Draft

Tucannon Subbasin Summary

February 23, 2001

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

Tucannon Subbasin Summary

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Tucannon Subbasin Summary

Background

The Northwest Power Planning Council (NPPC), an interstate compact agency of Idaho, Montana, Oregon and Washington, was established under the authority of the Pacific Northwest Electric Power Planning and Conservation Act of 1980. The act directs the Council to develop a program to "protect, mitigate and enhance fish and wildlife, including related spawning grounds and habitat, on the Columbia River and its tributaries...affected by the development, operation and management of hydroelectric projects while assuring the Pacific Northwest an adequate, efficient, economical and reliable power supply." The Act also directs the Council to ensure widespread public involvement in the formulation of regional power policies.

Under the Northwest Power Act, the Council's fish and wildlife program is not intended to address all fish and wildlife problems in the basin from all sources. But the Council adopted the vision; objectives, strategies and scientific foundation with the belief that they will complement and help support other fish and wildlife recovery actions in the region.

The Northwest Power Act directs the Council to develop its Columbia River Basin Fish and Wildlife Program and make periodic major revisions by requesting recommendations from the region's federal and state fish and wildlife agencies, appropriate Indian tribes (those within the basin) and other interested parties. As a planning, policy-making and reviewing body, the NPPC develops and then monitors implementation of the program, which is implemented by the Bonneville Power Administration, the U.S. Army Corps of Engineers, the Bureau of Reclamation and the Federal Energy Regulatory Commission and its licensees.

This program recognizes that others besides the Council are developing plans and taking actions to address these issues. In particular, the four Northwest states and the Columbia Basin's 13 Indian tribes each have fish and wildlife initiatives under way. Many of these parties already have subbasin and watershed planning initiatives under way, and are also addressing Endangered Species Act concerns.

The program's goals, objectives, scientific foundation and actions are structured in a "framework," an organizational concept for fish and wildlife mitigation and recovery efforts that the Council introduced in the 1994-1995 version of the program. The 2000 program, organized with the framework concept, is intended to bring together, as closely as possible, Endangered Species Act requirements, the broader requirements of the Northwest Power Act, and the policies of the states and Indian tribes of the Columbia River Basin into a comprehensive program that has a solid scientific foundation. The program also states explicitly what the Council is trying to accomplish, links the program to a specific set of objectives, describes the strategies to be employed and establishes a scientific basis for the program. Thus, the program guides decision-making and provides a reference point for evaluating success.

Ultimately, the NPPC will amend into the Program specific subbasin plans that are consistent with the basin wide goals and objectives the Program sets forth. The NPPC relies on subbasin summaries to provide the context for the development of subbasin plans. The subbasin assessment and

planning process will complete the Program at the subbasin level and provide the implementation plans out of which fish and wildlife projects are proposed for BPA funding to implement the Program. These subbasin summaries are an interim arrangement pending development of the new Program. Subbasin summaries are a documentation of existing assessments, plans, and other information available within each subbasin and are written by subbasin teams.

Fish, wildlife and natural resource managers comprised the membership for the development of the Tucannon subbasin summary. Core members that participated represented U.S. Forest Service (USFS), USDA Natural Resource Conservation Service (NRCS), Nez Perce Tribe (NPