areas.
- Participate in a cooperative stewardship program to foster classifier wetland community protection.

Noxious weeds

- Monitor the spread of and evaluate the effectiveness of noxious weed control programs.
- Continue control programs for noxious weeds to restore natural habitat conditions and communities for wildlife species.
- Develop an information and education stewardship program for noxious weeds.

Loss of legacy resources

- Work with landowners and managers to retain late successional habitats on state, and private lands (land exchanges, conservation easements).
- Develop and implement active management prescriptions to restore and promote late successional habitats.
- Develop an information and education stewardship program to foster late seral community protection

Roads

- Reduce road densities through closures, obliteration, and reduced construction.
- Support planned road closures on public land and encourage closure of other roads.
- Improve enforcement of road closures.

Loss of Nutrients

- Implement programs to reintroduce anadromous fish carcasses to the ecosystem.
- Support cooperative efforts that benefit both anadromous fish and wildlife populations.

Imnaha Subbasin Recommendations

Projects and Budgets

Project: 27017 – Bull trout population assessment and life history characteristics in association with habitat quality and land use: template for recovery planning

Sponsor: Utah Cooperative Fish and Wildlife Research Unit, USGS

Short Description

Assess bull trout population density, abundance and life history characteristics for core areas of the Imnaha Subbasin and evaluate relationships to habitat quality and land use based on field evaluations and mark/recapture techniques.

Abbreviated Abstract

The goal of this project is to understand and document population abundance and rates of population change for threatened bull trout (*Salvelinus confluentus*) in the Imnaha River Subbasin, and to relate population and life history characteristics to habitat quality and land use. The data and conservation assessment tools provided by this project will be used in bull trout recovery planning and will provide a template for research, monitoring, and evaluation programs for bull trout populations throughout this as well as other provinces. We propose to do a comprehensive population assessment for all life stages of bull trout in combination with detailed habitat assessments for the streams identified. This assessment will provide information on densities, population abundance and structure, movement, and habitat quality. Basic population abundance and density information is crucial for determining population status, for monitoring population size and trends, and to evaluate opportunities for, and the effectiveness of, management activities aimed at bull trout recovery. Based on established and cost effective mark and recapture techniques, the Pradel-type mark/recapture analysis we have proposed provides a simple response variable, lambda, which can be used to evaluate how each sub-population is responding to current habitat conditions or would likely respond to future habitat improvements. We will develop a simple population life-cycle model based on bull trout abundance data and life history characteristics combined with information on habitat quality and land use patterns. Within each of the proposed watersheds, we have identified core areas (streams), which demonstrate a range of habitat quality as well as different management types (e.g., private vs. USFS). Further, the USFS Effectiveness Monitoring program annually provides detailed stream habitat assessments for different land use management types for watersheds throughout the Columbia Basin, which may ultimately be used for evaluating the effect of habitat quality on bull trout survival in additional areas.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
199405400	Characterize the Migratory Patterns, Structure, Abundance, and Status of Bull Trout Populations from Subbasins in the Columbia Plateau	complementary
	IDFG General Parr Monitoring	provides information for
	NWPPC Ecosystem Diagnostics and Treatment (EDT)	project data can be use to validate EDT model

Relationship to Existing Goals, Objectives and Strategies

The goals of this project will help managers evaluate threats to listed salmon and trout from potential habitat degradation as identified in the Imnaha River Subbasin Plan (Plan). These goals should also provide a benefit to listed salmon and steelhead populations in this basin. In this summary, the Imnaha subbasin in general is described as being in relatively good condition with sedimentation as potentially the most serious problem. Land uses that have historically affected bull trout include timber harvest, road building, mining, grazing, irrigation development, and recreation. Most of these land uses continue to take place although in some cases not to the extent or in the same manner as in the past. Logging, road construction, and farming all have the potential of being sediment producers and thereby adversely affecting fish production. Roads along the mainstem Imnaha River and Big Sheep Creek remain in use today, although they have been improved. Sinuosity of streams in the Imnaha River is low because of geology, and in localized areas because of riprap and bank stabilization associated with road building. Much of the riparian vegetation has been modified over time. The mainstem Imnaha River is lacking in large woody debris.

The potential for increasing fish survival from habitat changes needs to be identified, core areas need to be protected, and evaluation needs to occur when habitat changes are implemented, in order to evaluate the effectiveness of management actions and aide in future bull trout planning for other areas. Portions of Big Sheep Creek and the Imnaha River mainstem may benefit from fencing to protect from the detrimental effects of cattle grazing. Riparian reserves or no-activity buffers designated under consultation with NMFS for ESA listed spring chinook salmon should help protect bull trout habitat from logging, although there is very limited overlap between chinook salmon and bull trout in Sheep Creek (Dambacher and Jones 1997). Regarding the potential impact of habitat, the Plan suggests that monitoring for the purpose of collecting baseline fisheries production information should commence in areas proposed for U.S. Forest Service logging activities (87% of mainstem habitat is USFS). This information is essential to evaluating future fisheries impacts of proposed timber sales. The Plan further states that the only area that remains relatively static in management goals and strategies is the Eagle Cap Wilderness Area. In addition, the need for bull trout population assessment information has been identified by the NWPPC Fish and Wildlife Program and Subbasin Summaries, USFWS, and the Oregon Plan for Salmon and Watersheds, in order to aide in recovery planning and adaptive management in the region.

Stream habitat surveys are currently being used by state and federal conservation agencies (Bain et al. 1999) to address legal mandates. Consultation protocols for aquatic species protected under the Endangered Species Act include documentation of the stream habitat characteristics (NMFS 1996). There are also attempts to utilize aquatic habitat metrics as thresholds in meeting the mandates of the Clean Water Act and physical attributes of stream are being used as management standards in federal land management plans. These habitat data need to be explicitly related back to fish survival and recovery.

Review Comments

This USFWS suggests that this proposal was designed to develop techniques to assess recovery planning and provide information for implementing the biological opinion. The proposed work would assess bull trout population density, abundance, and life history characteristics for core areas of the Imnaha Subbasin and evaluate relationships to habitat quality and land use based on field evaluations and mark/recapture techniques. The USFWS suggests the proposed work would "also provide the technical information to develop a template for bull trout recovery planning." The USFWS indicated that the proposed work is "needed to evaluate population response to recovery measures within and outside of the tributaries." According to the USFWS, the proposed work would help implement reasonable and prudent measure 10.A.3.1 and terms and conditions 11.1, 11.2. and 11.A.2.2.b in the FCRPS biological opinion..

The USFWS views the proposed work "as an extremely important project for assisting in determining bull trout population status and habitat conditions" and believes there is a "need to systematically collect critical tributary information on bull trout to help in assessing the effects of FCRPS operation." The USFWS supports the funding of this proposal.

Budget

FY02	FY03	FY04
$469,792 Category: High Priority Comments:	$269,888 Category: High Priority	$269,888 Category: High Priority

Actions by Others

The USFS Effectiveness Monitoring program has sampled several sites within this basin and will continue to sample selected sites in the future as part of their program (Kershner, *in review*). Selected stream reaches are monitored for ~ 40 different biotic and abiotic stream and riparian features meant to describe the effects of land management (see Table 2 in proposal). The USFS has contributed >1 million dollars towards that program across the Columbia Basin, and we have proposed collaborating with them for bull trout habitat assessment (Jeff Kershner, USFS, is a PI on this proposed project).

ODFW and USFS sample for a variety of bull trout populations measures intermittently in this subbasin.

Project: 27021 – Adult Steelhead Escapement Monitoring – Imnaha River Subbasin

Sponsor: Nez Perce Tribe

Short Description

Quantify adult steelhead abundance, population growth rate, spatial distribution, and genetic stock structure in all tributaries of the Imnaha River subbasin through the operation of adult spawner escapement monitoring facilities

Abbreviated Abstract

Snake River steelhead (*Oncorhynchus mykiss*) are listed as threatened under the Endangered Species Act exhibiting significantly declining numbers and low level of abundance of adults counted at Lower Granite Dam (Busby et al. 1996; CRI 2000). Tributary specific quantitative information of steelhead status and population structure upstream of Lower Granite Dam is limited for B-run aggregates and virtually non-existent for A-run aggregates, making development of fisheries conservation or management actions problematic. Independent populations within the Snake River steelhead ESU have not been defined according to criteria in NMFS' Viable Salmonid Population document (VSP; McElhany et al. 2000). However, based on the limited available data, the NMFS assumes that there are at least five populations of A-run and five populations of B-run steelhead in the Snake River Steelhead ESU. The component populations are an indicator of the status of the entire ESU (McElhany et al 2000), and as such the NMFS Biological Opinion (2000) calls for defining populations based on biological criteria and evaluating population viability in accordance with NMFS' VSP approach. The VSP defines population performance measures in terms of four key parameters: abundance, population growth rate, spatial structure, and diversity then relates performance and risks at the population scale to risks affecting the persistence of the entire ESU.

This study will provide Tier 2 level baseline tributary-specific status information through monitoring of adult steelhead escapement in tributaries of the Imnaha River subbasin. Annual non-biased and precise quantification of adult abundance and monitoring of spatial distribution will provide population growth rate and genetic stock structure information. Primary data and derived values will support: 1) evaluation of recovery efforts and NMFS BiOp RPAs, 2) implementation and evaluation of management actions and harvest opportunities, and 3) evaluation of the hatchery steelhead contribution/impacts to natural reproduction within the subbasin in relation to the overall subbasin stock status.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
0	Lower Snake River Compensation Plan Hatchery Evaluations.	Conducts escapement monitoring in Lightning and Cow Creeks. Assist with juvenile survival trapping and survival estimation from the lower Imnaha River.
	Lower Snake River Compensation Plan O&M and Evaluations - ODFW	Provides adult escapement monitoring in Little Sheep Creek. Evaluation of hatchery production and natural production returns.
199701501	Imnaha River Smolt Monitoring	Provides juvenile emigration characteristics and survival data, will provide SAR information for steelhead in future years.
198805301	Northeast Oregon Hatchery	Will provide new weir at Gumboot that can operate in high flow conditions and will be utilized by this proposal.

Relationship to Existing Goals, Objectives and Strategies:

This project has a clear relationship to specific objectives in the Imnaha River Subbasin Summary. The research, monitoring and evaluation goal of the federal government is to identify trends in abundance and productivity in populations of listed anadromous salmonids. Accurate long-term abundance data sets will provide the most reliable means of determining population status (i.e. abundance, trend, distribution, and variation). This project is relevant to the following objectives and strategies:

- **Objective 1** Conduct population status monitoring to determine juvenile and adult distribution, population status and trends.
- **Objective 2** Monitor the status of environmental attributes potentially affecting salmonid populations, their trends, and associations with salmonid population status.
- **Objective 3** Monitor the effectiveness of intended management actions of aquatic systems, and the response of salmonid populations to these actions.
- **Objective 5**
  - Strategy 2. Conduct Tier 2 monitoring to obtain detailed population assessment and assessments of relationships between environmental characteristics and salmonid population trends.

Monitoring of steelhead abundance would aid the Nez Perce Tribe in determining the success of their goals to "restore anadromous fish in rivers and streams at levels to support the historical, cultural, and economic practices of the tribes," and "reclaim anadromous and resident fish resource and the environment on which the resource depends for future generations." The project would also allow the Tribe to determine the status and success of management objectives 1, 3 and 6 were successful ("Restore and recover historically present fish species," "Manage salmon and steelhead for long-term population persistence," and "Implement effective monitoring and evaluation of supplementation and habitat enhancement programs of project-specific and reference stream [control] locations."). This project would specifically fulfill the requirements of Nez Perce Tribe research monitoring and evaluation objectives.

- **Objective 1. Conduct Lower Snake River Compensation Plan (LSRCP) hatchery evaluations.**
  - **Strategy 7. Determine adult steelhead abundance, spatial structure, and genetic diversity.**
- **Objective 4. Develop a comprehensive monitoring and evaluation plan including a summary of existing information on chinook and steelhead population status, including base line genetic stock structure.**
  - **Strategy 4. Summarize spawning distribution and timing, juvenile emigration and survival, juvenile (hatchery) releases, life history, ecological interactions, genetics, and fish health.**
  - **Strategy 5. Identify critical uncertainties regarding the condition of stocks in the Snake River Basin and associated with supplementation of those stocks.**

Monitoring of steelhead population status is a stated objective for the Oregon Department of fish and Wildlife.

- Objective 8: Determine relative reproductive success of naturally-spawning hatchery and wild steelhead and chinook salmon in the Imnaha River Basin.
  - Strategy 2. Implement monitoring and evaluation to assess health, status and productivity of natural populations.
    - Action 2.1. Determine genetic diversity, using DNA analysis, of natural steelhead stocks in the Imnaha River basin by sampling 5 representative tributary basins for four consecutive years.

- Action 2.2. Monitor natural escapement and characterize spawning populations.
- Action 2.3. Evaluate ability to estimate escapement and straying and ability to characterize spawning populations.
- Action 2.4. Capture and enumerate returning adult fish at weirs on the Imnaha River and tributaries.

The first goal of Oregon's Steelhead Plan is to sustain healthy and abundant wild populations of steelhead. The following objectives will be used to achieve this goal:

- Objective 5. Monitor the status of wild steelhead populations so that long-term trends in populations can be determined.

The proposed steelhead project fulfills existing goals, objectives, strategies, and needs identified in the Imnaha River Subbasin Summary (Rabe et al. 2001). Fish hatchery and fisheries research needs outlined in the Imnaha Subbasin Summary that relate specifically to activities proposed by this project are summarized in Table 1.

Initiation of this project would allow movement toward developing the escapement abundance data sets that provide a scientific basis for management, conservation, and allow evaluation of recovery thresholds (NMFS Biological Opinion 2000). This proposed project is a critical aspect of a viable population management strategy in that it provides quantitative adult escapement abundance information that is recognized within the scientific community (Foose et al. 1995, Botkin et al. 2000) and in recovery planning efforts (NMFS Biological Opinion 2000). Quantifying adult salmon spawner abundance will provide a direct measurement of benefits of the Northwest Power Planning Council's Fish and Wildlife Program projects (funded by BPA) and effects of recovery alternatives. In addition, the goals and objectives of this proposal are consistent with and recommended by action plans identified in the Biological Opinion, Fish and Wildlife Program, Salmon River Subbasin Summary, and Wy-Kan-Ush-Me-Wa-Kush-Wit (Spirit of the Salmon; CRITFC 1995).

Action 179 in the NMFS Biological Opinion (2001) call for defining populations based on biological criteria and evaluating population viability in accordance with NMFS' VSP approach. This proposed project would focus on assessing steelhead population abundance and data necessary to estimate the population growth rate.

Action 180 in the NMFS Biological Opinion (2001) calls for Population Status Monitoring. This proposed project was developed to provide Tier 2 level population monitoring which will define population growth rates, detect changes in those growth rates or relative abundance in reasonable time.

Action 174 in the NMFS Biological Opinion (2001) directs funding contributions as appropriate for additional sampling efforts and specific experiments to determine relative distribution and timing of hatchery and natural spawners in relation to the reform of existing hatcheries and artificial production programs. This proposal will quantify and determine the spatial distribution of hatchery origin adults from the LSRCP Little Sheep Creek hatchery program into natural production areas with in the Imnaha River subbasin.

Action 193 in the NMFS Biological Opinion (2001) states that the action agencies shall investigate state-of-the-art, novel fish detection and tagging techniques for use, if warranted, in long-term research, monitoring, and evaluation efforts. This project looks to develop and validate the use of remote monitoring passive fish detection methods (resistivity counters). If successful resistivity counters would become the primary adult steelhead abundance monitoring method with random validation occurring with temporary weirs.

Hierarchical Tier 1 monitoring will be provided by data from this project in the form of status of spawners, juveniles, and hatchery-origin spawners. Some habitat monitoring will be provided by this project with stream temperature data, and in-stream flow data. The goals of Tier 2 monitoring will be provided by this project measuring spawner and redd counts at specific sites, juvenile density and emigration estimates, counts of hatchery fish on spawning sites, counts at weirs, and age structure of spawners on sites (NMFS BIOP 2000 9.6.5.2)

This proposal supports the NWPPC Fish and Wildlife Plan (NPPC 2000) under an adaptive management process using an experimental approach (III.B.2) to achieve abundant and productive fisheries that are able to support Tribal and non-tribal harvest (III.C.1), implement no-net decline management actions that support the recovery of ESA listed stocks (III.C.1 and 2.a), and evaluate effectiveness of NMFS BiOp RPA's and other management actions (III.D.9). Specifically, providing empirical data necessary to adequately describe the biological performance in terms of abundance and diversity (III.C.2) of steelhead in key individual tributaries to address critical uncertainties and data gaps (III.D.9) described in the Imnaha River subbasin summary under needs and goals sections (see below). This proposal implements actions required under the Artificial Production Review addressing the risks, benefits, and critical uncertainties associated with application of artificial propagation (III.D.4) and evaluates those factors in-relationship to natural/reference stocks throughout the entire Imnaha River subbasin.

Wy-Kan-Ush-Me-Wa-Kush-Wit (Spirit of the salmon) provides guidance to "Establish and monitor escapement checkpoints at mainstem dams and in index subbasins. Methods to be used include video counting at hydropower dams and at key locations in tributaries…. The least intrusive method should be used to collect the necessary information…. Establish additional monitoring programs for each of the subbasin tributary systems to monitor adult escapement and resulting smolt production, and to evaluate (by measuring the number of adults returning) the ability of managers to meet goals set by the Columbia River Fish Management Plan (CRFMP)."

Review Comments

This project addresses RPA 179 and 180. This proposal addresses a need for improved adult escapement; however, the reviewers suggest the level of detail that is provided may exceed what is necessary for making critical management decisions and deterring population/recovery status. The reviewers suggest the work could be "scaled back" yet still provide adequate population data. Although the sponsors suggested the work will provide information where data gaps (especially as related to 174 and 184) exist, the reviewers suggested an urgent issue wold not be addressed. The proposed work would provide more accuracy to the current approach and provide information for recovery efforts.

Budget

FY02	FY03	FY04
$1,055,449 Category: High Priority Comments:	$767,298 Category: High Priority	$741,804 Category: High Priority

Actions by Others

This project would be a cooperative effort among Tribal, state and federal agencies and independent scientists that would complement ongoing research and management activities. Project activities would actively seek collaboration and coordination with other agencies to establish standardized monitoring efforts that are comparable between streams and that provide regional information application. Adult steelhead abundance monitoring would be closely coordinated with the National Marine Fisheries Service for ESA recovery metrics.

The Nez Perce Tribe's LSRCP Evaluations project monitors adult steelhead escapement in Lightning Creek and Cow Creek. Stock status of wild steelhead in the Imnaha River subbasin was initiated in 2000 with operation of an adult escapement weir in Lightning Creek. This effort has been expanded to Cow Creek in 2001. The current proposal relies on the continuation of this monitoring and identifies Cow or Lightning creek as a test site for a resistivity counter due ability to link tests to direct counts. The LSRCP Program cooperators in Oregon are assessing steelhead population structure through genetic information from juvenile *O. mykiss.* A sample collection strategy was developed and initiated in 1999 to allow DNA genetic analysis of stock structure for steelhead in Imnaha and Grande Ronde subbasins. Twenty areas were targeted for sample collections. These sample collections are scheduled to continue for at least four years (through 2002). A long-term genetics monitoring (perhaps with reduced effort) is expected to occur as long as supplementation of steelhead populations in the system occurs.

The LSRCP program through ODFW operates the Little Sheep Creek adult collection and acclimation facility. Evaluation of hatchery returns and wild returns to the Little Sheep Creek weir is conducted annually. Creel surveys are conducted. ODFW is conducting is study addressing the contribution of resident *O. mykiss* in the Grande Ronde subbasin through otolith analysis. This information will provide inference to the Imnaha River subbasin and address aspects that this proposal is not addressing.

Project: 199701501 – Imnaha River Smolt Survival and Smolt to Adult Return Rate Quantification

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Sponsor: Nez Perce Tribe Department of Fisheries Resource Management

Short Description

Quantify juvenile emigrant abundance, determine smolt survival from the Imnaha River to Lower Granite and McNary dams, quantify smolt-to-adult return rate (SAR) of wild/natural chinook salmon at Lower Granite Dam and back to the Imnaha River

Abbreviated Abstract

The goal of this project is to monitor smolt-to-adult return rates (SAR's) of an index subpopulation of wild/natural chinook salmon in the Imnaha River. It will also continue collection of a time series of chinook salmon and steelhead smolt survival information to mainstem dams. Both types of information would provide accurate performance measures. The performance measures may be used to monitor changes that occur in natal streams, in migration routes, and survival of Imnaha River adult chinook salmon. The project will also quantify juvenile emigrant abundance in the Imnaha River to relate to natural production, in-river survival and determination of salmon life history traits. This information may also be utilized to examine effects of the Lower Snake River Compensation Plan supplementation program.

This project seeks to continue to provide the Fish Passage Center's Smolt Monitoring Program with emigration data. The Smolt Monitoring Program is identified in Appendix G of the 2000 FCRPS Biological Opinion (action 1193). Retrieval of PIT tag interrogation information from mainstem dams provides observations and estimates of arrival timing, travel time, and survival. This information is used to shape in-season water budget and spill requests for emigrating anadromous salmonid smolts through the mainstem river hydroelectric corridor. The expected results are a continuation of a series of arrival timing, travel time, and survival data.

Relationship to Other Projects

Project ID	Title	Nature of Relationship
199102800	Monitoring Smolt Migrations of wild Snake River spring/summer chinook salmon	Provide release-recapture data for evaluating spring/summer chinook salmon
199202604	Investigate Early Life History of Spring Chinook Salmon and Summer Steelhead in the Grande Ronde River Basin	Provide release-recapture data for evaluating spring/summer Chinook salmon
	Adult Steelhead Status Monitoring – Imnaha Sub Basin	New project – Sharing of adult escapement data, logistical support for field activities in the Imnaha Canyon.
	South Fork Salmon River SAR	New project – Sharing of technologies for interrogating and enumerating returning adult salmonids
2484	Johnson Creek Artificial Propagation Enhancement Monitoring and Evaluation	New project – Sharing of technologies for interrogating and enumerating returning adult salmonids
2654	Salmonid Gamete Preservation	Sharing of adult escapement data, logistical support for field activities in the Imnaha Canyon.
2644	Lower Snake River Adult Escapement Monitoring	Sharing of adult escapement data, logistical support for field activities in the Imnaha Canyon
	Nez Perce Tribe Lower Snake River Compensation Plan Hatchery Evaluations	(Formerly funded by the USFWS) Cost-shared operation of trapping and tagging operations, technical and administrative support
20552	Smolt Monitoring Program Umbrella	Daily collection of smolt data for use in the Smolt Monitoring Program
198712700	Smolt Monitoring by Non-Federal Entities	Sharing of emigration data from the Grande Ronde, Salmon, and Snake Rivers, and

Project ID	Title	Nature of Relationship
		mainstem dams through the Fish Passage Center.
198909800	Idaho Salmon Supplementation Studies	Sharing and comparing emigration data (arrival time, travel time, survival)
198909801	Evaluate Salmon Supplementation in Idaho Rivers	Sharing and comparing emigration data (arrival time, travel time, survival)
198909803	Idaho Salmon Supplementation Studies	Sharing and comparing emigration data (arrival time, travel time, survival)
8712702	Comparative Survival Rate Study	Assist the program by providing PIT tagged natural Chinook salmon for the study
19833500	Nez Perce Tribal Hatchery Program	Sharing and comparing emigration data from tributaries of the Clearwater and Imnaha Rivers (arrival time, travel time, survival) through technical work groups
1774	Northeast Oregon Hatchery Program	Functions as a component of the monitoring and evaluation program

Relationship to Existing Goals, Objectives and Strategies

The 2000 FCRPS Biological Opinion's Research, Monitoring, and Evaluation Plan (NMFS 2000) stated in section 9.5.6 calls for population status monitoring. It recommends monitoring the population growth rate. However, the authors acknowledge that it will be difficult to detect population responses "due to the normal salmon return times and naturally high variability in salmonid populations." The recommended high priority monitoring and evaluation measures called for are the development of short-term measures of stock performance, such as recruits per spawner, and measures, such as survival, that focus on life history stages. NMFS (2000) estimates in Table 9.2-4 that the egg to adult, or any constituent life stage, survival rate for the Imnaha River chinook salmon population must increase by 126% to 166% before recovery is achieved. The Imnaha River Smolt Survival and Smolt to Adult Return Rate Quantification Project will provide short term measures of stock performance by producing a SAR for natural chinook salmon at Lower Granite Dam and the mouth of the Imnaha River and juvenile survival estimates from the mouth of the Imnaha River to Lower Granite Dam and Lower Monumental Dam for natural and hatchery chinook salmon and steelhead. We consider achieving short-term measures of survival as taking the necessary logical steps towards monitoring the population growth rate and population responses due to environmental changes. The emphasis on providing short term measures of stock performance and life history stages does not change the primary purpose of the original Imnaha River Smolt Monitoring Project and it will continue to supply the Fish Passage Center with in-season migration data as called for in Appendix H, actions 1193 and 1240.

This program has been providing emigration data to the Fish Passage Center since 1994 when it began participating as part of the Smolt Monitoring by Non-Federal Entities (Project No. 8712700) and began operating as a cost-shared project to the Nez Perce Tribe's Lower Snake River Compensation Plan hatchery evaluation studies. The Nez Perce Tribe's Lower Snake River Compensation Plan hatchery evaluation studies has been collecting emigration data from Imnaha River since 1992 as part of a long term monitoring effort funded by the U.S. Fish and Wildlife Service. The Imnaha River Smolt Survival and Smolt to Adult Return Rate

Quantification program will continue to assist this program in maintaining a time series of data that represent a variety of environmental conditions and hydro-operations. The rationale behind monitoring smolts is to provide managers with in-season information on chinook salmon and steelhead smolt emigration relative to water budget and spill planning in the mainstem Snake and Columbia River hydroelectric corridor. In-season shaping of the water budget, dam operations and spill requests are crucial to maximize smolt survival past the eight hydroelectric projects. The Imnaha River provides a tributary specific in-season view of the magnitude of the run from the Imnaha for natural and hatchery chinook salmon and steelhead. Survival can be improved with specific emigration information. For example, when this study was initiated in 1994, 90% of the natural Imnaha River chinook salmon smolts migrated past Lower Granite Dam (LGR) before spill was initiated in an attempt to improve survival. Imnaha Smolt Monitoring Program identified the emigration timing and the ranges in timing from the Imnaha River, and the median and 90% arrival timing dates at LGR. This demonstrates how the water budget can be shaped to provide improved survival conditions for Imnaha River chinook salmon smolts.

The proposed monitoring and evaluation activities are designed to provide information at a Tier 2 level, as defined in Appendix G of the FCRPS Biological Opinion (NMFS 2000). The smolt monitoring research is also designed to address the Tribal Recovery Plan (Wy-Kan-Ush-Mi Wa-Kish-Wit 1995), which states "to develop experimental and monitoring programs in association with these projects to study the relationships between natural and supplemented components of the populations". It suggests that smolt abundance be estimated at tributary mouths to estimate egg to smolt survival production parameter. The Tribal Recovery Plan also suggests a suite of juvenile salmon passage alternatives which would require stream reach survival estimates to evaluate effectiveness of the preferred alternative through PIT tagging of smolts. The Tribal Recovery Plan recommends that additional monitoring programs be established “for each of the subbasin tributary systems to monitor adult escapement and resulting smolt production, and to evaluate (by measuring the number of adults returning) the ability of managers to meet goals set by the Columbia River Fish Management Plan.”

Estimation of SAR’s for the Imnaha River are necessary for implementing a monitoring and evaluation component of the Nez Perce Tribe’s Spring Chinook Master plan for the Northeast Oregon Hatchery Program (Ashe et al. 2000). The policy process component of the masterplan refers to technical outlines provied by the document entitled “Review of Artificial Production of Anadromous and Resident Fish in the Columbia Basin” (Brannon et al. 1999, cited in Ashe et al. 2000). Guieline 17 recommends that a hatchery fish monitoring program needs to be developed on performance from release to return, including information on survival success…(Brannon et al. 1999, cited in Ashe et al. 2000). The rationale is to compare performance parameters with native (natural) fish.

Funding of the Imnaha Smolt Monitoring Program Imnaha River Smolt Survival and Smolt to Adult Return Rate Quantification program will allow for the continued collection and marking of chinook salmon and steelhead with Passive Integrated Transponder (PIT) tags at a level that will result in juvenile survival estimates to the Columbia and Snake River dams and allows for the analysis of returns of PIT tagged adult chinook salmon as recommended in the FCRPS Biological Opinion (NMFS 2000) in Action 185. This program will develop a novel fish detection technique as specified in Action 193 by implementing technology developed for detecting adults in the ladders of mainstem dams (Downing 2000). The development of a passive weir or interrogation facility capable of detecting PIT tagged adult fish would allow for a SAR calculation at the mouth of the Imnaha River and would be another logical step toward monitoring the population growth rate and population response to environmental change. Although our objectives do not intend to compare the performance of Imnaha River fish with downstream stocks as called for in Action 188, the submission of Imnaha PIT tagging files to PTAGIS will allow for a basin-wide research and analysis to occur in the future. Action 189 can only occur if enough fish are tagged to determine a SAR. An example of the use of returning Imnaha River PIT tagged fish used for basin-wide research and analysis is the adult radio telemetry studies conducted by the University of Idaho and the National Marine Fisheries Service. A total of 30 of the 85 adult natural chinook salmon reported as adult PIT tag recaptures have been radio tagged at Bonneville Dam from 1998 to 2001 (PTAGIS June 21, 2001). The research is conducted independently from the Nez Perce Tribe.

Past research for this program was justified under sections 5.1B and 5.1B.1 of the 1987 Columbia River Basin Fish and Wildlife Program. Under the new 2000 Columbia River Basin Fish and Wildlife Program the primary strategies are as follows: 1) Identify and resolve key uncertainties for the program, 2) monitor, evaluate, and apply results, and 3) make information from this program readily available. At a basin-wide and subbasin level, SAR's of natural chinook salmon is a key uncertainty and needs to be quantified if population status monitoring is to be achieved as called for in section 9.5.6 of the 2000 FCRPS Biological Opinion.

At the subbasin level, the Imnaha River Subbasin Summary states "anadromous fish production in the Imnaha River subbasin is currently being limited by out-of-subbasin factors." Management objectives 10 and 13 of the Nez Perce Tribe listed in the Imnaha Subbasin summary identify the desire to "maintain a natural smolt-to-adult survival rate of 2 to 6% for salmon and steelhead" and to "address key limiting survival factors at mainstem hydroelectric facilities." More specifically, the Statement of Fish and Wildlife Needs in the summary identify the following monitoring and evaluation needs for chinook salmon: 1) "Continue and expand efforts to monitor the effectiveness of the chinook captive broodstock and LSRCP and NEOH artificial production programs", 2) "determine smolt-to-adult survival, survival factors, spawning escapement and life history characteristics of natural and hatchery origin spawning populations", and 3) "monitor smolt and adult survival and migration characteristics and calculate number of returns per spawner to determine if productivity of natural and hatchery populations is affected by modifications of dams on the Columbia and Snake Rivers." The statement for the monitoring and evaluation needs for steelhead state, "Continue and expand efforts to quantify juvenile abundance and smolt-to-adult return rates (SAR) of wild/natural and hatchery reared steelhead, continue and expand monitoring of hatchery supplementation and interactions with natural fish" (Bryson 2001).

Review Comments

This project addresses RPA 184, 185 and 189.

Budget

FY02	FY03	FY04
$466,802 Category: High Priority Comments:	$1,308,590 Category: High Priority	$558,866 Category: High Priority

Actions by Others

This project would be a cooperative effort among Tribal, state and federal agencies and independent scientists that would complement ongoing research and management activities. Project activities will actively seek collaboration and coordination with other agencies to establish standardized monitoring efforts that are comparable between streams and that provide regional information application. Adult salmon abundance monitoring will be closely coordinated with the National Marine Fisheries Service for ESA recovery metrics. Prior to the implementation of the Imnaha Smolt Monitoring Program the Nez Perce Tribe's Lower Snake River Compensation Plan hatchery evaluation studies was collecting emigration data from Imnaha River since 1992 as part of a long term monitoring effort funded by the U.S. Fish and Wildlife Service.

The 2000 FCRPS Biological Opinion places great emphasis on biological requirements primarily in terms of abundance and productivity for the viable salmonid population (VSP) concept to determine whether the species-level requirements of ESUs are being met (NMFS 2000). This information is critical to develop the individual species recovery plan separate from the basin-wide recovery strategy (NMFS 2000). Until the VSP standards are formally applied for recovery goals for all ESUs, NMFS relies on the abundance goals of the 1995 recovery plan for spring/summer chinook salmon. At the current time, there is no method to accurately determine the abundance level. This project will develop indexes that can be used to more accurately reflect that abundance of the designated Imnaha River "ESU" population stock. The PATH project and CRI project can use data generated from this project for better input to their respective models.

Imnaha Subbasin Research, Monitoring, and Evaluation Activities

A comprehensive research, monitoring and evaluation program through the Lower Snake River Compensation Program has been underway in the Imnaha subbasin since 1984 (USFWS 2001).

Project Descriptions

Comparative Survival Rate Study of Hatchery PIT-Tagged Chinook Salmon (PSMFC, FPC, ODFW: BPA Project No. 8712702) - PIT-Tag Marking Spring and Summer Chinook Salmon at Lookingglass Hatchery

The Comparative Survival Study is a long term PIT tag study to develop smolt-to-adult survival indices for spring and summer stream type chinook originating above Lower Granite Dam to evaluate smolt migration mitigation measures and actions (such as flow augmentation, spill, and transportation) for the recovery of listed salmon stocks.

Lower Snake River Compensation Plan Steelhead and Chinook Salmon Evaluations (ODFW)

This research project meets the needs for evaluation of steelhead and chinook salmon hatchery production in the Imnaha River subbasin. The LSRCP was designed to establish and maintain artificial production programs for steelhead and chinook salmon to mitigate for fish losses associated with construction and operation of Lower Snake River Dams. A long-term evaluation and monitoring process is envisioned for the duration of operation of the hatcheries to develop and maintain fish runs, which meet recovery and compensation goals at minimum costs. ODFW is conducting an ongoing comprehensive evaluation of LSRCP activities in Oregon that address the following general guidelines:

1. Develop and evaluate operational procedures that will meet recovery and compensation goals as well as management objectives by priority.
2. Monitor operational practices to document hatchery production capabilities and challenges.
3. Monitor fish-rearing activities and results to document accomplishment of goals.
4. Coordinate research and management programs with hatchery capabilities.

5. Recommend hatchery production strategies that are consistent with endangered species recovery efforts.
8. Develop knowledge and information to guide recovery actions and to monitor recovery in Imnaha river basin.
9. Investigate characteristics of endemic stocks that may be influenced by hatchery production.

The RM&E program is designed to:

7. Estimate annual adult returns and smolt-to-adult survival
8. Evaluate the influence of various release strategies on survival and life history
9. Evaluate natural and hatchery chinook smolt performance and survival within the subbasin and through the Snake River
10. Compare life history and genetic characteristics of natural and hatchery fish
11. Determine and compare progeny-to-parent ratios of natural and hatchery fish
12. Determine success of restoring recreational fisheries

Other research, monitoring, and evaluation activities within the Imnaha subbasin that are used to complement fish and wildlife projects are provided in Table 40.

Table 40. BPA-funded Columbia River Basin Fish and Wildlife Program research, monitoring, and evaluation activities within the Imnaha River subbasin (Bonneville Power Administration and Northwest Power Planning Council 1999)

Activity	Watershed Location	Agency	BPA #	Dates
Compilation of existing and potential sites for anadromous fish hatcheries	Basin-wide	USSBA	8405100	1984-1986
Standardization of fish health monitoring	Basin-wide	ODFW	8711800	1987-1991
Smolt monitoring	Imnaha River	PSMFC	8712700	1987-1998
Habitat study	Imnaha River	NPT	8801500	1987-1993
Hatchery site feasibility and conceptual design	Imnaha River	Montgomery Watson	8805300	1991-1997
Outplanting facilities plan	Imnaha River	NPT	8805301	1989-1999
Evaluation of re-establishment actions	Basin-wide	ODFW	8805304	1989-1999
NE OR artificial production study	Basin-wide	ODFW	8805305	1997-1999
Genetic evaluations of hatchery and natural fish populations	Camp Creek	NMFS	8909600	1989-1999
Genetic evaluations of hatchery and natural fish populations	Imnaha Pond Hatchery	NMFS	8909600	1989-1999
Genetic evaluations of hatchery and natural fish populations	Grouse Creek	NMFS	8909600	1989-1999
Genetic evaluations of hatchery and natural fish populations	Little Sheep Creek	NMFS	8909600	1989-1999
Genetic evaluations of hatchery and natural fish populations	Imnaha River	NMFS	8909600	1989-1999
Genetic evaluations of hatchery and natural fish populations	Lick Creek	NMFS	8909600	1989-1999
Evaluate supplementing summer steelhead	Little Sheep Creek	ODFW	8909700	1989, 1991-1993

Activity	Watershed Location	Agency	BPA #	Dates
Evaluate supplementing summer steelhead	Imnaha River	ODFW	8909700	1989, 1991-1993
Evaluate supplementing summer steelhead	Deer Creek	ODFW	8909700	1989, 1991-1993
Pit tagging wild chinook	Imnaha River	NMFS	9102800	1991-1999
Fish passage evaluation	Imnaha River	USACE	9204100	1992-1995
Fish passage evaluation	Imnaha River	USACE	9204101	1996
Genetics, population, and passage of natural fall chinook	Imnaha River	WDFW	9204600	1992-1996
Telemetry tracking	Basin-wide	USFS	9307000	1993-1996
Bull trout life history	Indian Creek	ODFW, OS Systems	9405400	1994-1997
Bull trout life history	Imnaha River	ODFW, OS Systems	9405400	1994-1997
Bull trout life history	McCully Creek	ODFW, OS Systems	9405400	1994-1997
Bull trout life history	Big Sheep Creek	ODFW, OS Systems	9405400	1994-1997
Audit Columbia basin anadromous hatcheries	Little Sheep Creek Pond	Montgomery Watson	9500200	1995
Audit Columbia basin anadromous hatcheries	Imnaha Pond Hatchery	Montgomery Watson	9500200	1995
Pit tagging hatchery chinook	Imnaha Pond Hatchery	ODFW	9602001	1996

Statement of Fish and Wildlife Needs

Monitoring & Evaluation

15. Continue and expand efforts to monitor the effectiveness of the chinook salmon captive broodstock and LSRCP and NEOH artificial production programs.
16. Quantify mortality rates and straying of adult chinook salmon from Lower Granite Dam to natural production areas.
17. Need to determine smolt-to-adult survival, survival factors, spawning escapement and life history characteristics of natural and hatchery origin spawning populations.
18. Need to monitor smolt and adult survival and migration characteristics and calculate number of returns per spawner to determine if productivity of natural and hatchery populations is affected by modifications of dams on Columbia and Snake rivers.
19. Need to monitor spring chinook salmon status by examining population trends and develop modeling and monitoring “tools” to determine stray rates and impacts of hatchery-produced chinook salmon to chinook salmon populations in the Imnaha River.
20. Need to determine life history and movement patterns of spring chinook salmon within the Imnaha Subbasin, including assessment of adult holding areas, juvenile rearing areas, and juvenile migration patterns.
21. Need to evaluate effectiveness of experimental hatchery rearing and release treatments.
22. Need to evaluate the success of Captive and Conventional broodstock programs for restoring fisheries and increasing endemic stocks of spring chinook salmon in Big Sheep and the mainstem Imnaha River. Use continued spawning ground surveys, life history monitoring, fisheries monitoring and other techniques.

23. Need to monitor and determine success of restoring recreational and tribal fisheries in Imnaha Basin.
24. Need to determine relative reproductive success of hatchery fish spawning in nature.
25. Need to monitor spawning distribution and recolonization of vacant habitat.
26. Need to investigate the development of run size estimate models for harvest allocation decisions.
27. Need to continue to participate in planning, consultation and ESA permitting activities pertaining to Imnaha Basin chinook salmon populations.
28. Need to determine seasonal and reach specific survival of smolts in the subbasin.

Table 41. Subbasin Summary FY - Funding Proposal Matrix

Project Proposal ID	**27017**	**27021**	**199701501**
Provincial Team Funding Recommendation	**High Priority**	**High Priority**	**High Priority**
General Needs			
1	X		
2			
3			
4			
5	X		
6			
7			
Aquatic Habitat - Enhancement			
1			
2			
3			
4	X		
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20	X		
21	X		
22			
23	X		
24	X		
Aquatic Habitat – Planning			
1	X		
Summer Steelhead – Hatchery			
1		X	
2		X	
3			
4			
5			
6			
Summer Steelhead – Monitoring & Evaluation			
1		X	X
2		X	X

Project Proposal ID	27017	27021	199701501
3		X	
4		X	
5		X	
6		X	X
7			X
8		X	
9			
10		X	
11		X	
12			
13		X	
Chinook Salmon – Hatchery			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
Chinook Salmon – Monitoring & Evaluation			
1			X
2			
3	X		X
4	X		X
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
Coho Salmon			
1			
Sockeye Salmon			
1			
Bull Trout			
1	X		
2	X		
3	X		
4	X		
5	X		
6	X		
7	X		
8	X		
9	X		
Redband Trout			
1			

Project Proposal ID	27017	27021	199701501
Lamprey			
1			
2			
3			
4			
5			
Mountain Whitefish			
1			
2			
3			
Exotic Species			
1			
2			
Nutrient Cycling			
1			
2			
Wildlife/Terrestrial Needs			
1			
2			
3			
4			
5			
Wildlife/Terrestrial Needs – Ponderosa Pine Communities			
1			
2			
3			
4			
Wildlife/Terrestrial Needs – Native Prairie Ecosystems			
1			
2			
3			
4			
Wildlife/Terrestrial Needs – Classified Wetlands			
1			
2			
3			
Wildlife/Terrestrial Needs – Noxious Weeds			
1			
2			
3			
Wildlife/Terrestrial Needs – Loss of Legacy Resources			
1			
2			
3			
Wildlife/Terrestrial Needs – Roads			
1			
2			
3			
Wildlife/Terrestrial Needs – Loss of Nutrients			
1			
2			

Legend to Imnaha Subbasin Needs (from Subbasin Summary)

General Needs

8. Coordinate implementation and M&E activities within the subbasin to maximize effectiveness and minimize redundancy. Look for ways to improve consistency among projects.
9. Ensure aquatic and terrestrial subbasin databases are compatible and accessible to all parties.
10. Continue and improve enforcement by state, federal and tribal entities of laws and codes related to protection of fish and wildlife and their habitats, including increased efforts for in and out-of-season poaching and in road closure areas.
11. Continue to educate the public and persons or agencies with resource protection obligations regarding natural resource laws, compliance and enforcement.
12. Development of Federal Recovery Plans for threatened and endangered species to provide recovery guidance for state, tribal and local entities.
13. Reduce the risk of catastrophic wildfire in the subbasin.
14. Ensure natural river drawdown strategy alternative is implemented for recovery of listed species.

Aquatic Habitat

Enhancement

25. Replace culverts that present passage barriers and sediment sources based on a prioritized assessment of existing installations.
26. Implement restoration efforts designed to achieve the site potential shade and other temperature surrogates identified in the appropriate TMDLs for the subbasin.
27. Reduce nutrient pollution to achieve the percent reduction targets identified in the appropriate TMDLs for the subbasin.
28. Using existing assessments, seek out opportunities for cooperative habitat restoration and enhancement projects on public and private land.
29. Restore, protect, and create riparian, wetland and floodplain areas within the subbasin and establish connectivity.
30. Restore in-stream habitat to natural conditions and protect as much as possible to provide suitable holding, spawning, and rearing areas for anadromous and resident fish.
31. Reduce stream temperature to levels meeting appropriate state standards.
32. Restore and augment streamflows at critical times using (but not limited to) water right leases, transfers, or purchases, and improved irrigation efficiency.
33. Reduce stream temperatures where appropriate and when feasible.
34. Consider additional gauging stations to monitor improvement in flows and temperatures as habitat improvement projects are completed.
35. Upgrade existing gauging stations to improve access to real-time streamflow and water temperature data.
36. Reduce sediment, fertilizer and pesticide loading from agricultural practices.
37. Reduce the impacts of confined animals with regard to waste and sediment production.
38. Reduce stormwater, road, and urban/suburban sewage impacts to aquatic resources.
39. Address streambank instability issues where they are defined or can be shown to be a potential problem.
40. Acquire water rights when opportunities arise to help restore more natural flows to streams within the subbasin.
41. Reduce road densities and their associated impacts to watershed functions by supporting planned road closures on public land and encouraging closure of other roads.
42. Implement management plans designed to meet established TMDLs and achieve water quality standards.
43. Periodically conduct longitudinal water temperature surveys such as with Forward Looking Infrared Radar (FLIR).
44. Continue long-term water temperature monitoring throughout the subbasin.
45. Continue compliance and effectiveness monitoring on federal and private land use activities (e.g., mining, grazing, logging, and pollution sources).
46. Improve understanding of the interaction between ground and surface water sources, especially as it pertains to switching irrigation from surface water to wells.
47. Need to characterize rearing and spawning habitats and monitor changes in amount and distribution.
48. Need to evaluate the improvements to adult and juvenile habitat capacity to evaluate success of fish habitat projects.

Planning

2. Continue to develop and update watershed assessments at multiple scales (i.e. transect, reach, watershed) to facilitate integrated resource management and planning efforts. Ensure that databases used for the development of assessments are sufficiently maintained and available to relevant entities.

Summer Steelhead

Hatchery

7. Complete genetic profiling within the subbasin to determine population structure, gene flow and genetic diversity within the subbasin.
8. Continue gene conservation efforts (cryopreservation) for steelhead to preserve genetic diversity within the subbasin.

9. Redevelop hatchery broodstocks as necessary to meet conservation and harvest augmentation goals.
10. Need to develop new methods to minimize the impact of hatchery production activities on endemic stocks.
11. Need to evaluate hatchery production programs to assure that they meet LSRCP compensation goals.
12. Need to develop Annual Operating Plans and write annual reports for all projects.

Monitoring & Evaluation

14. Continue and expand efforts to quantify juvenile abundance and smolt-to-adult return rates (SAR) of wild/natural and hatchery reared steelhead.
15. Continue and expand monitoring of hatchery supplementation and interactions with natural fish.
16. Need to determine genetic population structure to define steelhead sub-populations within the subbasin.
17. Use improved statistical sampling techniques to ensure current spawning ground surveys are an appropriate measure of productivity. Using these techniques, reassess escapement and spawner/recruitment goals.
18. Need to calculate returns per spawner from index surveys to determine if this relationship is improving as smolt passage facilities are modified at Columbia and Snake River dams. Consider alternative approaches to assess population status.
19. Need to determine life history and movement patterns of steelhead including assessment of adult holding areas, juvenile rearing areas, and juvenile migration patterns.
20. Need to determine smolt-to-adult survival and survival factors throughout the entire life cycle of summer steelhead, including separating freshwater from ocean survival.
21. Need to determine extent of hatchery straying within the subbasin to control potentially adverse genetic effects on the endemic population(s).
22. Need to monitor harvest of steelhead stocks.
23. Need to determine extent of summer steelhead distribution within the subbasin at various life history stages.
24. Need to monitor summer steelhead by examining drainage escapements and population trends.
25. Need to determine life history composition of *Oncorhynchus mykiss* including the role of resident and anadromous forms to basin-wide production.
26. Need to evaluate the success of artificial production programs for restoring fisheries and increasing natural spawning populations.

Chinook Salmon (Includes all races unless specifically noted)

Hatchery

12. Periodically conduct genetic profiling (i.e., population structure, gene flow and genetic similarity) to monitor influence of hatchery stocks on recovery/conservation of natural populations.
13. Continue gene conservation efforts (cryopreservation) for spring and summer chinook salmon in the subbasin.
14. Complete NEOH planning and implementation of facility needs in Imnaha subbasin to meet production changes resulting from ESA listings and to meet basin goals.
15. Develop and implement, if appropriate, a plan to supplement fall chinook populations in the lower Imnaha River and reintroduce fall chinook into historic habitat.
16. Need to finalize and implement Conventional Broodstock and Captive Broodstock program sliding scales for the management of these programs.
17. Need to continue to participate in planning, consultation and ESA permitting activities pertaining to Imnaha Basin chinook salmon populations.
18. Need to collect sufficient numbers of parr and adults for the Imnaha Captive and Conventional Broodstock Programs, respectively.
19. Need to monitor health of chinook salmon in captivity and develop new treatments and preventative measures for bacterial kidney disease.
20. Need to develop Annual Operating Plans and write annual reports for all projects.
21. Need to improve existing acclimation facilities to meet program goals.
22. Need to modify existing and/or construct additional hatchery facilities to remove current facility limitations to meeting Imnaha hatchery production goals.

Monitoring & Evaluation

29. Continue and expand efforts to monitor the effectiveness of the chinook salmon captive broodstock and LSRCP and NEOH artificial production programs.
30. Quantify mortality rates and straying of adult chinook salmon from Lower Granite Dam to natural production areas.
31. Need to determine smolt-to-adult survival, survival factors, spawning escapement and life history characteristics of natural and hatchery origin spawning populations.
32. Need to monitor smolt and adult survival and migration characteristics and calculate number of returns per spawner to determine if productivity of natural and hatchery populations is affected by modifications of dams on Columbia and Snake rivers.

33. Need to monitor spring chinook salmon status by examining population trends and develop modeling and monitoring “tools” to determine stray rates and impacts of hatchery-produced chinook salmon to chinook salmon populations in the Imnaha River.
34. Need to determine life history and movement patterns of spring chinook salmon within the Imnaha Subbasin, including assessment of adult holding areas, juvenile rearing areas, and juvenile migration patterns.
35. Need to evaluate effectiveness of experimental hatchery rearing and release treatments.
36. Need to evaluate the success of Captive and Conventional broodstock programs for restoring fisheries and increasing endemic stocks of spring chinook salmon in Big Sheep and the mainstem Imnaha River. Use continued spawning ground surveys, life history monitoring, fisheries monitoring and other techniques.
37. Need to monitor and determine success of restoring recreational and tribal fisheries in Imnaha Basin.
38. Need to determine relative reproductive success of hatchery fish spawning in nature.
39. Need to monitor spawning distribution and recolonization of vacant habitat.
40. Need to investigate the development of run size estimate models for harvest allocation decisions.
41. Need to continue to participate in planning, consultation and ESA permitting activities pertaining to Imnaha Basin chinook salmon populations.
42. Need to determine seasonal and reach specific survival of smolts in the subbasin.

Coho Salmon

2. Develop and implement, if appropriate, a plan to reintroduce coho salmon to the Imnaha River subbasin.

Sockeye Salmon

2. Develop and implement, if appropriate, a plan to reintroduce sockeye salmon to the Imnaha River subbasin.

Bull Trout

10. Collect life history, distribution, and homing behavior information of bull trout within the subbasin and in relevant core areas.
11. Evaluate connectivity and the degree of interchange between populations throughout the subbasin. Reestablish connectivity of populations affected by water diversions if feasible.
12. Monitor core populations to establish trends and measure population response to recovery and restoration activities.
13. Determine the extent and magnitude of nonnative species interaction and hybridization to better define treatment options.
14. Continue presence/absence surveys to locate bull trout populations throughout the subbasin.
15. Assess the relationship between resident and migratory life history forms.
16. Evaluate ecological interactions between bull trout and anadromous salmonids.
17. Determine survival rates of bull trout between life stages and assess productivity.
18. Determine water temperature associations of migratory bull trout.

Redband Trout

2. Investigate potential existence of redband trout in the subbasin.

Lamprey (brook and Pacific)

~~6.~~ Conduct presence/absence surveys for lamprey in the Imnaha subbasin

7. Develop and implement a plan to reintroduce lamprey to the Imnaha River subbasin.
8. Determine habitat requirements and limiting factors for Pacific lamprey production in the subbasin.
9. Assess the rehabilitation potential of Pacific lamprey in the subbasin.
10. Assess the rehabilitation process for Pacific lamprey in the subbasin.

Mountain Whitefish

4. Assess abundance, distribution, population dynamics, life history, and genetic characteristics.
5. Evaluate ecological interactions between mountain whitefish and anadromous salmonids.
6. Determine water temperature associations of resident and migratory life history forms.

Exotic Species

3. Determine distribution of introduced non-native species and their effects on native salmonids.
4. Assess overall predation on salmonids by exotic species.

Nutrient Cycling

2. Implement cooperative programs to reintroduce anadromous fish carcasses to the ecosystem.
3. Support cooperative efforts to benefit anadromous fish runs.

Wildlife/Terrestrial Needs

1. Acquire lands when opportunities arise for improved habitat protection, restoration, and connectivity and for mitigation of lost wildlife habitat (land purchases, land trusts, conservation easements, landowner cooperative agreements, exchanges).
2. Implement and (where applicable) continue noxious weed control programs.
3. Assist landowners with land holdings and easements for restoration and enhancement of wildlife habitat.
4. Mitigate hydropower impacts on loss of wildlife and wildlife habitats, including indirect impacts caused by the introduction of cheap power and water to the subbasin.
5. Participate in threatened, endangered, and sensitive species recovery or conservation strategy efforts in the subbasin.

Ponderosa pine communities

1. Acquire lands when opportunities arise for improved habitat protection, restoration, and connectivity for ponderosa pine communities and for mitigation of lost wildlife habitat for ponderosa pine associated species (land purchases, land trusts, conservation easements, landowner cooperative agreements, exchanges).
2. Work with landowners and managers to restore ponderosa pine communities
3. Create and maintain large diameter snags in ponderosa pine communities.
4. Participate in a cooperative stewardship program to foster ponderosa pine protection.

Native prairie ecosystems

1. Acquire lands when opportunities arise for improved habitat protection, restoration, and connectivity for native prairie ecosystems and for mitigation of lost wildlife habitat for native prairie ecosystem associated species (land purchases, land trusts, conservation easements, landowner cooperative agreements, exchanges).
2. Work with landowners and managers to restore native prairie ecosystems
3. Support native plant nurseries and seedbanks
4. Support continued restoration of native prairie flora (i.e. sharp-tail grouse) and fauna (Spalding’s catch fly).

Classified Wetlands

1. Acquire lands when opportunities arise for improved habitat protection, restoration, and connectivity for classified wetlands and for mitigation of lost wildlife habitat for classified wetland associated species (land purchases, land trusts, conservation easements, landowner cooperative agreements, exchanges).
2. Protect, restore and create wetland and riparian habitat particularly in lower elevation riparian areas.
3. Participate in a cooperative stewardship program to foster classifier wetland community protection.

Noxious weeds

1. Monitor the spread of and evaluate the effectiveness of noxious weed control programs.
2. Continue control programs for noxious weeds to restore natural habitat conditions and communities for wildlife species.
3. Develop an information and education stewardship program for noxious weeds.

Loss of legacy resources

1. Work with landowners and managers to retain late successional habitats on state, and private lands (land exchanges, conservation easements).
2. Develop and implement active management prescriptions to restore and promote late successional habitats.
3. Develop an information and education stewardship program to foster late seral community protection

Roads

1. Reduce road densities through closures, obliteration, and reduced construction.
2. Support planned road closures on public land and encourage closure of other roads.
3. Improve enforcement of road closures.

Loss of Nutrients

1. Implement programs to reintroduce anadromous fish carcasses to the ecosystem.
2. Support cooperative efforts that benefit both anadromous fish and wildlife populations.

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Appendices

Appendix A - Rare plant species of the Imnaha subbasin

All species occur on Regional Forester's Sensitive Species List for Oregon. (USDA Forest Service Region 6 1999)

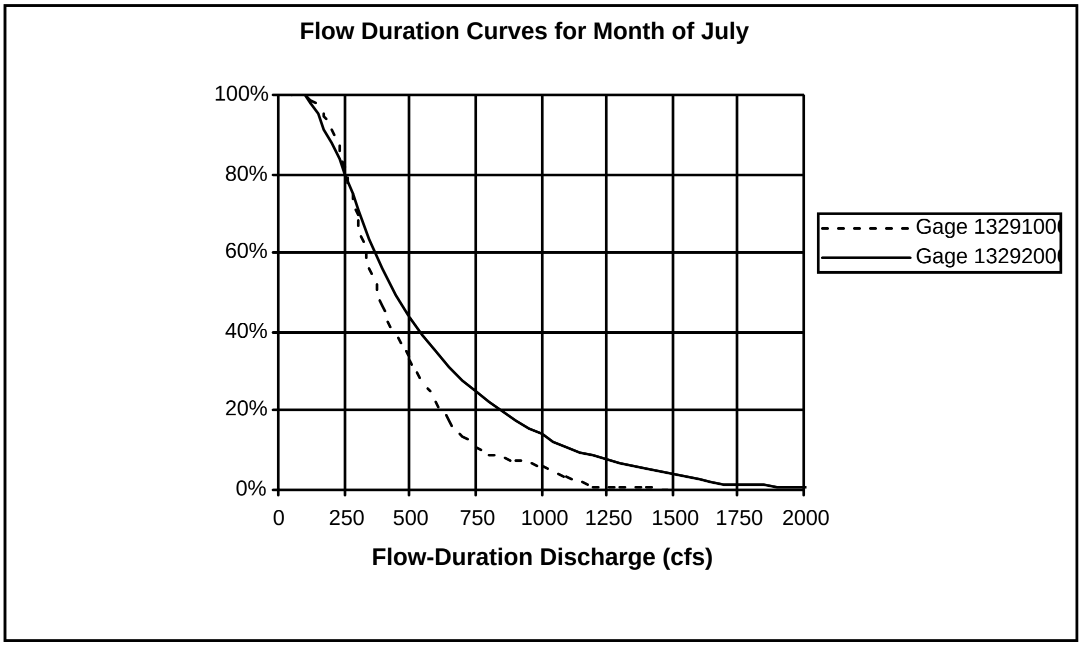
Scientific Name	Common Name	US FWS	OR	Heritage SRANK
Achnatherum wallowensis	Wallowa Ricegrass			S2
Allium geyeri var. geyeri	Geyer's Onion			S1
Arabis hastatula	Hells Canyon Rockcress			S1
Asplenium trichomanes-ramosum	Green Spleenwort			S1
Botrychium ascendens	Upward-lobed Moonwort	SoC	C	S2
Botrychium campestre	Prairie Moonwort			S1
Botrychium crenulatum	Crenulate Moonwort	SoC	C	S2
Botrychium fenestratum				S2?
Botrychium lanceolatum	Lance-leaf Grape-fern			S2
Botrychium lineare	Skinny Moonwort	SoC		S1
Botrychium lunaria	Moonwort			S2
Botrychium minganense	Mingan Moonwort			S2
Botrychium montanum	Mountain Moonwort			S2
Botrychium paradoxum	Twin-spike Moonwort	SoC	C	S1
Botrychium pedunculosum	Stalked Moonwort	SoC	C	S1
Botrychium pinnatum	Pinnate Grape-fern			S3
Bupleurum americanum	Bupleurum			S1
Calochortus longebarbatus var. longebarbatus	Long-bearded Mariposa-lily	SoC		S2
Calochortus macrocarpus var. maculosus	Green-band Marioposa-lily			S2
Calochortus nitidus	Broadfruit Mariposa-lily	SoC		S1
Carex atrata var. atrosquama	Blackened Sedge			S1
Carex backii	Back's Sedge			S1
Carex dioica var. gynocrates	Yellow Bog Sedge			S1
Carex hystericina	Porcupine Sedge			S2
Carex nardina	Spikenard Sedge			S2?
Carex norvegica	Scandinavian Sedge			S1
Carex nova	New Sedge			S1
Castilleja fraterna	Fraternal Paintbrush	SoC		S2
Castilleja rubida	Purple Alpine Paintbrush	SoC		S2
Cheilanthes feei	Fee Lipfern			S2
Cypripedium fasciculatum	Clustered Lady-slipper	SoC	C	S2
Dryopteris filix-mas	Male Fern			S3
Erigeron disparipilus	White Cushion Erigeron			S2

Erigeron engelmannii var. davisii	Engelmann's Daisy			S1
Kobresia bellardii (K. myosuroides)	Bellard's Kobresia			S1
Kobresia simpliciuscula	Simple Kobresia			S1
Leptodactylon pungens ssp. hazeliae	Hazel's Prickly-phlox	SoC	C	S1
Lipocarpha aristulata	Aristulate Lipocarpha			S1
Listera borealis	Northern Twayblade			S1
Lomatium erythrocarpum	Red-fruited Lomatium	SoC	LE	S1
Lomatium greenmanii	Greenman's Lomatium	SoC	LT	S1
Lycopodium complanatum	Ground Cedar			S2
Mimulus clivicola	Bank Monkey-flower			S2
Mimulus hymenophyllus	Membrane-leaved Monkey-flower	SoC	C	S1
Mirabilis macfarlanei	Macfarlane's Four O'clock	LT	LE	S1
Pellaea bridgesii	Bridges' Cliffbrake			S2
Phacelia minutissima	Dwarf Phacelia	SoC	C	S1
Phlox multiflora	Many-flowered Phlox			S1
Platanthera obtusata	Small Northern Bog-orchid			S1
Primula cusickiana	Wallowa Primrose			
Rubus bartonianus	Bartonberry	SoC	C	S2
Salix farriae	Farr's Willow			S2
Saxifraga adscendens var. oregonensis	Wedge-leaf Saxifrage			S1
Senecio dimorphophyllus	Payson's Groundsel			S2
Silene spaldingii	Spalding's Silene	PT	LE	S1
Thalictrum alpinum var. hebetum	Alpine Meadowrue			S2
Townsendia montana	Mountain Townsendia			S1
Townsendia parryi	Parry's Townsendia			S1
Trifolium douglasii	Douglas Clover			S1
Trollius laxus var. albiflorus	American Globeflower			S1

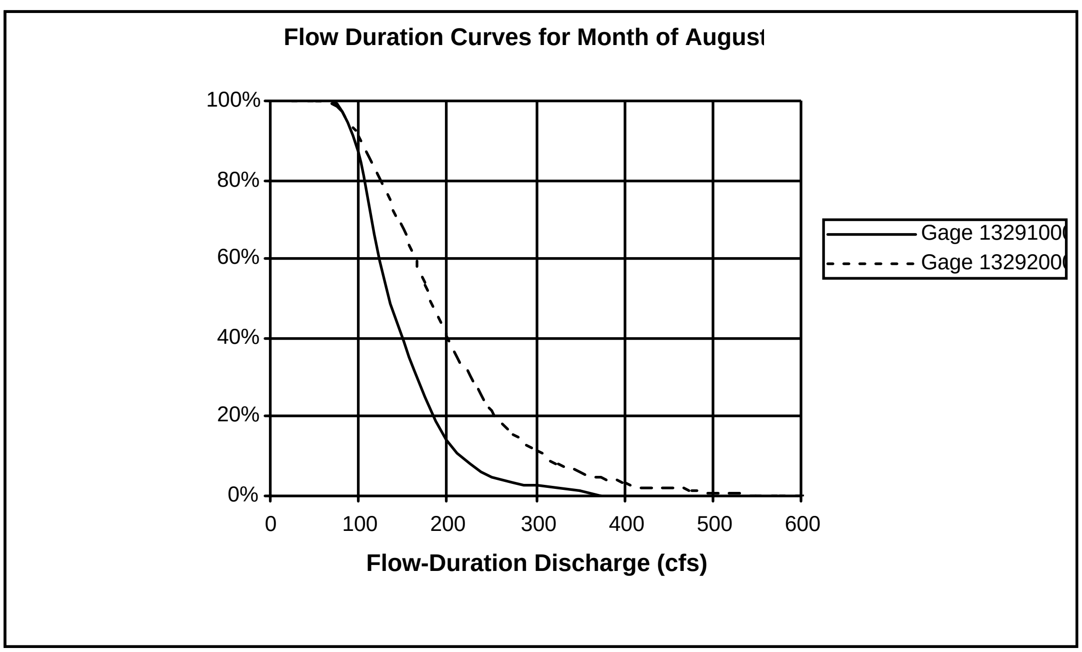
US FWS Rank:
SoC = Species of Concern PT = Proposed Threatened LT = Listed Threatened
Oregon:
C = Candidate LT = Listed Threatened LE = Listed Endangered

Natural Heritage State Rank:
S1 = Critically Imperiled S2 = Imperiled S3 = Rare, Uncommon or Threatened

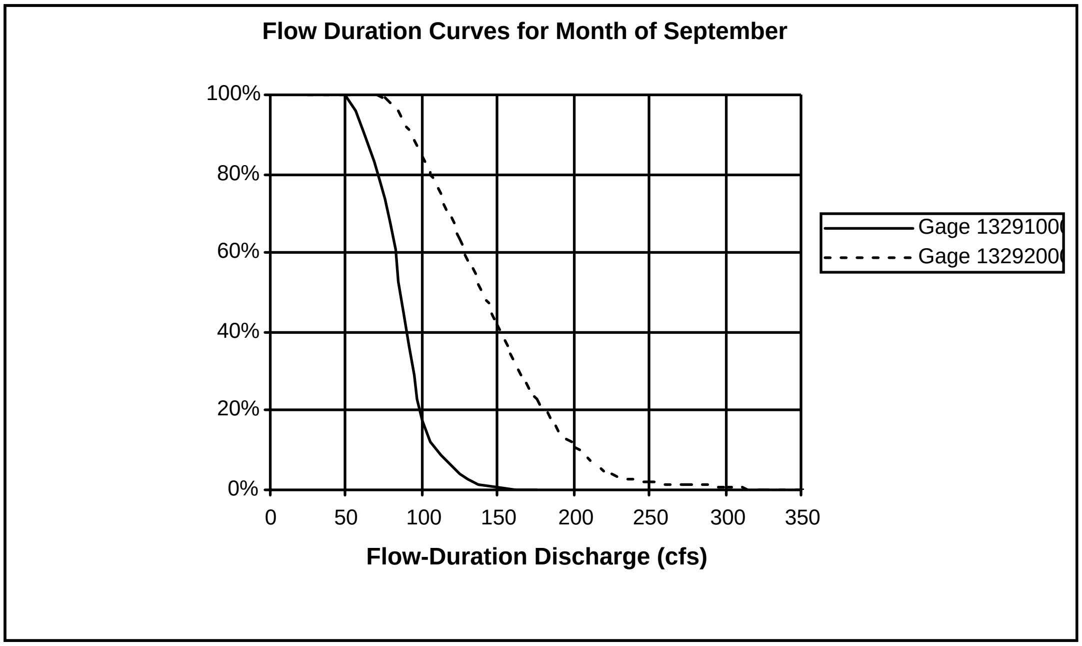
Appendix B - Flow Duration Curves for the Imnaha Subbasin



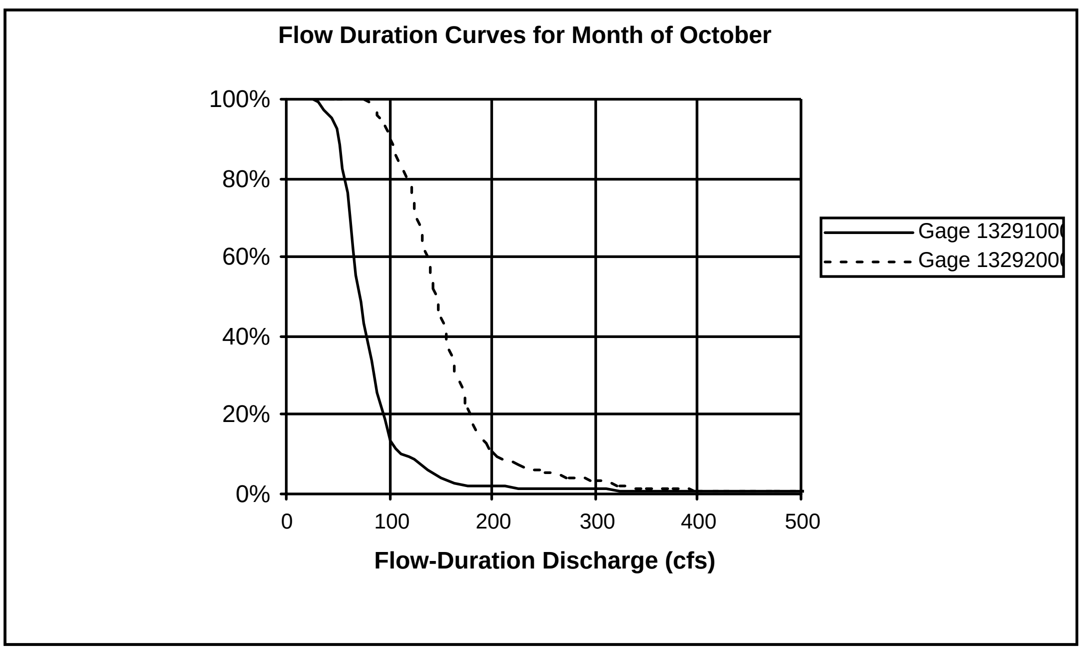
Appendix Figure B1. Flow duration curve for July, gages 13291000 and 13292000



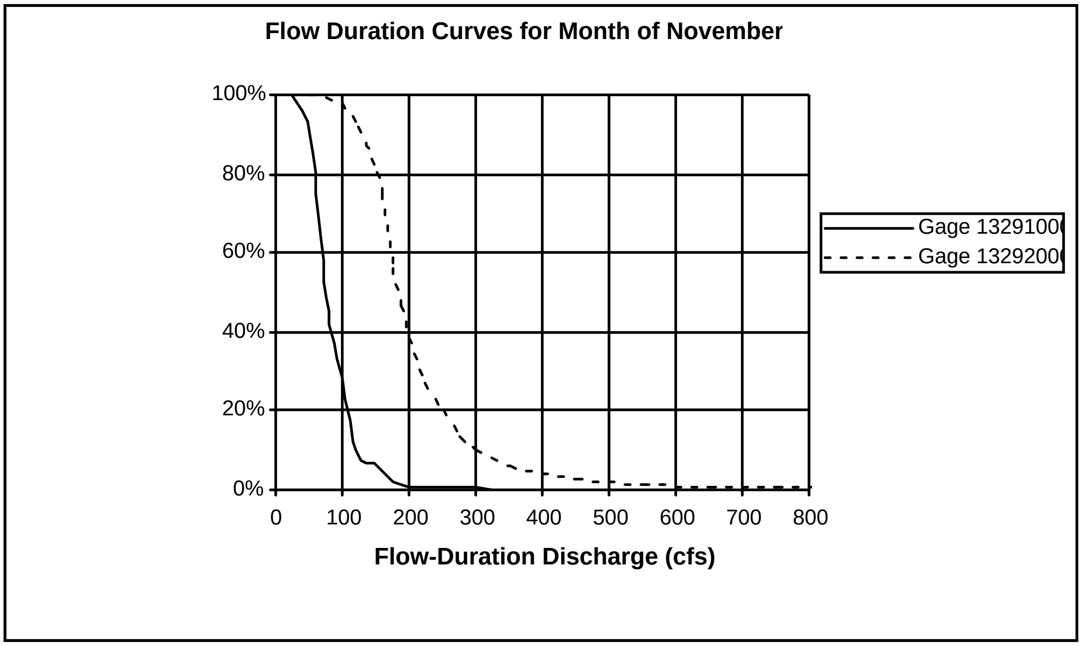
Appendix Figure B2. Flow duration curve for August, gages 13291000 and 13292000



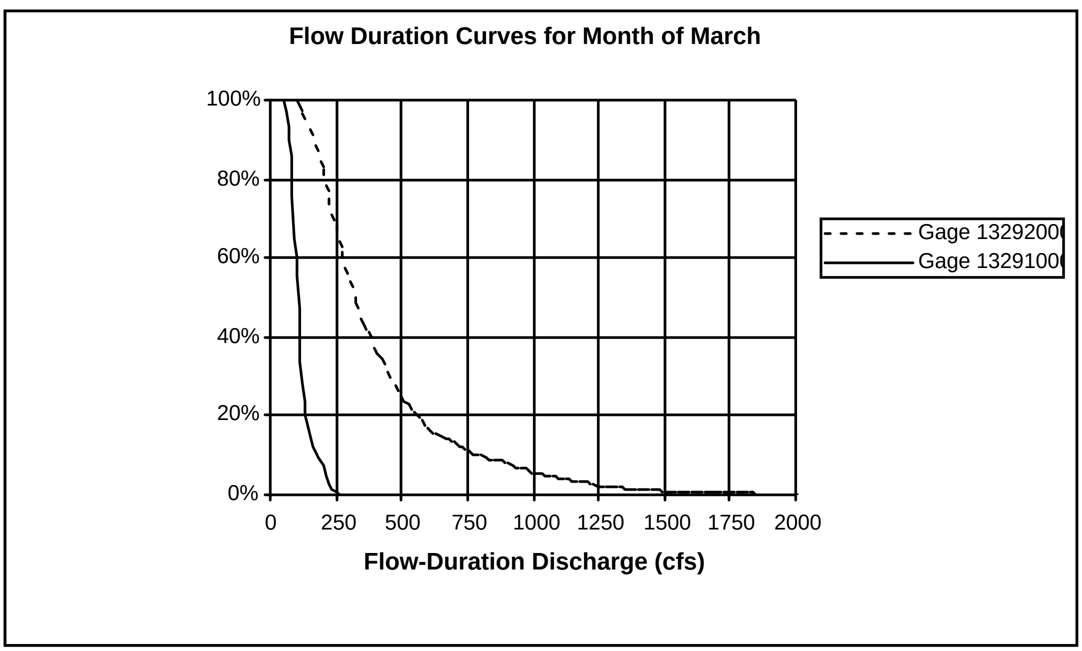
Appendix Figure B3. Flow duration curve for September, gages 13291000 and 13292000



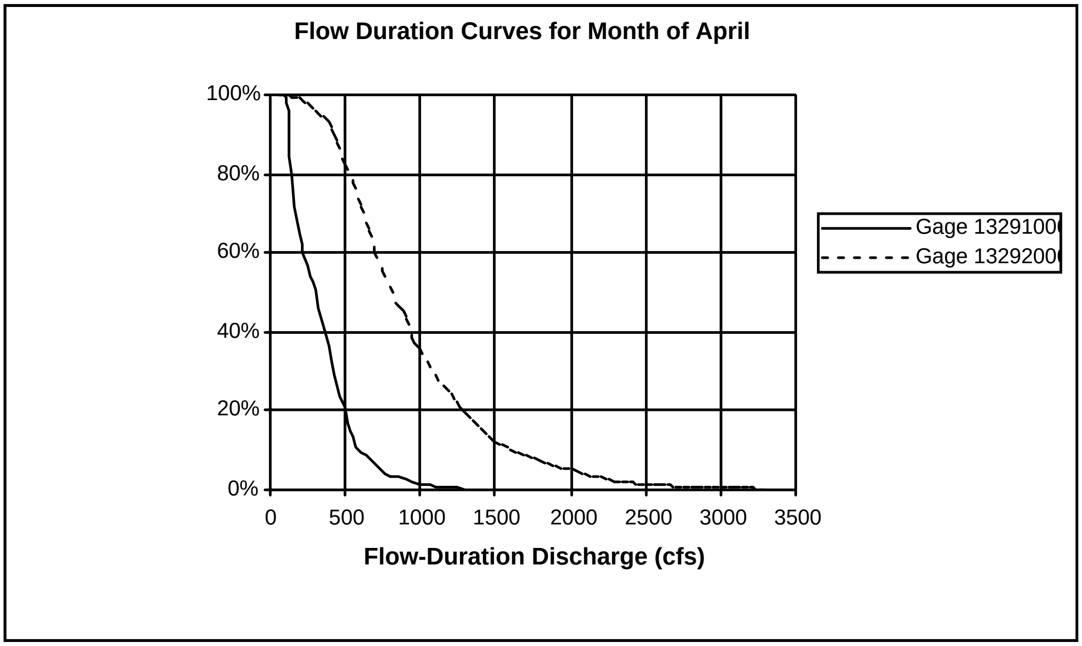
Appendix Figure B4. Flow duration curve for October, gages 13291000 and 13292000



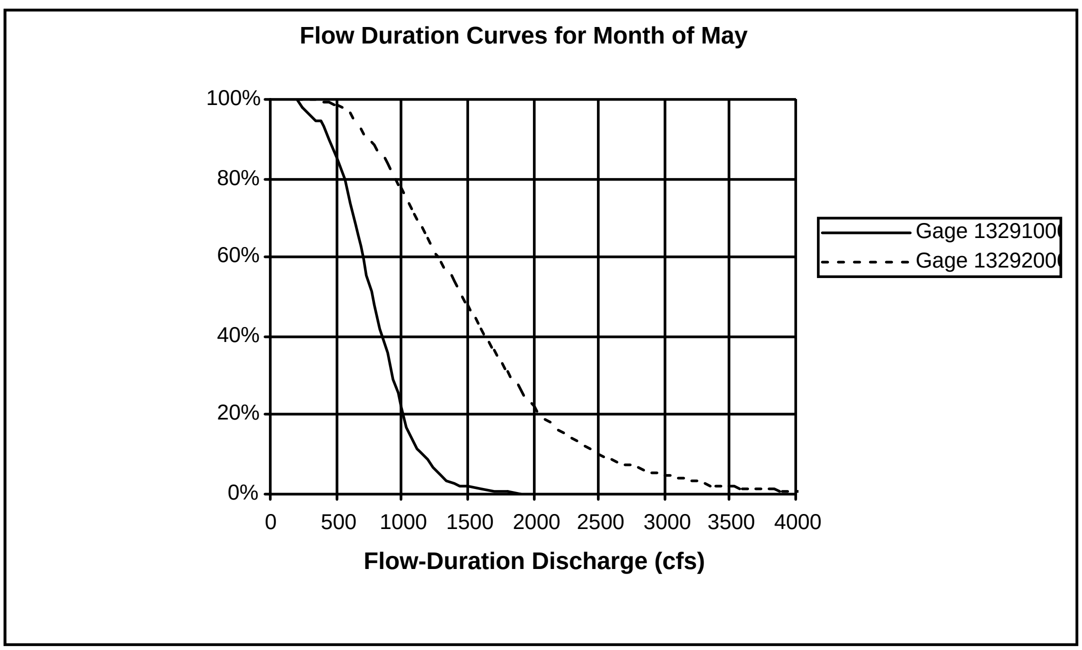
Appendix Figure B5. Flow duration curve for November, gages 13291000 and 13292000



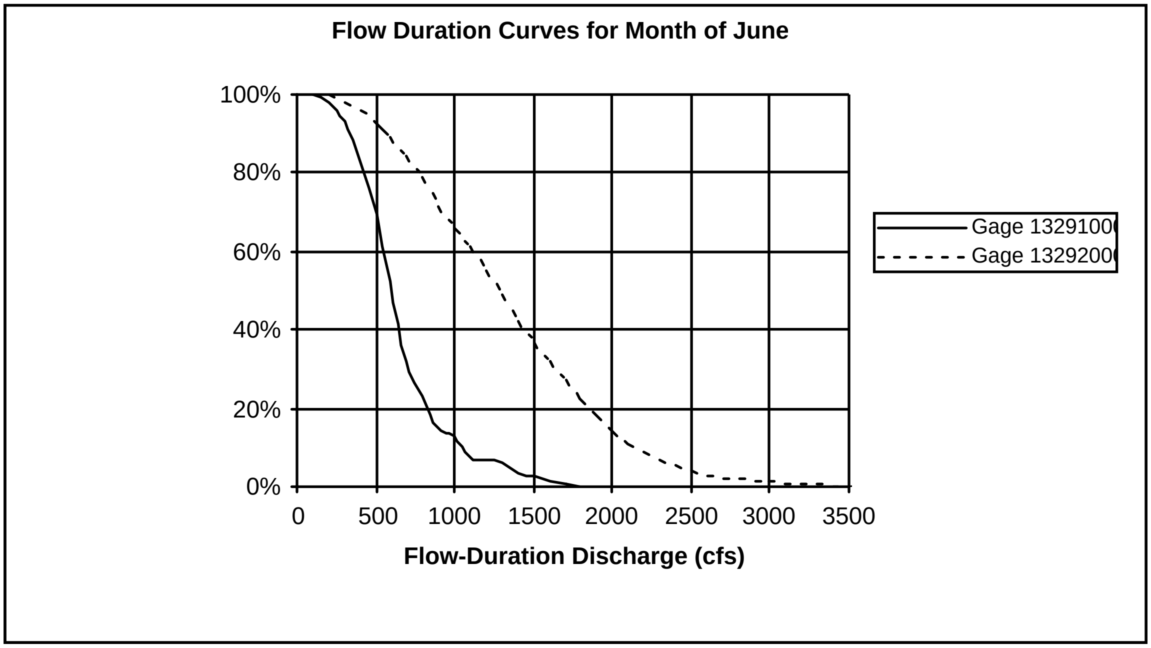
Appendix Figure B6. Flow duration curve for March, gages 13291000 and 13292000



Appendix Figure B7. Flow duration curve for April, gages 13291000 and 13292000



Appendix Figure B8. Flow duration curve for May, gages 13291000 and 13292000



Appendix Figure B9. Flow duration curve for June, gages 13291000 and 13292000

Appendix C - List of McCully Creek Water Rights at or upstream from the Sheep Creek Ditch (WVI Canal) (Bliss 2001)

Certificate Number (1)	**Name on Certificate & Proof #**	**Priority Date**	**CFS** (2) **or AF**	**Acres**	**Use**	**Ditch** (7)	**Stream** (6 & 7)	**Point of Diversion Location**	**Place of Use Location**
9327 Decree p. 15	Down, Charles Proof #21	1877	(a) 11.35 cfs (b) 5.68 cfs	474	Irrigation Domestic Stock	Sheep Creek Ditch	McCully Creek	Watermaster unable to determine from Imnaha Decree. (8)	T3S, R45E, Sec 1,13 T3S, R46E, Sec 7
9341 Decree p. 17	Gaulke & Kernan Proof #36	1877	(a) 4.10 cfs (b) 2.05 cfs	164	Irrigation Domestic Stock	Sheep Creek Ditch	McCully Creek	Watermaster unable to determine from Imnaha Decree. (8)	T3S, R45E, Sec 1
9369 Decree p. 21	McClain, Alice Proof #84	1877	(a) 3.88 cfs (b) 1.94 cfs	155.2	Irrigation Domestic Stock	Sheep Creek Ditch	McCully Creek	Watermaster unable to determine from Imnaha Decree. (8)	T3S, R45E, Sec 12
9390 Decree p. 26	Tucker, DG Proof #125	1877	(a) 3.83 cfs (b) 1.92 cfs	153.2	Irrigation Domestic Stock	Sheep Creek Ditch	McCully Creek	Watermaster unable to determine from Imnaha Decree. (8)	T3S, R46E, Sec 7
9391 Decree pp. 26 through 28	Wallowa Valley Improvement District #1 Proof #126	1905	(a) 129.09 cfs (b) 64.54 cfs	5163.4	Irrigation Domestic Stock	Sheep Creek Ditch (formerly Mountain Sheep Ditch)	Little Sheep Creek and tributaries crossed by line of Sheep Creek Ditch		T2S, R45E, Sec 25,35,36 T3S, R45E, Sec 1,2,10,11, 12,13,14 T3S, R46E, Sec 5,6,7,8,18
9397 Permit 5335 Decree p. 28	Wallowa Valley Improvement District #1 Proof #127	1919	(a) 33.65 cfs (b) 16.83 cfs	1346.1	Irrigation	Sheep Creek Ditch (formerly Mountain Sheep Ditch)	Big Sheep Creek, Little Sheep Creek, and springs and streams crossed by line of Sheep Creek Ditch		T2S, R45E, Sec 25 T2S, R45E, Sec 30,31 T3S, R45E, Sec 10,11, 14,15
9397 Permit 5335 Decree p. 29	Wallowa Valley Improvement District #1 Proof #127	1919	(a) 128.92 cfs (b) 64.46 cfs	5,156.6	Supple-mental Irrigation	Sheep Creek Ditch	Big Sheep Creek and tributaries crossed by line of Sheep Creek Ditch		T2S, R45E, Sec 25,35,36 T3S, R45E, Sec 1,2,10,11, 12,13,14 T3S, R46E, Sec 5,6,7,8,18
3890 Permit R-223	Wallowa Valley Improvement District #1	1912	315 af	-----	Supple-mental Irrigation	Mountain Sheep Ditch	(footnote 3)	Mountain Sheep Reservoir (now Kinney Lake Res.) in T3S, R46E, Sec 8	See Cert. 2439
2439	Mountain Sheep Ditch Company	1913	18.55 cfs to fill reservoir under permit R-223; plus use of stored water	1484	Supple-mental Irrigation	Little Sheep Ditch & Mountain Sheep Res.	(footnotes 3 & 4)	Sheep Creek Ditch in T3S, R46E, Sec 18; Reservoir in T3S, R46E, Sec 8	T2S, R45E, Sec 36 T2S, R45E, Sec 31 T3S, R46E, Sec 5,6,7,8

Certificate Number (1)	**Name on Certificate & Proof #**	**Priority Date**	**CFS** (2) **or AF**	**Acres**	**Use**	**Ditch** (7)	**Stream** (6 & 7)	**Point of Diversion Location**	**Place of Use Location**
2163	Charles Down	1917	1.98 cfs	158	Irrigation	Sheep Creek Ditch	(footnote 3)	T3S, R46E, Sec 18, SE SW	T3S, R45E, Sec 12,13
3794	F C Gowing	1921	0.44 cfs	35	Supple-mental Irrigation	Sheep Creek Ditch, a tributary of Prairie Creek and Wallowa River	(footnote 3)	T2S, R45E, Sec 23, SW SW (note: the diversion on Sheep Creek Ditch is 5 miles to NNW into Prairie Creek drainage)	T2S, R45E, Sec 22
3473	Chas. F. Johnson & L. W. Johnson	1921	1.24 cfs	99 w/ only 25 prim.	Irrigation & Suppl. Irrigation	Freewater or Sheep Creek Ditch, tributary of Prairie Creek	(footnote 3)	T2S, R45E, Sec 26, SW NE (note: the diversion on Sheep Creek Ditch is 4 miles to NNW into Prairie Creek drainage)	T2S, R45E, Sec 22,23
14520	Silver Lake Ditch Company	1941	57.83 cfs with 19.20 cfs from Little Sheep Creek and 38.55 cfs from McCully Creek	1550 w/ only 39.5 pri.	Irrigation & Suppl. Irrigation	Litlle Sheep Creek Ditch	(footnotes 3 & 4)	Little Sheep Creek in T4S, R46E, Sec 4, SE SE; McCully Creek in T3S, R46E, Sec 19 NE NE	T2S, R45E Sec 13,26 T2S, R45E, Sec 1,12,13, 23,24,25,26,36
14521	Farmers Water Ditch Company	1941	123.07 cfs with 70.35 cfs from Little Sheep Creek and 52.74 cfs from McCully Creek	About 3282, w/ only 18 prim.	Irrigation & Suppl. Irrigation	Farmers Ditch	(footnotes 3 & 4)	Little Sheep Creek in T4S, R46E, Sec 4, SE SE; McCully Creek in T3S, R46E, Sec 19 NE NE	T2S, R45E, Sec 2,11 T1S, R45E, Sec 28,32,33,34 T2S, R45E, Sec 1,2,3,5,10, 11,12,13,14,15,22,23,24,26

Certificate Number (1)	Name on Certificate & Proof #	Priority Date	CFS (2) or AF	Acres	Use	Ditch (7)	Stream (6 & 7)	Point of Diversion Location	Place of Use Location
52840	Roy W. Daggett	1976	0.56 cfs from Wallowa River, 0.12 cfs from Prairie Creek, 0.12 cfs from unnamed stream (McCully Creek)	32	Irrigation	Note stated	Wallowa River, Prairie Creek, and unnamed stream (McCully Creek)	McCully Creek in T2S, R45E, Sec 2, SW SE (note: 8.5 miles north of point where Sheep Creek Ditch spills into Prairie Creek drainage, after McCully Creek water flows through Farmers Ditch)	T1S, R45E, Sec 20,29

(1) Decree = Imnaha Decree; the Decree was signed May 29, 1930.

(2) The Imnaha Decree has the following water use provisions:
Amounts for irrigation are (a) 1/40th cfs per acre April 1 - July 31 and (b) 1/80th cfs per acre August 1 – October 15.
Amount for stock is 0.1 cfs/1000 head, but the flow can be increased to prevent ditches from freezing over.
Amount for domestic use is undefined and may have included gardening; older allowances for domestic use were about 0.01 to 0.05 cfs.
Stock and domestic use have preference over irrigation.
[Note that amounts for stock and domestic use are not shown in the table; Mike Coppin, manager of the Wallowa Valley Canal indicated in December 2000 that all water diverted during the non-irrigation season is routed into the Wallowa subbasin for stock and domestic uses.]

(3) McCully Creek is intercepted by Sheep Creek Ditch, now referred as Wallowa Valley Canal.

(4) Sheep Creek Ditch and Little Sheep Ditch are the same.

(5) Diversions appear to be on main channel of McCully Creek after it flows into the Wallowa Subbasin.

(6) The Decree Map clearly shows McCully Creek with two channels, one entering the Wallowa Subbasin and one continuing on down to what is interpreted as the (Little) Sheep Creek Ditch, then on to Little Sheep Creek.

(7) It is unclear how to interpret what is meant by "Sheep Creek Ditch" in reference to the two McCully Creek channels and the 1877 water rights. A review of points of diversion in the Proofs and permits may clarify this. The Decree map, dated 1927, shows a split channel, with one channel flowing north into the Prairie Creek drainage and the other flowing east to Sheep Creek Ditch, then north into the Prairie Creek drainage. Today, the north channel has a permanent diversion structure. This has been referred to as McCully Creek Diversion #1. The 1877 rights appear to be associated with this diversion, even though the Decree indicates Sheep Creek Ditch. The other channel is intercepted by Sheep Creek Ditch (Wallowa Valley Improvement District canal) in T3S, R46E, Sec 19, NW NE, which matches the location noted on the enclosed USGS reference map as T3S, R46E, Sec 19, SE SE NW NE. This has been referred to as McCully Creek Diversion #2. Waters from the two diversions do not mix as they enter the Prairie Creek drainage, as shown on the Decree map and based on a recent site inspection. It is possible that the 1877 rights were at first diverted from Sheep Creek ditch (diversion #2), with the diversion later moved to diversion #1. It is also possible that there are two Sheep Creek ditches, or that the 1877 rights could be diverted from either diversion, or that the name of the ditch applicable to the 1877 rights was inaccurately recorded in the Decree.

(8) The watermaster, Shad Hatton, has indicated he is unable to determine at this time what the legal diversion point is for the 1877 rights. He stated that many of the early rights were not very accurate, and that interpretation of the rights today would require a site inspection for each right to determine current diversion locations.

Appendix D - Wildlife species of the Imnaha subbasin

Amphibians	
Ambystoma macrodactylum	Long-toed Salamander
Ascaphus truei	Tailed Frog
Bufo boreas	Western Toad
Hyla regilla	Pacific Treefrog
Rana catesbeiana	Bullfrog
Rana luteiventris	Columbia Spotted Frog
Birds	
Accipiter cooperii	Cooper’s Hawk
Accipiter gentilis	Northern Goshawk
Accipiter striatus	Sharp-shinned Hawk
Actitis macularia	Spotted Sandpiper
Aechmophorus occidentalis	Western Grebe
Aegolius acadicus	Northern Saw-whet Owl
Aegolius funereus	Boreal Owl
Aeronautes saxatalis	White-throated Swift
Agelaius phoeniceus	Red-winged Blackbird
Aix sponsa	Wood Duck
Alectoris chukar	Chukar
Ammodramus savannarum	Grasshopper Sparrow
Amphispiza belli	Sage Sparrow
Anas acuta	Northern Pintail
Anas americana	American Wigeon
Anas clypeata	Northern Shoveler
Anas crecca	Green-winged Teal
Anas cyanoptera	Cinnamon Teal
Anas discors	Blue-winged Teal
Anas esperus us s	Mallard
Anas strepera	Gadwall
Anthus spinoletta	Water Pipit
Aquila chrysaetos	Golden Eagle
Archilochus alexandri	Black-chinned Hummingbird
Ardea herodias	Great Blue Heron
Asio flammeus	Short-eared Owl
Asio otus	Long-eared Owl
Athene cunicularia	Burrowing Owl
Aythya affinis	Lesser Scaup
Aythya americana	Redhead
Aythya collaris	Ring-necked Duck
Aythya valisineria	Canvasback

Bartramia longicauda	Upland Sandpiper
Bombycilla cedrorum	Cedar Waxwing
Bonasa umbellus	Ruffed Grouse
Botaurus lentiginosus	American Bittern
Branta canadensis	Canada Goose
Bubo virginianus	Great Horned Owl
Bucephala albeola	Bufflehead
Bucephala clangula	Common Goldeneye
Bucephala islandica	Barrow's Goldeneye
Buteo jamaicensis	Red-tailed Hawk
Buteo lagopus	Rough-legged Hawk
Buteo regalis	Ferruginous Hawk
Buteo swainsoni	Swainson's Hawk
Calidris bairdii	Baird's Sandpiper
Calidris minutilla	Least Sandpiper
Carduelis pinus	Pine Siskin
Carduelis tristis	American Goldfinch
Carpodacus cassinii	Cassin's Finch
Carpodacus purpureus	Purple Finch
Casmerodius albus	Great Egret
Cathartes aura	Turkey Vulture
Catharus fuscescens	Veery
Catharus guttatus	Hermit Thrush
Catharus ustulatus	Swainson's Thrush
Catherpes mexicanus	Canyon Wren
Catoptrophorus semipalmatus	Willet
Certhia americana	Brown Creeper
Ceryle alcyon	Belted Kingfisher
Chaetura vauxi	Vaux's Swift
Charadrius semipalmatus	Semipalmated Plover
Charadrius esperus	Killdeer
Chen caerulescens	Snow Goose
Chen rossii	Ross's Goose
Chlidonias niger	Black Tern
Chondestes grammacus	Lark Sparrow
Chordeiles minor	Common Nighthawk
Cinclus mexicanus	American Dipper
Circus cyaneus	Northern Harrier
Cistothorus palustris	Marsh Wren
Coccothraustes vespertinus	Evening Grosbeak
Coccyzus americanus	Yellow-billed Cuckoo
Colaptes auratus	Northern Flicker
Columba fasciata	Band-tailed Pigeon

Columba livia	Rock Dove
Contopus borealis	Olive-sided Flycatcher
Contopus sordidulus	Western Wood-pewee
Corvus brachyrhynchos	American Crow
Corvus corax	Common Raven
Cyanocitta stelleri	Steller's Jay
Cygnus buccinator	Trumpeter Swan
Cygnus columbianus	Tundra Swan
Cypseloides niger	Black Swift
Dendragapus canadensis	Spruce Grouse
Dendragapus obscurus	Blue Grouse
Dendroica coronata	Yellow-rumped Warbler
Dendroica nigrescens	Black-throated Gray Warbler
Dendroica petechia	Yellow Warbler
Dendroica esperus	Townsend's Warbler
Dolichonyx oryzivorus	Bobolink
Dryocopus pileatus	Pileated Woodpecker
Dumetella carolinensis	Gray Catbird
Empidonax hammondii	Hammond's Flycatcher
Empidonax oberholseri	Dusky Flycatcher
Empidonax occidentalis	Cordilleran Flycatcher
Empidonax traillii	Willow Flycatcher
Empidonax wrightii	Gray Flycatcher
Eremophila alpestris	Horned Lark
Euphagus cyanocephalus	Brewer's Blackbird
Falco columbarius	Merlin
Falco mexicanus	Prairie Falcon
Falco peregrinus anatum	American Peregrine Falcon
Falco rusticolus	Gyrfalcon
Falco sparverius	American Kestrel
Fulica americana	American Coot
Gallinago gallinago	Common Snipe
Gavia immer	Common Loon
Geothlypis trichas	Common Yellowthroat
Glaucidium gnoma	Northern Pygmy-owl
Grus canadensis tabida	Greater Sandhill Crane
Haliaeetus leucocephalus	Bald Eagle
Himantopus mexicanus	Black-necked Stilt
Hirundo pyrrhonota	Cliff Swallow
Hirundo rustica	Barn Swallow
Histrionicus histrionicus	Harlequin Duck
Icteria virens	Yellow-breasted Chat
Icterus galbula	Northern Oriole

Ixoreus naevius	Varied Thrush
Junco hyemalis	Dark-eyed Junco
Lanius excubitor	Northern Shrike
Lanius ludovicianus	Loggerhead Shrike
Larus californicus	California Gull
Larus delawarensis	Ring-billed Gull
Larus esperus us	Bonaparte's Gull
Larus pipixcan	Franklin's Gull
Leucosticte atrata	Black Rosy-Finch
Leucosticte tephrocotis	Gray-crowned Rosy Finch
Limnodromus scolopaceus	Long-billed Dowitcher
Limosa fedoa	Marbled Godwit
Lophodytes cucullatus	Hooded Merganser
Loxia curvirostra	Red Crossbill
Loxia leucoptera	White-winged Crossbill
Martes pennanti	Fisher
Melanerpes lewis	Lewis's Woodpecker
Meleagris gallopavo	Wild Turkey
Melospiza lincolnii	Lincoln's Sparrow
Melospiza melodia	Song Sparrow
Mergus merganser	Common Merganser
Molothrus ater	Brown-headed Cowbird
Myadestes esperus	Townsend's Solitaire
Myiarchus cinerascens	Ash-throated Flycatcher
Nucifraga columbiana	Clark's Nutcracker
Numenius americanus	Long-billed Curlew
Nyctea scandiaca	Snowy Owl
Nycticorax nycticorax	Black-crowned Night Heron
Oporornis tolmiei	Macgillivray's Warbler
Oreoscoptes montanus	Sage Thrasher
Otus flammeolus	Flammulated Owl
Otus kennicottii	Western Screech Owl
Oxyura jamaicensis	Ruddy Duck
Pandion haliaetus	Osprey
Parus esperus us	Black-capped Chickadee
Parus gambeli	Mountain Chickadee
Parus rufescens	Chestnut-backed Chickadee
Passer domesticus	House Sparrow
Passerculus sandwichensis	Savannah Sparrow
Passerella iliaca	Fox Sparrow
Passerina amoena	Lazuli Bunting
Pelecanus erythrorhynchos	American White Pelican
Perdix perdix	Gray Partridge

Perisoreus canadensis	Gray Jay
Phalacrocorax auritus	Double-crested Cormorant
Phalaenoptilus nuttallii	Common Poorwill
Phalaropus lobatus	Red-necked Phalarope
Phalaropus tricolor	Wilson's Phalarope
Phasianus colchicus	Ring-necked Pheasant
Pheucticus melanocephalus	Black-headed Grosbeak
Pica pica	Black-billed Magpie
Picoides albolarvatus	White-headed Woodpecker
Picoides arcticus	Black-backed Woodpecker
Picoides pubescens	Downy Woodpecker
Picoides tridactylus	Three-toed Woodpecker
Picoides villosus	Hairy Woodpecker
Pinicola enucleator	Pine Grosbeak
Pipilo chlorurus	Green-tailed Towhee
Pipilo esperus	Spotted Towhee
Piranga ludoviciana	Western Tanager
Podiceps auritus	Horned Grebe
Podiceps grisegena	Red-necked Grebe
Podilymbus Podiceps	Pied-billed Grebe
Pooecetes gramineus	Vesper Sparrow
Porzana esperus	Sora
Rallus limicola	Virginia Rail
Recurvirostra americana	American Avocet
Regulus calendula	Ruby-crowned Kinglet
Regulus satrapa	Golden-crowned Kinglet
Riparia riparia	Bank Swallow
Salpinctes obsoletus	Rock Wren
Sayornis saya	Say's Phoebe
Seiurus noveboracensis	Northern Waterthrush
Selasphorus platycercus	Broad-tailed Hummingbird
Selasphorus rufus	Rufous Hummingbird
Setophaga ruticilla	American Redstart
Sialia currucoides	Mountain Bluebird
Sialia mexicana	Western Bluebird
Sitta canadensis	Red-breasted Nuthatch
Sitta carolinensis	White-breasted Nuthatch
Sitta pygmaea	Pygmy Nuthatch
Sphyrapicus nuchalis	Red-naped Sapsucker
Sphyrapicus esper	Red-breasted Sapsucker
Sphyrapicus thyroideus	Williamson's Sapsucker
Sphyrapicus varius	Yellow-bellied Sapsucker
Spizella breweri	Brewer's Sparrow

Spizella passerina	Chipping Sparrow
Stelgidopteryx serripennis	Northern Rough-winged Swallow
Stellula calliope	Calliope Hummingbird
Sterna forsteri	Forster's Tern
Sterna hirundo	Common Tern
Strix nebulosa	Great Gray Owl
Sturnella neglecta	Western Meadowlark
Sturnus vulgaris	Starling
Tachycineta bicolor	Tree Swallow
Tachycineta thalassina	Violet-green Swallow
Tringa flavipes	Lesser Yellowlegs
Tringa melanoleuca	Greater Yellowlegs
Tringa solitaria	Solitary Sandpiper
Troglodytes aedon	House Wren
Troglodytes troglodytes	Winter Wren
Turdus migratorius	American Robin
Tyrannus tyrannus	Eastern Kingbird
Tyrannus verticalis	Western Kingbird
Tyto alba	Common Barn Owl
Vermivora celata	Orange-crowned Warbler
Vermivora ruficapilla	Nashville Warbler
Vireo cassinii	Cassin's Vireo
Vireo gilvus	Warbling Vireo
Vireo olivaceus	Red-eyed Vireo
Vireo solitarius	Solitary Vireo
Wilsonia pusilla	Wilson's Warbler
Xanthocephalus xanthocephalus	Yellow-headed Blackbird
Zenaida macroura	Mourning Dove
Zonotrichia leucophrys	White-crowned Sparrow
Zonotrichia querula	Harris' Sparrow
Mammals	
Alces alces	Moose
Antrozous pallidus	Pallid Bat
Canis latrans	Coyote
Castor canadensis	American Beaver
Cervus elaphus	Wapiti (Elk)
Cervus elaphus nelsonii	Rocky Mountain Elk
Eptesicus fuscus	Big Brown Bat
Erethizon dorsatum	Common Porcupine
Euderma maculatum	Spotted Bat
Felis concolor	Mountain Lion
Glaucomys sabrinus	Northern Flying Squirrel

Gulo gulo	Wolverine
Lasionycteris noctivagans	Silver-haired Bat
Lasiurus cinereus	Hoary Bat
Lemmiscus curtatus	Sagebrush Vole
Lepus americanus	Snowshoe Hare
Lepus townsendii	White-tailed Jackrabbit
Lutra canadensis	Northern River Otter
Lynx canadensis	Lynx
Lynx rufus	Bobcat
Marmota flaviventris	Yellow-bellied Marmot
Martes americana	American Marten
Mephitis mephitis	Striped Skunk
Microtus longicaudus	Long-tailed Vole
Microtus montanus	Montane Vole
Microtus richardsoni	Water Vole
Mus musculus	House Mouse
Mustela erminea	Ermine
Mustela frenata	Long-tailed Weasel
Mustela vison	Mink
Myotis californicus	California Myotis
Myotis ciliolabrum	Western Small-footed Myotis
Myotis evotis	Long-eared Myotis
Myotis lucifugus	Little Brown Myotis
Myotis thysanodes	Fringed Myotis
Myotis volans	Long-legged Myotis
Myotis yumanensis	Yuma Myotis
Ochotona princeps	American Pika
Odocoileus hemionus	Mule Deer
Odocoileus virginianus	White-tailed Deer
Ondatra zibethicus	Common Muskrat
Oreamnos americanus	Mountain Goat
Ovis canadensis	Rocky Mountain (Bighorn) Sheep
Perognathus parvus	Great Basin Pocket Mouse
Peromyscus maniculatus	Deer Mouse
Phenacomys intermedius	Heather Vole
Pipistrellus esperus	Western Pipistrelle
Plecotus townsendii pallescens	Pale Western Big-eared Bat
Procyon lotor	Common Raccoon
Reithrodontomys megalotis	Western Harvest Mouse
Sciurus niger	Eastern Fox Squirrel
Sorex merriami	Merriam's Shrew
Sorex palustris	Water Shrew
Sorex preblei	Preble's Shrew

Sorex vagrans	Vagrant Shrew
Spermophilus beldingi	Belding's Ground Squirrel
Spermophilus columbianus	Columbian Ground Squirrel
Spermophilus lateralis	Golden-mantled Ground Squirrel
Spermophilus townsendii	Townsend's Ground Squirrel
Spilogale gracilis	Western Spotted Skunk
Sylvilagus nuttallii	Mountain Cottontail
Tamias amoenus	Yellow-pine Chipmunk
Tamiasciurus hudsonicus	Red Squirrel
Thomomys talpoides	Northern Pocket Gopher
Ursus americanus	Black Bear
Vulpes vulpes	Red Fox
Zapus princeps	Western Jumping Mouse
Reptiles	
Charina bottae	Rubber Boa
Chrysemys picta	Painted Turtle
Coluber constrictor	Racer
Crotalus viridis	Western Rattlesnake
Eumeces skiltonianus	Western Skink
Pituophis catenifer	Gopher Snake
Sceloporus occidentalis	Western Fence Lizard
Thamnophis elegans	Western Terrestrial Garter Snake
Thamnophis sirtalis	Common Garter Snake

Appendix E - Habitat matrix table for the Imnaha River Section 7 watershed (reproduced from USDA Forest Service 1998a)

Pathway/Indicators	Properly Functioning	At Risk	Not Properly Functioning
Water Quality			
Temperature (1)	50-57°F (max 7-day average)	57-60°F (max 7-day-spawning) 57-64°F (migration/rearing)	>60°F (max 7-day spawning) >64°F (migration/rearing)
Sediment/Substrate (1)	Embeddedness <20%. Dominant substrate is gravel or cobble. Gravel/cobble bars stable. Turbidity low.	Embeddedness 20-30%. Gravel and cobble is subdominant. Gravel/cobble bars are in the process of stabilizing. Turbidity moderate.	Embeddedness >30%. Bedrock, sand, silt, or small gravel dominant. Gravel/cobble bars very mobile. Turbidity high.
Chemical Contamination	Low levels of chemical contamination; no CWA 303(d) designated reaches.	Moderate levels of chemical contamination; one CWA 303(d) designated reach.	High levels of chemical contamination; more than one CWA 303(d) designated reach.
Habitat Access			
Physical Barriers	Man-made barriers do not restrict fish passage.	Man-made barriers present restrict fish passage at base/low flows.	Man-made barriers present restrict fish passage at a range of flow conditions.
Habitat Elements			
Large Woody Material (1) >20 pieces/mi.	Meets standards (left). Adequate sources for LWM recruitment from riparian areas.	Currently meets standards for properly functioning, but lacks potential sources from riparian areas of LWM recruitment to maintain that standard, *or* Doesn't meet standard, but has recruitment potential.	Does not meet standards for properly functioning and lacks potential LWM recruitment.
Pool Frequency and Quality (1) Width (ft.) Pools/mi. 5 184 10 96 15 70 20 56 25 47 50 26	Meets pool frequency standards (left) and LWM recruitment standards for properly functioning habitat, or has adequate flow and bedrock to maintain pools. Residual (holding) pool depth greater than 3 meters with good cover and cool water. Minor reduction of pool volume by fine sediment acceptable.	Meets pool frequency standards (left) but LWM recruitment standards inadequate to maintain pools over time. Lacks adequate flow or bedrock to form stable pools. Residual (holding) pool depth less than 3 meters with less than adequate cover/temperature. Moderate reduction in pool volume by fine sediment.	Does not meet pool frequency standards. Does not contain deep pools. Pool volumes are reduced by fine sediment.
Off-Channel habitat	Natural potential *or* backwaters with cover and low energy off-channel areas	Some backwater and high-energy side channels.	Few or no backwaters; no off-channel ponds.
Refugia	Habitat refugia exists and are buffered	Habitat refugia exists but are not adequately buffered	Habitat refugia does not exist.
Channel Conditions and Dynamics			
Width:Depth ratio (1)	Meet Rosgen's classification system (Rosgen 1996).	Does not meet Rosgen's classification system, but morphology/vegetation components are in place and system is moving towards meeting this classification.	Does not meet Rosgen's classification system and morphology/vegetation componenets are not in place.
Streambank Condition (1)	≥90% stable.	80-90% stable.	<80% stable.
Floodplain Connectivity	Off-channel areas are hydrologically connected to the main channel. Overbank flows occur and maintain wetland functions, riparian vegetation and succession, where channel type allows.	Reduced linkage of wetland floodplains. Overbank flows are reduced relative to historic frequency as evidenced by moderate degradation of wetland function, where channel type allows formation of wetlands.	Severe reduction in hydrologic connectivity. Wetland functions degraded, where channel type allows formation of wetlands.

(*Continued on next page*)

Pathway/Indicators	Properly Functioning	At Risk	Not Properly Functioning
		Hydrology/flow	
Changes in Peak/Base Flow	Watershed hydrographs indicated peak flow, base flow, and flow timing characteristics comparable to an undisturbed watershed.	Some evidence of altered peak flow, base flow, and/or flow timing.	Pronounced changes in peak flow, base flow, and/or flow timing.
Increase in Drainage Network	Zero or minimum increase in drainage network density due to roads.	Moderate increases in drainage network density due to roads (5%).	Significant increases in drainage network density due to roads (>20%).
		Watershed Conditions	
Road Density and Location	<2 mi/sq.mi.; no valley bottom roads.	2-3 mi/sq.mi.; some valley bottom roads.	>3 mi/sq.mi.; many valley bottom roads.
Disturbance History	<15% ECA with no concentration of disturbance in unstable areas or riparian areas.	<15% ECA with some disturbance in unstable areas or riparian areas.	>15% ECA with disturbance concentrated in unstable areas or riparian areas.
Riparian Reserves	Riparian reserves provide shade, LWM recruitment, habitat protection, and connectivity in all subwatersheds. Riparian plant community has the vigor, health, composition and diversity to support riparian reserve values.	Moderate loss of connectivity or function or riparian reserves. Riparian plant community lacking the vigor, health, composition and/or diversity to support riparian reserve values, but is in an upward trend.	Riparian reserves are fragmented with poor connectivity and little protection of habitats. Riparian plant community lacking the vigor, health, composition and/or diversity to support riparian reserve values, and is in a static or downward trend.

1. Items identified as RMO criteria for PACFISH. Data in this table matches PACFISH guidelines and NMFS Table 1 Matrix (NMFS memo dated September 4, 1996).

Appendix F - Northwest Power Planning Council (1990) Smolt Density Model – Spring Chinook

StreamName	TributaryTo	From	To	Present	LengthMiles	WidthFeet	UseType	HabitatQuality	SmoltCapacity	Major Habitat Constraints
Imnaha R	Snake R	Mouth	Cow Cr	100	4.30	65	Primarily rearing and migration	Excellent	50622	
Cow Cr	Imnaha R	Mouth	Long Prong	9	10.90	12	Primarily rearing and migration	Excellent	2309	
Imnaha R	Snake R	Cow Cr	Lightning Cr	100	1.10	75	Primarily rearing and migration	Excellent	12949	
Lightning Cr	Imnaha R	Mouth	Rhodes Cr	31	5.30	16	Primarily rearing and migration	Excellent	5324	
Imnaha R	Snake R	Lightning Cr	Horse Cr	100	5.40	80	Primarily rearing and migration	Excellent	63571	
Horse Cr	Imnaha R	Mouth	Pumpkin Cr	40	7.50	14	Primarily rearing and migration	Excellent	8240	
Imnaha R	Snake R	Horse Cr	Big Sheep Cr	100	11.50	80	Primarily rearing and migration	Excellent	135384	
Big Sheep Cr	Imnaha R	Mouth	Camp Cr	100	1.10	19	Primarily rearing and migration	Excellent	4100	
Big Sheep Cr	Imnaha R	Camp Cr	Little Sheep Cr	100	2.00	34	Primarily rearing and migration	Excellent	13342	
Big Sheep Cr	Imnaha R	Little Sheep Cr	Squaw Cr	100	12.30	38	Primarily spawning and rearing	Excellent	206343	Channelization
Big Sheep Cr	Imnaha R	Squaw Cr	Marr Cr	56	1.60	20	Primarily spawning and rearing	Excellent	7911	
Big Sheep Cr	Imnaha R	Marr Cr	Griffith Cr	52	10.70	23	Primarily spawning and rearing	Excellent	57582	Unscreened or poor diversion
Big Sheep Cr	Imnaha R	Griffith Cr	Carrol Cr	43	1.70	18	Primarily spawning and rearing	Excellent	5943	Unscreened or poor diversion
Big Sheep Cr	Imnaha R	Carrol Cr	Owl Cr	72	6.50	21	Primarily spawning and rearing	Excellent	43387	
Big Sheep Cr	Imnaha R	Owl Cr	Lick Cr	100	3.90	15	Primarily spawning and rearing	Excellent	25826	
Lick Cr	Big Sheep Cr	Mouth	Headwaters	34	10.00	18	Primarily spawning and rearing	Excellent	27018	
Big Sheep Cr	Imnaha R	Lick Cr	Big Sheep Cr, S Fk	40	3.00	11	Primarily spawning and rearing	Excellent	5827	
Imnaha R	Snake R	Big Sheep Cr	Freezeout Cr	100	12.90	50	Primarily rearing and migration	Excellent	126555	
Imnaha R	Snake R	Freezeout Cr	Grouse Cr	100	5.40	50	Primarily spawning and rearing	Excellent	119197	
Imnaha R	Snake R	Grouse Cr	Summit Cr	100	3.00	50	Primarily spawning and rearing	Excellent	66220	
Imnaha R	Snake R	Summit Cr	Crazyman Cr	100	5.80	45	Primarily spawning and rearing	Excellent	115224	
Imnaha R	Snake R	Crazyman Cr	Gumboot Cr	100	3.30	50	Primarily spawning and rearing	Poor	8093	Ice floes/icing conditions
Imnaha R	Snake R	Gumboot Cr	Blackhorse Cr	100	1.70	50	Primarily spawning and rearing	Poor	4169	Ice floes/icing conditions
Imnaha R	Snake R	Blackhorse Cr	Dry Cr	100	1.00	50	Primarily spawning and rearing	Poor	2452	Ice floes/icing conditions
Imnaha R	Snake R	Dry Cr	Skookum Cr	100	6.50	50	Primarily spawning and rearing	Poor	15942	Ice floes/icing conditions
Imnaha R	Snake R	Skookum Cr	Imnaha R, N Fk	100	9.50	45	Primarily spawning and rearing	Poor	20969	Ice floes/icing conditions

Appendix G - Northwest Power Planning Council (1990) Smolt Density Model – Summer Steelhead

StreamName	TributaryTo	From	To	Present	LengthMiles	WidthFeet	UseType	HabitatQuality	SmoltCapacity	Major Habitat constraints
Imnaha R	Snake R	Mouth	Cow Cr	100	4.30	65	Primarily rearing and migration	Excellent	5484	
Cow Cr	Imnaha R	Mouth	Long Prong	100	10.90	12	Primarily rearing and migration	Excellent	2566	
Long Prong	Cow Cr	Mouth	Buckaroo Cr	100	3.20	4	Primarily rearing and migration	Excellent	251	
Buckaroo Cr	Long Prong	Mouth	Headwaters	25	2.40	4	Primarily rearing and migration	Excellent	47	
Cow Cr	Imnaha R	Long Prong	Headwaters	40	9.20	6	Primarily rearing and migration	Excellent	433	
Imnaha R	Snake R	Cow Cr	Lightning Cr	100	1.10	75	Primarily rearing and migration	Excellent	1618	
Lightning Cr	Imnaha R	Mouth	Rhodes Cr	82	5.30	16	Primarily spawning and rearing	Excellent	3452	
Rhodes Cr	Lightning Cr	Mouth	Headwaters	20	5.10	5	Primarily spawning and rearing	Excellent	250	
Lightning Cr	Imnaha R	Rhodes Cr	Sleepy Cr	74	4.70	15	Primarily spawning and rearing	Excellent	2559	
Sleepy Cr	Lightning Cr	Mouth	Medicine Cr	27	11.70	6	Primarily spawning and rearing	Excellent	929	
Medicine Cr	Sleepy Cr	Mouth	Headwaters	43	6.20	4	Primarily migration	Not Rated	0	
Sleepy Cr	Lightning Cr	Medicine Cr	Headwaters	52	3.80	6	Primarily spawning and rearing	Excellent	592	
Lightning Cr	Imnaha R	Sleepy Cr	Headwaters	100	12.10	10	Primarily spawning and rearing	Excellent	5935	
Imnaha R	Snake R	Lightning Cr	Horse Cr	100	5.40	80	Primarily rearing and migration	Excellent	8476	
Horse Cr	Imnaha R	Mouth	Pumpkin Cr	58	7.50	14	Primarily spawning and rearing	Excellent	3038	
Pumpkin Cr	Horse Cr	Mouth	Headwaters	83	10.00	3	Primarily spawning and rearing	Excellent	1236	
Horse Cr	Imnaha R	Pumpkin Cr	Headwaters	81	16.50	6	Primarily spawning and rearing	Excellent	3933	
Imnaha R	Snake R	Horse Cr	Big Sheep Cr	100	11.50	80	Primarily rearing and migration	Excellent	18051	
Big Sheep Cr	Imnaha R	Mouth	Camp Cr	100	1.10	19	Primarily rearing and migration	Excellent	410	
Camp Cr	Big Sheep Cr	Mouth	Trail Cr	43	2.70	10	Primarily spawning and rearing	Excellent	582	Unscreened or poor diversion/channelization
Camp Cr	Big Sheep Cr	Trail Cr	Headwaters	100	11.60	6	Primarily spawning and rearing	Excellent	3414	Unscreened or poor diversion/channelization
Big Sheep Cr	Imnaha R	Camp Cr	Little Sheep Cr	100	2.00	34	Primarily rearing and migration	Excellent	1334	
Big Sheep Cr	Imnaha R	Little Sheep Cr	Squaw Cr	100	12.30	38	Primarily rearing and migration	Excellent	9170	Channelization
Squaw Cr	Big Sheep Cr	Mouth	Squaw Cr, E Fk	100	1.60	5	Primarily spawning and rearing	Excellent	392	
Squaw Cr, S Fk	Squaw Cr	Mouth	Headwaters	62	3.20	3	Primarily spawning and rearing	Excellent	291	
Big Sheep Cr	Imnaha R	Squaw Cr	Marr Cr	56	1.60	20	Primarily spawning and rearing	Excellent	879	
Marr Cr	Big Sheep Cr	Mouth	Headwaters	100	7.00	4	Primarily spawning and rearing	Excellent	1373	
Big Sheep Cr	Imnaha R	Marr Cr	Griffith Cr	52	10.70	23	Primarily spawning and rearing	Excellent	6398	Unscreened or poor diversion/channelization

Appendix G (cont.)
Northwest Power Planning Council (1990) Smolt Density Model – Summer Steelhead

StreamName	TributaryTo	From	To	Present	LengthMiles	WidthFeet	UseType	HabitatQuality	SmoltCapacity	Major Habitat constraints
Griffith Cr	Big Sheep Cr	Mouth	Headwaters	15	6.30	3	Primarily spawning and rearing	Excellent	148	
Big Sheep Cr	Imnaha R	Griffith Cr	Carrol Cr	43	1.70	18	Primarily spawning and rearing	Excellent	660	Unscreened or poor diversion/channelization
Carrol Cr	Big Sheep Cr	Mouth	Headwaters	43	6.90	2	Primarily spawning and rearing	Excellent	291	
Big Sheep Cr	Imnaha R	Carrol Cr	Owl Cr	72	6.50	21	Primarily spawning and rearing	Excellent	4820	
Big Sheep Cr	Imnaha R	Owl Cr	Lick Cr	100	3.90	15	Primarily spawning and rearing	Excellent	2869	
Lick Cr	Big Sheep Cr	Mouth	Headwaters	85	10.00	18	Primarily spawning and rearing	Excellent	7505	
Big Sheep Cr	Imnaha R	Lick Cr	Big Sheep Cr, S Fk	40	3.00	11	Primarily spawning and rearing	Excellent	647	
Little Sheep Cr	Big Sheep Cr	Mouth	Bear Gulch	100	3.10	20	Primarily spawning and rearing	Excellent	3041	
Bear Gulch	Little Sheep Cr	Mouth	Headwaters	81	10.00	4	Primarily spawning and rearing	Excellent	1589	
Little Sheep Cr	Big Sheep Cr	Bear Gulch	Devils Gulch	100	2.40	10	Primarily spawning and rearing	Excellent	1177	
Devils Gulch	Little Sheep Cr	Mouth	Headwaters	43	10.40	3	Primarily spawning and rearing	Excellent	658	
Little Sheep Cr	Big Sheep Cr	Devils Gulch	Lightning Cr	100	2.20	12	Primarily spawning and rearing	Excellent	1294	
Lightning Cr	Little Sheep Cr	Mouth	Headwaters	61	4.70	4	Primarily spawning and rearing	Excellent	562	
Little Sheep Cr	Big Sheep Cr	Lightning Cr	Hayden Cr	87	5.70	12	Primarily spawning and rearing	Excellent	2952	
Little Sheep Cr	Big Sheep Cr	Hayden Cr	Mccully Cr	93	10.00	11	Primarily spawning and rearing	Excellent	5072	
Little Sheep Cr	Big Sheep Cr	Mccully Cr	Ferguson Cr	100	2.80	20	Primarily spawning and rearing	Excellent	2746	
Imnaha R	Snake R	Big Sheep Cr	Freezeout Cr	100	12.90	50	Primarily rearing and migration	Excellent	12655	
Freezeout Cr	Imnaha R	Mouth	Headwaters	76	8.30	9	Primarily spawning and rearing	Excellent	2821	
Imnaha R	Snake R	Freezeout Cr	Grouse Cr	100	5.40	50	Primarily rearing and migration	Excellent	5297	
Grouse Cr	Imnaha R	Mouth	Rich Cr	100	3.00	30	Primarily spawning and rearing	Excellent	4414	
Rich Cr	Grouse Cr	Mouth	Headwaters	88	5.50	5	Primarily spawning and rearing	Excellent	1200	
Grouse Cr	Imnaha R	Rich Cr	Morgan Cr	100	5.00	15	Primarily spawning and rearing	Excellent	3678	
Morgan Cr	Grouse Cr	Mouth	Headwaters	67	4.00	5	Primarily spawning and rearing	Excellent	657	
Grouse Cr	Imnaha R	Morgan Cr	Headwaters	80	10.40	13	Primarily spawning and rearing	Excellent	5305	
Imnaha R	Snake R	Grouse Cr	Summit Cr	100	3.00	50	Primarily rearing and migration	Excellent	2943	
Summit Cr	Imnaha R	Mouth	Headwaters	62	7.00	8	Primarily spawning and rearing	Excellent	1730	
Imnaha R	Snake R	Summit Cr	Crazyman Cr	100	5.80	45	Primarily rearing and migration	Excellent	5121	
Crazyman Cr	Imnaha R	Mouth	Headwaters	91	7.00	6	Primarily spawning and rearing	Excellent	1874	
Imnaha R	Snake R	Crazyman Cr	Gumboot Cr	100	3.30	50	Primarily spawning and rearing	Poor	2428	Ice floes/icing conditions

Appendix G (cont.)
Northwest Power Planning Council (1990) Smolt Density Model – Summer Steelhead

StreamName	TributaryTo	From	To	Present	LengthMiles	WidthFeet	UseType	HabitatQuality	SmoltCapacity	Major Habitat constraints
Gumboot Cr	Imnaha R	Mouth	Gumboot Cr, N Fk	100	0.70	9	Primarily spawning and rearing	Excellent	309	
Gumboot Cr, N Fk	Gumboot Cr	Mouth	Headwaters	86	2.80	7	Primarily spawning and rearing	Excellent	826	
Gumboot Cr	Imnaha R	Gumboot Cr, N Fk	Headwaters	100	6.40	10	Primarily spawning and rearing	Excellent	3139	
Imnaha R	Snake R	Gumboot Cr	Blackhorse Cr	100	1.70	50	Primarily spawning and rearing	Poor	1250	Ice floes/icing conditions
Imnaha R	Snake R	Blackhorse Cr	Dry Cr	100	1.00	50	Primarily spawning and rearing	Poor	735	Ice floes/icing conditions
Dry Cr	Imnaha R	Mouth	Dry Cr, N Fk	62	1.60	8	Primarily spawning and rearing	Poor	116	Ice floes/icing conditions
Dry Cr, N Fk	Dry Cr	Mouth	Headwaters	62	3.20	5	Primarily spawning and rearing	Poor	145	Ice floes/icing conditions
Dry Cr	Imnaha R	Dry Cr, N Fk	Headwaters	93	3.20	7	Primarily spawning and rearing	Poor	309	Ice floes/icing conditions
Imnaha R	Snake R	Dry Cr	Skookum Cr	100	6.50	50	Primarily spawning and rearing	Poor	4782	Ice floes/icing conditions
Skookum Cr	Imnaha R	Mouth	Headwaters	20	4.30	14	Primarily spawning and rearing	Poor	186	Ice floes/icing conditions
Imnaha R	Snake R	Skookum Cr	Imnaha R, N Fk	100	9.50	45	Primarily spawning and rearing	Poor	6290	Ice floes/icing conditions

Appendix H - Northwest Power Planning Council (1990) Smolt Density Model – Fall Chinook

StreamName	TributaryTo	From	To	Present	LengthMiles	WidthFeet	UseType	HabitatQuality	SmoltCapacity	Major Habitat constraints
Imnaha R	Snake R	Mouth	Cow Cr	100	4.30	65	Primarily spawning and rearing	Excellent	227799	low winter water temperatures
Imnaha R	Snake R	Cow Cr	Lightning Cr	100	1.10	75	Primarily spawning and rearing	Excellent	58274	low winter water temperatures
Imnaha R	Snake R	Lightning Cr	Horse Cr	100	5.40	80	Primarily spawning and rearing	Excellent	286073	low winter water temperatures
Imnaha R	Snake R	Horse Cr	Big Sheep Cr	100	11.50	80	Primarily spawning and rearing	Excellent	609230	low winter water temperatures

Appendix I - Hatchery Genetic Management Plan for the Imnaha Subbasin

(The following documents were not developed cooperatively with co-managers. ODFW developed it and submitted it to NMFS without co-manager review or comment. This HGMP also does not reflect the current program.)

SECTION 1.0 GENERAL PROGRAM DESCRIPTION

1.1) Name of Program

Imnaha River Spring/Summer Chinook Salmon

1.2) Population (or stock) and species

Oncorhynchus tshawytscha, chinook salmon (stock 029)

1.3) Responsible organization and individual

ODFW Portland Staff:

Name (and Title): Trent Stickell
Organization: Oregon Department of Fish and Wildlife
Address: 2501 SW First, Portland, OR 97207
Telephone: 503-827-5252
Fax: 503-872-5632
Email: Trent.W.Stickell@state.or.us

ODFW Regional Staff:

Name (and Title): Bruce Eddy
Organization: Oregon Department of Fish and Wildlife (ODFW)
Address: 107 20th Street
Telephone: 541-963-2138
Fax: 541-963-6670
Email: bruce.r.eddy@state.or.us

Co-Management Organizations: Nez Perce Tribe (NPT)
Confederated Tribes of the Umatilla Indian Reservation (CTUIR)

1.4) Location(s) of hatchery and associated facilities:

- *Adult holding, spawning, egg incubation, and rearing:*
- Lookingglass hatchery is located 18 miles north of the town of Elgin, adjacent to Lookingglass Creek 2.2 miles above its confluence with the Grande Ronde River at about river mile 86. Elevation at the hatchery is 2,550 feet above sea level. Adult facilities consist of a trap and two concrete raceways (4,560 ft^3). Incubation is in 288 vertical incubator trays with a capacity of 2.3 million eggs to hatching. There are 32 Canadian troughs for starting fish each with a capacity of 100 to 125 pounds of fish. Rearing is in 18 concrete raceways (3,000 ft^3) each with a capacity of 4,000 lb (Lewis 1996).
- *Adult collection, acclimation and release:*
  Imnaha collection and acclimation facility is located three hours from Lookingglass hatchery, approximately 30 miles from the town of Imnaha, adjacent to the Imnaha River at river mile 45.5. Elevation at the Imnaha facility is 3,760 feet above sea level. Facilities consist of an adult trap, spawning area and one pond (13,000 ft^3). The pond is used for adult holding in the fall and juvenile acclimation and release in the spring. Capacity for juveniles is about 19,500 lb.

Other organizations involved and intent

The U.S. Fish and Wildlife Service, through the Lower Snake River Compensation Plan (LSRCP), funds production and operation expenditures at Lookingglass hatchery and Imnaha acclimation pond. The Nez Perce Tribe, Oregon Department of Fish and Wildlife, and the Confederated Tribes of the Umatilla Indian Reservation are co-managers of the Imnaha River spring/summer chinook salmon program.

1.5) Type of program:

The Imnaha River spring/summer chinook salmon (stock 029) fish propagation project is managed as a "**mitigation**" and "**supplementation**" program.

1.6) Purpose (Goal) of program (Nandor 1995**):**

Produce up to 3,210 spring/summer chinook salmon adults for in-place, in-kind mitigation.

1.7) Specific performance objectives(s) of program:

1.8) List of Performance Indicators designated by "benefits" and "risks"

1.9) Expected size of program

1.9.1 Expected Release -

Production goals for 1999 brood Imnaha spring/summer chinook salmon (AOP 1999):

- 420,000 smolts released into the Imnaha River.
- 70,000 smolts released into the Big Sheep and Lick Creeks.
- Actual production will be based on egg take, with Imnaha River releases as first priority.

1.9.2 Adult fish produced and harvested

The number of spring/summer chinook salmon collected at the Imnaha weir since 1990 is presented in Table 1. Estimated total adults produced from juvenile Imnaha spring/summer chinook salmon released for this program is reported in Table 2.

Table 1: Summary of spring/summer chinook salmon collected at the Imnaha weir and their disposition since 1990 (adults and jacks combined). Released = released alive above the weir. Retained = transferred to Lookingglass hatchery for brood stock. Data taken from ODFW Annual Report Series, Evaluation of Lower Snake River Compensation Plan Facilities in Oregon.

Brood	Unmarked Fish			Marked Fish		
Year	Collected	Released	Retained	Collected	Released	Retained
1990	183	102	81	221	68	153
1991	223*	126	97	282	67	215
1992	413*	280	133	431	179	252
1993	650*	543	107	593	248	345
1994	72	52	20	91	60	31
1995	38	0	38	30	0	30
1996	145	73	72	99	23	76
1997	84	61	23	204	55	149
1998	150	73	77	236	136**	96
1999	73	51	22	323	69	254

* = In 1990 and 1991 not all the Imnaha spring/summer chinook salmon juveniles released were marked. Estimates of unmarked hatchery fish included in the above numbers are: 1991 = 92; 1992 = 253; and 1993 = 302.

** = Includes 25 fish out-planted to Big Sheep Creek and 14 fish out-planted to Lick Creek.

Table 2: Estimated total adult spring/summer chinook salmon produced from juveniles released as part of this program. Data taken from ODFW Annual Report Series, "Evaluation of Lower Snake River Compensation Plan Facilities in Oregon". Strays = non-harvest freshwater recoveries outside the Imnaha Basin.

Run Year	Harvest		Imnaha Return *	Strays	Total Return
	Ocean	Columbia R.			
1990	2	18	276		296
1991	0	8	142		150
1992	9	23	1,214		1,246
1993	8	0	973		981
1994	0	1	151	7	159
1995	0	1	190	4	195
1996	3	0	200	1	204

* = Compensation goal area.

1.9.3 Escapement Goals

The escapement goal for this program is 3,210 adults annually (Nandor 1995).

1.10) Date Program started or is expected to start:

Lookingglass Hatchery and the Imnaha Acclimation Pond were both completed in 1982. The first releases of spring/summer chinook salmon for this program occurred in March 1984 (1982 brood).

1.11) Expected duration of program:

The Imnaha spring/summer chinook salmon stock 029 program is an ongoing project.

1.12) Watersheds targeted by program:

All hatchery-reared fish are released into the Imnaha River Subbasin (as defined by the Northwest Power Planning Council (NWPPC)).

SECTION 2.0 RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

2.1) List all existing cooperative agreements, memorandum of agreement, or other management plans or court orders under which program operates. Confirm HGMP consistency.

2.2) Status of natural populations in target area.

2.2.1. Geographic and temporal spawning distribution

Spring/summer chinook salmon historically spawned throughout the mainstem and major tributaries of the Imnaha River (Olsen et. al. 1994). Currently spawning is primarily in the mainstem (a 30-mile section from Freezeout Creek to the Blue Hole), Big Sheep Creek (an 11.5-mile section from Coyote Creek to 0.25 miles above Lick Creek), and Lick Creek (a 2.8-mile section from the confluence to the crossing of Forest Service Road 39) (Olsen et. al. 1994). Spawning has also been documented in South Fork Imnaha River (Nez Perce Tribe of Idaho et. al. 1990). Spawning ground surveys conducted in the Imnaha River in 1995 (August 25th to September 11th) and 1997 (August 20th to September 5th) documented new redds and live fish throughout these periods (Parker et. al. 1995, Parker and Keefe 1997). Migrating natural and hatchery adult spring/summer chinook salmon enter the Imnaha weir from July through September (Table 5). Spawning at Lookingglass hatchery occurs in August and September (Table 5).

2.2.2. Annual spawning abundance for as many years as available

2.2.3. Progeny to parent ratios, survival data by life stage, or other measures of productivity for as many brood years as available.

2.2.4. Annual proportions of hatchery and natural fish on natural spawning grounds for as many years as possible.

The number of marked and unmarked spring chinook passed about the Imnaha weir since 1990 is provided in Table 1. For the period 1990 through 1999, the proportion of marked fish among the fish released from the Imnaha weir has averaged 43.6% and ranged from 24.0% to 65.1%. However, spring/summer chinook salmon do spawn in areas below the weir and the weir only traps about 52% of the run (AOP 1999). The proportion of marked carcasses recovered during 1994 through 1997 spawning ground surveys in the Imnaha River Basin is reported in Table 3.

Table 3: Origin of spring/summer chinook salmon carcasses, based on marking of hatchery fish, recovered during spawning ground surveys in the Imnaha River. Data from: 1994 and 1996 (Kinery 1999); 1995 (Parker et. al. 1995); and 1997 (Parker and Keefe 1997).

Run Year	Marked	Unmarked	Percent Marked
1994	24	30	44.4%
1995	5	23	17.9%
1996	8	60	11.8%
1997	109	59	64.9%

* = Compensation goal area.

2.2.5. Status of natural population relative to critical and viable population thresholds.

2.3) Relationship to harvest objectives.

Three utilization objectives for Imnaha spring chinook salmon are identified in Nez Perce Tribe of Idaho et. al. (1990). These objectives include both hatchery and naturally produced fish. Fish from this program will also contribute to ocean and Columbia River harvest.

1. Establish tribal and sport harvest opportunity in the subbasin.
2. Provide opportunity for an annual non-selective tribal harvest of 350 fish.
3. Provide opportunity for an annual non-selective sport harvest of 350 fish.

2.4) Relationship to habitat protection and recovery strategies.

This hatchery program is part of a cooperative recovery strategy for naturally produced spring/summer chinook salmon in the Imnaha River.

2.5) Ecological interactions

Potential ecological interactions with listed fish specifically caused by this hatchery program are unknown.

SECTION 3.0 WATER SOURCE:

SECTION 4.0 FACILITIES:

SECTION 5.0 ORIGIN AND IDENTITY OF BROODSTOCK

5.1) Source

Brood stock for the Imnaha River spring/summer chinook salmon program is collected from adult returns trapped at Imnaha weir and then transferred to Lookingglass hatchery for spawning. This includes both hatchery and naturally produced fish. The number of fish transferred to Lookingglass hatchery is reported in Table 1, and the number of fish spawned in Table 4.

5.2.1 History

Since the beginning of this program in 1982 only natural or hatchery produced Imnaha River spring/summer chinook salmon have been used for brood stock.

Table 4. Imnaha River spring/summer chinook salmon spawning data for the 1990 through 1999 brood years.

Brood Year	Marked Males Spawned	Marked Females Spawned	Unmarked Males Spawned	Unmarked Females Spawned	% Un-marked	Spawning Ratio F/M	Average Fecundity	Egg Take (1,000's)	Fry Ponded (1,000's)	Fingerling releases (1,000's)
1990	35	49	39	25	43.2%	1.00	4,414	327	270	0
1991	11	24	27	15	54.5%	1.03	4,954	193	163	0
1992	46	86	69	28	42.4%	0.99	4,754	542	465	0
1993	134	139	58	54	29.1%	1.01	5,425	1,047	1,010	283
1994	15	13	6	9	34.9%	1.05	5,082	112	96	0
1995	16	9	30	6	59.0%	0.33	4,541	68	51	0
1996	15	7	37	17	71.1%	0.46	4,276	103	102	0
1997	54	50	8	7	12.6%	0.92	4,962	283	206	0
1998	59	33	31	28	39.1%	0.68	5,059	309	183	0

5.2.2 Annual Size

The program annual brood stock collection goal is 400 (Nez Perce Tribe of Idaho et. al. 1990). Actual collection goals are established each year through development of the annual operation plan. The green egg take goal for 1999 is 576,500 (AOP 1999). Actual number of males and females spawned is reported in Table 4.

5.2.3 Past and proposed level of natural fish in brood stock

Naturally spawning fish included in the brood stock, are reported in Table 4. The proportion of naturally produced fish (Unmarked) spawned has averaged 39.4% and ranged from 8.3% to 71.1% for the 1990 through 1999 brood years. Guidelines for the Imnaha weir call for retaining 2 of every 5 unmarked adults and 3 of every 5 Ad+CWT adults by age and sex, and 2 of every 5 unmarked jacks and Ad+CWT jacks trapped as brood stock (AOP 1999).

5.2.4 Genetic and ecological differences

There is currently no information about genetic and ecological differences between the hatchery stock and wild Imnaha fish. However, the brood stock is based on and annually incorporates locally adapted naturally produced fish, which should minimize differences.

5.2.5 Reasons for choosing

Brood stock is collected at Imnaha weir and incorporates naturally produced fish in order to maintain local adaptation and wild type characteristics.

5.3) Unknowns

SECTION 6.0 BROODSTOCK COLLECTION

6.1) Prioritized Goals:

6.2) Supporting Information:

6.2.1 Proposed number of each sex

The program goal is to collect 400 fish for brood stock, and to spawn them in a ratio of 1 male to 1 female (Nez Perce Tribe of Idaho et. al. 1990). Actual collection designs are established each year in the annual operation plan. The collection design for the 1999 run year is described in section 6.2.3 (below).

6.2.2 Life-history stage to be collected (e.g., eggs, adults, etc.)

Returning adults and jacks are collected at Imnaha trap. The fish are sorted based on the design below in section 6.2.3, and fish retained for brood stock are transported to Lookingglass hatchery.

6.2.3 Collection or sampling design

All adults that enter the Imnaha trap are sorted by origin (marked vs. unmarked), sex and age. Fish retained for brood stock are 2 of every 5 unmarked adults and 3 of every 5 Ad+CWT adults by age and sex, and 2 of every 5 unmarked jacks and all Ad+CWT jacks (AOP 1999). Within the above criteria adults are selected randomly from the available fish for the brood stock. Brood stock fish are marked with an opercle punch and a jaw tag. Fish not retained for brood stock are marked with an opercle punch and released above the weir. Hatchery jacks may be placed above the weir, up to 10% of the males passed above the weir.

Table 5. Imnaha spring/summer chinook salmon program adult collection and spawning dates.

Run	Collection at Imnaha Weir		Spawning at Lookingglass Hatchery	
Year	Beginning	Ending	Beginning	Ending
1990	9-Jul	18-Sep	23-Aug	18-Sep
1991	3-Jul	12-Sep	21-Aug	16-Sep
1992	18-Jun	8-Sep	18-Aug	8-Sep
1993	7-Jul	8-Sep	12-Aug	10-Sep
1994	27-Jun	13-Sep	24-Aug	8-Sep
1995	2-Aug	30-Aug	17-Aug	7-Sep
1996	23-Jul	4-Sep	14-Aug	12-Sep
1997	8-Jul	3-Sep	15-Aug	12-Sep
1998	11-Jul	8-Sep	5-Aug	14-Sep
1999	27-Jul	7-Sep	6-Aug	9-Sep

6.2.4 Identity -

(a) Methods for identifying target populations (if more than one population may be present).

Naturally produced fish are identified based on lack of marks or tags. The Imnaha weir is in a location where only one wild population would be encountered.

(b) Methods for identifying hatchery origin fish from naturally spawned fish.

All hatchery fish released in the Imnaha basin from the 1990 brood year on have been marked with an adipose fin clip plus coded-wire tag (Ad+CWT). The only except is small numbers of fish which lose their marks.

6.2.5 Holding -

6.2.6 Disposition of Adults

Returning spring/summer chinook salmon collected at Imnaha weir are either retained for brood stock or released above the weir (see section 6.2.3 above). Hatchery fish are distinguished based on marks. Carcasses are either placed in to habitat for stream enrichment or sent to a landfill.

6.3) Unknowns:

SECTION 7.0 MATING

7.1) Selection method

7.1.1 Adult Selection -

Hatchery and natural origin fish are used for the brood stock. Fish are spawned based on a matrix determined each year. The specific matrix is based on the actual number of adults retained for brood each year (by origin, sex and age). The goal is to include all fish retained for brood stock in the spawning population. Cryopreservation of sperm may be used. Sperm from unmarked males will be cryopreserved for gene banking.

7.1.2 Selection of Egg Take -

All females collected for brood stock, except pre-spawning mortalities, are spawned. Excess fish are not collected and thus selection or culling of eggs is not done. Disease monitoring may result in segregated rearing for fish health reasons but is not used to cull eggs.

7.2) Males

Fish for this program are matrix spawned, determined annually based on brood stock collection. Overall sex ratios (including jacks) for the last 10 years are reported in Table 4.

7.3) Fertilization

7.3.1 Fertilization Scheme -

7.3.2 Fish Health Procedures -

Fish health procedures are established in the annual operation plan. Specific plans for February 1999 through January 2000 are reported in AOP (1999).

7.4) Cryopreserved gametes

Sperm are cryopreserved for gene banking and use in the matrix spawning.

7.5) Unknowns

SECTION 8.0 REARING AND INCUBATION

SECTION 9.0 RELEASE

9.1) Life history stage, size, and age at release

Spring/summer chinook salmon smolts are released as yearlings from late March through early May after approximately 400 – 430 days of rearing in a hatchery environment. The target size at release for this program is 30.2 gm/fish (15 fish/lb) for direct releases. Acclimation groups compare two sizes at release 18.1 gm/fish (25 fish/lb) and 30.2 gm/fish (15 fish/lb). Actual size at release for the 1988 to 1997 brood years is reported in Table 6.

During the 1990's there have been no releases of spring/summer chinook salmon unfed fry in the Imnaha Basin. The only non-smolt release was 283,046 1993 brood year fingerlings released in July 1994 at 4.6 gm/fish (98 fish/lb). These fingerling were excess to smolt production goals and were out-planted for natural rearing in the Imnaha Basin. Locations included in Big Sheep, Little Sheep, Cow, Freezeout, Horse, and Lightling Creeks and the main stem Imnaha River. These fish were 100% marked with an adipose fin clip. No unfed fry or fingerling releases are planned in the current Annual Operation Plan.

9.2) Life history stage, size, and age of natural fish of same species

9.3) Dates of release and release protocol

Releases consist of both acclimated and direct release groups. If smolt production numbers are below the program goal, releases at the Imnaha acclimation site take precedence over releases in Big Sheep and Lick Creeks, and acclimated releases take precedence over direct releases. Smolts have been released from late March through early May (Table 6). The current Annual Operation Plan calls for a direct release April 5th and 6th, and for a volitional acclimation release. The volitional release is to begin March 22nd with any remaining fish forced out April 15th.

9.4) Location(s) of release

Currently all smolts are released at the acclimation pond, located at the site of the Imnaha adult collection weir (about river mile 45.5). The program goal is to also release smolts in to Big Sheep Creek and Lick Creek. During the 1990's the only release not at the acclimation site was 79,947 1988 brood year smolts released in to Big Sheep Creek in 1990 (Table 6).

9.5) Acclimation procedures

All smolts are reared at Lookingglass hatchery from hatching until release or transfer to the acclimation pond. Lookingglass hatchery transfers smolts to the acclimation pond as yearlings in March. The current Annual Operation Plan calls for a March 1st transfer with a volition release to begin March 22nd. Plans for the direct release group are to haul them April 5th and 6th from Lookingglass hatchery for direct release in to the Imnaha River near the acclimation site.

9.6) Number of fish released

Imnaha River spring/summer chinook salmon releases for the last 10 years are reported in Table 6. Anticipated actual releases in 2000 (1998 brood year) are 180,000 smolts (AOP 1999). The program goal is a 490,000 smolt release.

Table 6. Releases of spring/summer chinook salmon in the Imnaha River Basin for the last 10 years, 1988 through 1997 brood years (1990 – 1999 release years).

Brood Year	Release Type	Release Dates		Location	Number Released	Kg Released	gm/fish
1988	Acclimated	03/31/90	03/31/90	Imnaha Accl. Pond	249,793	7,395	29.6
	Direct	04/02/90	04/04/90	Imnaha Accl. Pond	114,722	2,738	23.9
	Direct	04/02/90	04/02/90	Big Sheep Creek	79,947	1,973	24.7
1989	Acclimated	03/22/91	04/09/91	Imnaha Accl. Pond	398,909	9,622	24.1
1990	Acclimated	03/30/92	03/30/92	Imnaha Accl. Pond	175,398	5,547	31.6

Brood Year	Release Type	Release Dates		Location	Number Released	Kg Released	gm/fish
	Direct	03/30/92	03/30/92	Imnaha Accl. Pond	87,188	1,832	21.0
1991	Acclimated	04/12/93	04/12/93	Imnaha Accl. Pond	157,659	4,089	25.9
1992	Acclimated	04/11/94	04/11/94	Imnaha Accl. Pond	271,353	6,810	25.1
	Direct	04/11/94	04/11/94	Imnaha Accl. Pond	167,274	3,717	22.2
1993	Acclimated	03/28/95	05/05/95	Imnaha Accl. Pond	445,670	11,091	24.9
	Direct	03/28/95	04/24/95	Imnaha Accl. Pond	144,399	3,123	21.6
1994	Acclimated	04/02/96	04/02/96	Imnaha Accl. Pond	91,240	2,242	24.6
1995	Acclimated	04/08/97	04/08/97	Imnaha Accl. Pond	50,911	1,360	26.7
1996	Acclimated	04/07/98	04/07/98	Imnaha Accl. Pond	93,108	2,005	21.5
1997	Acclimated	04/16/99	04/16/99	Imnaha Accl. Pond	184,725	4,528	24.5
	Direct	04/05/99	04/05/99	Imnaha Accl. Pond	10,242	320	31.3

9.7) Marks used to identify hatchery adults

All juvenile spring/summer chinook salmon released for this program will be Ad+CWT marked. In addition some fish will be marked with Passive Integrated Transponders (PIT tags). The number of fish to be PIT tagged will be determined in the Annual Operation Plan. The 1999 AOP calls for 23,499 Imnaha spring/summer chinook salmon to be PIT tagged, this includes a sample from each rearing pond at Lookingglass hatchery.

9.8) Unknowns

SECTION 1.0. GENERAL PROGRAM DESCRIPTION

1.0) Name of Program

Imnaha Subbasin Hatchery Summer Steelhead Program (Lower Snake River Compensation Plan)

1.1) Population (or stock) and species

Oncorhynchus mykiss, summer steelhead (stock 029)

1.2) Responsible organization and individual

ODFW Portland Staff:

Name (and Title):	**Trent Stickell**
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ODFW Regional Staff:

Name (and Title):	**Bruce Eddy, Grande Ronde Watershed District Manager**
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Other organizations involved:

US Fish and Wildlife Service
Confederated Tribes of the Umatilla Indian Reservation
Nez Perce Tribe (NPT)

1.3) Location(s) of hatchery and associated facilities:

- *Adult Collection, Holding and Spawning:*
  Adult summer steelhead are collected, held and spawned at Little Sheep Creek acclimation facility. This facility is located along Little Sheep Creek, a tributary to the Imnaha River and consists of one acclimation pond and one adult holding pond.

- *Rearing (from green-egg to eyed-egg):*
  After fish are spawned, green eggs are transferred to Wallowa Hatchery for eye-up. Wallowa Hatchery is located along Spring Creek, a secondary tributary to the Wallowa River, one mile west of Enterprise, Oregon. Site elevation is 3,700 feet above sea level (IHOT, 1995).

- *Incubation and Rearing (from eyed-egg to smolt):*
  After eye-up, fish are transferred to and reared at Irrigon Hatchery. Irrigon Hatchery is located along the south bank of the Columbia River, above John Day Dam, near Irrigon, Oregon. Site elevation is 277 feet above sea level.

- *Acclimation to release:*

  Currently, 330,000 smolts are scheduled to be transferred from Irrigon Hatchery in March and April and acclimated at Little Sheep Creek facility for at least three weeks, before being released into Little Sheep Creek.

1.4) Type of program:

Imnaha River summer steelhead stock is managed to compensate for a portion of the summer steelhead losses caused by the construction and operation of four lower Snake River dams and to support sports and tribal fisheries.

1.5) Purpose of program:

1) Compensate for summer steelhead abundance lost due to the construction and operation of Ice Harbor, Lower Granite, Little Goose and Lower Monumental dams.
2) Improve sport harvest, while minimizing impacts on naturally produced steelhead in the Imnaha River Basin (Salmon and Steelhead Stock Summaries for the Grande Ronde River Basin, 1994).
3) Broodstock maintenance to perpetuate program goals.

1.6) **Specific performance objectives(s) of program: To be addressed later.**
1.7) **List of performance Indicators designated by "benefits" and "risks": To be addressed later.**

1.8 Expected size of program:

1.8.1 Expected Releases

Current ODFW production goals for the Imnaha River subbasin summer steelhead program are:

- Release 230,000 marked smolts at 5.0/lb into Little Sheep Creek in April (Lower Snake Program Annual Operation Plan (AOP), 1999).
- Release 100,000 marked smolts at 5.0/lb into Big Sheep Creek in May (AOP, 1999).

Adult fish produced and harvested

The number of adults returning to Little Sheep Creek facility since 1990 is presented in Table 1.

Table 1. Adults returned to Little Sheep Creek and number of adults spawned, 1990 to 1998.

			Adults Passed Above the Trap			Adults Spawned		
Return Year	Origin	Adults Counted	Male	Female	Percent Wild	Male	Female	Percent Wild
1990	Wild	57	7	11		11	23	
	Hatchery	924	293	305	2.9	146	156	10.1
1991	Wild	29	6	8		4	9	
	Hatchery	366	23	18	25.5	129	121	4.9
1992	Wild	128	37 **1/**	38		27 **1/**	33	
	Hatchery	661	52	57	40.8	188	144	15.3
1993	Wild	99	17	60		4	18	
	Hatchery	1173	60	17	50.0	154	116	7.5
1994	Wild	53	21	20		12	8	
	Hatchery	141	19	17	53.2	10	94	16.4
1995	Wild	17	2	10		1	4	
	Hatchery	278	28	6	26.1	101	95	2.5
1996	Wild	48	22 **3/**	19		6	6	
	Hatchery	443 **/4**	36	32	34.0	108	153	4.4
1997	Wild	29	9	15		2	2	
	Hatchery	937	32	21	31.2	182	182	1.1
1998	Wild	33	7	18		2	6	
	Hatchery	686	44	72	17.7	192 **5/**	340	1.5

1/ Includes 12 wild males spawned and released
3/ Includes 6 wild males spawned and released
4/ Includes 22 males and 46 females outplanted to local ponds.
5/ Produced 1,598,340 green eggs.

The 1989 to 1993 summer steelhead (stock 029) brood reared at Irrigon Hatchery and released into Little Sheep Creek survived at an average rate of 0.49% and were caught primarily in tribal gillnet (Columbia Basin) and other freshwater fisheries (Lewis, 1999). The harvest rate of summer steelhead stock 029, for run years 1991 through 1996 averaged 110 per year (ODFW RFMEP, 1997).

Escapement Goals -

LSRCP compensation goals for Imnaha program is 2,000 hatchery steelhead adults to the Snake River, above Ice Harbor Dam. The current *US v. OR* wild adult escapement goals is 2,000 to the Imnaha basin (All Species Review, 1996).

1.10) Date program started or is expected to start:

The Imnaha subbasin summer steelhead program (stock 029) began in 1982.

1.11) Expected duration of program:

The program will continue indefinitely with the objective of mitigating for loss and degradation of habitat and fish passage caused by the construction and operation of four lower Snake River dams.

1.12) Watersheds targeted by program:

Summer steelhead stock 029 are released into the Imnaha River subbasin.

SECTION 2.0. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

2.2) List all existing cooperative agreements, memorandum of agreement, or other management plans or court orders under which program operates. Confirm HGMP consistency.

2.3) Status of natural populations in target area.

2.2.1 <u>Geographic and temporal spawning distribution</u>

Migrating adults enter the Imnaha basin in the spring (between February and May), and typically spawn in May.

2.2.2 <u>Annual spawning abundance for as many years as available</u>

2.2.3 <u>Progeny to parent ratios, survival data by life stage, or other measures of productivity for as many brood years as available.</u>

<u>2.2.4 Annual proportions of hatchery and natural fish on natural spawning grounds for as many years as possible.</u>

The number of adults returned to Little Sheep Creek is reported in Table 1. Since 1996, the number of wild adults returned to Little Sheep Creek has varied from eight returns in 1991 to 60 returns in 1993. The proportion of wild adults returned to the river, in relation to the proportion of hatchery adult returns, declined significantly from those wild fish returned to Little Sheep Creek in 1992, 1993 and 1994.

In 1993, spawning surveys conducted by ODFW personnel in the Imnaha River subbasin showed that 82% (14 of 17) of the observed spawners were of wild origin (NE Region Stock Status Review, 1993).

2.2.5 <u>Status of natural population relative to critical and viable population thresholds.</u>

2.4) Relationship to harvest objectives.

Direct mortality to wild/natural fish shall remain below 15% for group A steelhead runs of 75,000 or less (All Species Review, 1997). All steelhead released into Imnaha subbasin are adipose clipped, such that they are distinguishable from naturally produced fish. Only adipose fin clipped steelhead may be retained in the sport fishery.

2.4) Relationship to habitat protection and recovery strategies.

This program does not include habitat protection and recovery strategies, although habitat projects are underway in the Imnaha..

2.5) Ecological interactions

No information specific to this program is available.

SECTION 5. ORIGIN AND IDENTITY OF BROODSTOCK

5.1) Source

Broodstock is indigenous to Little Sheep Creek and has been collected at Little Sheep Creek annually since the start of the program (1982) (ODFW Steelhead Plan, 1995). Imnaha stock is the only acceptable stock for release into the Imnaha River drainage (IHOT, 1995).

5.2.1) History

Adult collection and subsequent egg-take and fry ponded since 1990 are reported in Table 2. There have been no out-of-basin transfers used to supplement egg-take and program needs. All adults needed for broodstock were collected, held and spawned at Little Sheep Creek acclimation facility. Following egg-take and fertilization, viable eggs were transferred to Wallowa Hatchery and incubated through eye-up. Eyed eggs are then transferred to Irrigon Hatchery to rear until pre-smolt, at which time many were returned to Little Sheep Creek Acclimation Pond to rear for another three-to-four weeks before release. An anomaly to the standard program occurred in 1998: 1,122,000 eyed eggs were transferred to a satellite incubation and early rearing facility. This allotment was incubated and reared for 4-6 weeks and was released as fry (39,074 into the Imnaha River and 287,511 into Big Sheep Creek).

Table 2. Adult summer steelhead collected, number spawned, number of egg transferred and fry ponded at Little Sheep Creek, 1990 - 1999. Data taken from ODFW HMIS database, and ODFW staff.

Brood Year	Collection Facility	Adults Counted	Adults Collected # Males Spawned	 # Females Spawned	 Spawning Ratio (M:F)	Egg Take (in 1,000's) *Little Sheep Cr Facility*	Egg Transfers (in 1,000's) [In/Out] *Wallowa Hatchery*	Fry Ponded (in 1,000's) [/1] *Irrigon Hatchery*	Other Stock Transfers Ponded
1990	Little Sheep Creek Trap	981	157	179	0.88	849	849 / 536	425	0
1991	Little Sheep Creek Trap	395	133	130	1.02	455	0 / 339	326	0
1992	Little Sheep Creek Trap	789	205	177	1.16	749	0 / 506	456	0
1993	Little Sheep Creek Trap	1,872	158	134	1.18	647	0 / 483	437	0
1994	Little Sheep Creek Trap	194	22	102	0.13	454	454 / 352	347	0

1995	Little Sheep Creek Trap	295	102	99	1.02	342	342 / 310	306	0
1996	Little Sheep Creek Trap	489	114	159	0.68	728	728 / 559	471	0
1997	Little Sheep Creek Trap	968	184	184	1.0	877	877 / 438	123	0
1998	Little Sheep Creek Trap	719	192	346	0.55	1,691	1,066 / 890 1,122 / 0[/2]	384 0	0 0
1999	Little Sheep Creek Trap	344	127	127	1.0	607	607 / 516	506	0

[/1] Fry are ponded and reared to pre-smolt age at Irrigon Hatchery.
[/2] In 1998, 110,000 eyed eggs were transferred from Wallowa Hatchery and 1,011,000 viable eggs were transferred from Little Sheep Creek Acclimation Pond to a satellite incubation and early rearing facility operated by the NPT.

5.2.2) Annual Size

Past hatchery escapement goals were based upon annual smolt production needs. In the recent past, a return of 383 adults was needed to meet the annual green egg-take goal (538,000) which supplied 330,000 smolts to the Imnaha River subbasin (AOP, 1999). Annual number of adults collected, spawned and used for broodstock purposes are reported in Table 3.

5.2.3) Past and proposed level of natural fish in brood stock

In 1993, egg-takes were to include a 10% wild component (NE Region Stock Status Review, 1993). Current annual operation plans call for incorporating three of every five wild adult returns and three of nine hatchery adult returns into the brood. All remaining wild fish and four of nine hatchery fish were to be released above the weir at Little Sheep Creek acclimation pond. Refer to Table 2 regarding the past number of adult wild steelhead incorporated into the hatchery broodstock. Since 1995, percent wild component has been less than 4.5%; hence, 1993 wild recruitment goals have not been met. New proposed level of natural fish in the hatchery broodstock has not been determined.

5.2.4) Genetic and ecological differences

Information specific to this program is not currently available. However, the broodstock was originally founded from the Imnaha which is expected to minimize differences between the broodstock and wild fish.

5.2.5) Reasons for choosing

Little Sheep Cr. summer steelhead were chosen as the brood source for the Imnaha River subbasin program because they are indigenous to the basin.

5.3) Unknowns:

SECTION 6.0. BROODSTOCK COLLECTION

6.2) Supporting Information:

6.2.7 Proposed number of each sex

Past hatchery goals were to have a spawning population of 383 fish (145 males and 138 females) with a 5:4 male-to-female spawning ratio (AOP, 1999). Spawning ratios for 1994 and beyond are reported in Table 3.

6.2.8 Life-history stage to be collected (e.g., eggs, adults, etc.)

Returning adults are collected for broodstock. Age composition of returning adults are three, four and five.

6.2.9 Collection or sampling design

Little Sheep Creek fish trap opens in early March and runs until fish no longer enter the trap; typically in late-May. Fish are processed and spawned every Monday and Thursday.

6.2.10 Identity -

(c) Methods for identifying target populations (if more than one population may be present).

A portion (50,000 steelhead (15% broodstock production)) of the Imnaha stock are tagged with a coded wire tag, and marked with an adipose fin clip (Ad+CWT). CWT tag data allow differing hatchery stocks to be differentiated based upon their tag code; hence, the number of out-of-basin stray adults returning to the Imnaha River drainage and alternate subbasins can be monitored.

(d) Methods for identifying hatchery origin fish from naturally spawned fish.

From 1990 to present, all hatchery steelhead reared at Irrigon Hatchery have been adipose-clipped. For 1990 and 1991 broods, approximately 27% all steelhead produced at Little Sheep Creek were adipose fin clipped prior to release. Beginning with broodyear 1992, all hatchery reared summer steelhead have been marked with an adipose fin clip.

6.2.11 Holding -

Adults are collected and held throughout the run at Little Sheep Creek acclimation facility. Adults retained for broodstock purposes are spawned on-site.

6.2.12 Disposition of carcasses - Priorities set as of 1999

All deceased adults are taken to a local landfill.

SECTION 7.0. MATING

7.6) Selection method

7.1.3 Adult Selection -

Fish are mixed and randomly selected (from early, mid and late returns) for spawning. Hatchery origin fish (adipose fin clipped) along with some wild fish are used for broodstock. Prior to brood year 1992, not all steelhead were mass marked and identifiable from wild brood. Naturally produced adults are intentionally incorporated into the broodstock.

7.1.4 Selection of Egg Take -

If the hatchery reduces the number of eggs retained, a representative sample of each male/female cross is culled. Exceptions may occur if there is a high degree of disease or epidemics associated with certain parents; if this occurs, offspring of diseased parents may be culled, in order to maximize long-term survival of the brood.

7.7) Males

Target sex ratio for this program has been a 5:4 male-to-female spawning ratio. See Table 2 for actual spawning ratios from 1994 to present. Males are held early in the run to compensate for the lack of males at the end of the run.

7.8) Fertilization

7.3.3 Fertilization Scheme -

7.3.4 Fish Health Procedures -

In addition to the Department-wide fish disease control and disease prevention programs, Wallowa and Irrigon Hatchery monitors fish health, fish and egg movement, therapeutic and prophylactic treatments, and sanitation activities (IHOT, 1995). In addition, prespawning mortality and virus monitoring plans are conducted regularly (AOP, 1999).

7.9) Cryopreserved gametes

The NPT is investigating the possibility of cryopreserving wild sperm (AOP, 1999).

SECTION 9. RELEASE

9.1) Life history stage, size, and age at release

Juvenile Releases

Table 3 shows the history of summer steelhead releases into the Imnaha River subbasin, since 1990. Summer steelhead are primarily released as age one smolts; they rear in the hatchery environment for 12-14 months. For broodyears 1990 to 1998, the size of the steelhead at the time of release has averaged:

Snake River (R-1) (1990 only)	= 57.08 fish/lb. -- Fall Release Group (grade-outs)
Little Sheep Creek (1990-1999)	= 5.31 fish/lb. (4.68 - 6.40 fish/lb.) -- Spring Release Group
	= 125.00 fish/lb. -- Fall Release Group (1999 only)
Imnaha (1990-1994)	= 6.51 fish/lb. (5.30 - 8.30 fish/lb.) -- Spring Release Group
Big Sheep Creek (1998-1999)	= 59.00 fish/lb. -- Fall Release Group (1998)
	= 125.00 fish/lb. -- Fall Release Group (1999)

Adult returns

In 1996, 34 adults were released into Marr Pond and 33 adults were released into Wallowa Wildlife Refuge. Likewise, in 1997, two wild adults were returned to the Imnaha River and in 1999. From 1990 to 1999, all wild adults in excess to broodstock needs were released back into Little Sheep Creek, above the acclimation pond.

9.2) Life history stage, size, and age of natural fish of same species

9.3) Dates of release and release protocol

Most wild smolts migrate from April through June with peak migration in May. Hatchery smolts are programmed to track these trends, and are thus released predominately in mid-to-late April. Since broodyear 1996, steelhead have been released in mid-May, in addition to April releases to maximize acclimation. In 1998, grade-outs (5,015) were released in early November, and in 1999, two groups of juveniles were released into Big Sheep Creek (90,000) and Little Sheep Creek (59,990) during early September. The fall release groups are direct release and are surplus to what is needed to meet the smolt production goal of 330,000. Details regarding the number (and pounds) of fish stocked into each designated water body is provided in Tables 3.

9.4) Location(s) of release

As seen in Table 3, since 1990, summer steelhead have been released into Little Sheep Creek, a tributary to Big Sheep Creek, and the Imnaha River. Smolt releases into Little Sheep Creek have comprised a significant portion of each broodyears' production: between 61-91%. From 1990 to 1998, all steelhead released into Little Sheep Creek were of smolt age, and were released in the spring, approximately one year after parent fertilization. Beginning in 1998 juvenile steelhead (of fingerling size) were released in the fall, after being reared in the hatchery environment for 5-6 months.

From 1991 to 1995, summer steelhead were released directly into the mainstem Imnaha River. These releases comprised approximately 15-22% of broodyear production and averaged 6.51 fish/lb (see Table 3).

Beginning in 1998, summer steelhead juveniles have been released into Big Sheep Creek during the fall. In 1998, they comprised only 1% (5,015 fish) of total broodyear production, but in 1999 this releases group increased to 90,000 fish.

Table 3. Summer steelhead releases into the Imnaha River subbasin (broodyears 1990 to 1999). All data extrapolated from ODFW HMIS database.

Brood Year	Facility	Release Date	Location	Number Released	Lbs. Released	Number/lb.
1990	Irrigon H	11/21/90	Snake River - 1	71,698	1,256	57.08
	Irrigon H	04/23/91	Little Sheep Cr.	50,581	7,903	6.40
	Little Sheep Cr.	04/23/91	Little Sheep Cr.	192,401	37,505	5.13
	Irrigon	05/01-05/03/91	Little Sheep Cr.	86,235	14,373	6.00
1991	Irrigon H	04/27/92	Little Sheep Cr.	53,372	8,586	6.10
	Little Sheep Cr.	04/27/92	Little Sheep Cr.	196,560	35,100	5.60
	Irrigon	05/01/92	Imnaha R.	28,917	3,484	8.30
1992	Irrigon H	04/28/93	Little Sheep Cr.	48,725	8,479	5.75
	Little Sheep Cr.	04/28/93	Little Sheep Cr.	237,969	43,267	5.50
	Irrigon	04/29/93	Imnaha R.	53,692	8,849	6.07
1993	Irrigon H	04/25/94	Little Sheep Cr.	47,965	9,405	5.10
	Little Sheep Cr.	04/25/94	Little Sheep Cr.	252,819	54,019	4.68
	Irrigon	04/26/94	Imnaha R.	49,767	9,390	5.30
1994	Irrigon H	04/28/95	Imnaha R.	50,676	7,369	6.88
	Irrigon H	05/01/95	Little Sheep Cr.	57,012	10,653	5.35
	Little Sheep Cr.	05/01/95	Little Sheep Cr.	230,882	45,271	5.10
1995	Irrigon H	04/15/97	Little Sheep Cr.	56,566	10,608	5.05
	Little Sheep Cr.	05/13/97	Little Sheep Cr.	268,537	49,729	5.40
1996	Little Sheep Cr.	04/15/97	Little Sheep Cr.	208,937	39,422	5.30
	Little Sheep Cr.	05/13/97	Little Sheep Cr.	118,524	23,705	5.00
1997	Little Sheep Cr.	04/26/98	Little Sheep Cr.	117,096	24,264	4.83
1998	Irrigon H	11/04/98	Big Sheep Cr.	5,015	85	59.00
	Little Sheep Cr.	04/13/99	Little Sheep Cr.	215,294	45,135	4.77
	Little Sheep Cr.	05/18/99	Little Sheep Cr.	119,378	22,107	5.40
1999	Irrigon H	09/09/99	Big Sheep Cr.	90,000	720	125.00
	Irrigon H	09/10/99	Little Sheep Cr.	59,990	480	124.98

9.5) Acclimation procedures

Currently, 330,000 pre-smolts are transferred from Irrigon Hatchery in March and April and acclimated at Little Sheep Creek facility for at least three weeks, before being released into the Little Sheep Creek. March release groups are volitionally released and April release groups are force released following a 24 hour volitional opportunity (AOP, 1999).

9.6) Number of fish released

Summer steelhead hatchery releases since 1990 brood year is reported in Table 3. Fingerling in excess to smolt production goals may be released in the fall.

9.7) Marks used to identify hatchery adults

Since 1992, all juvenile summer steelhead released for this program have been externally marked with an adipose fin clip to identify hatchery fish among all returning adults. In 1999, 50,000 fish from the Little Sheep Creek release group (15% of total release group), will be tagged with a coded-wire tag in addition to the adipose fin clip (Ad+CWT). All fall releases are adipose fin clipped.

9.8) Unknowns

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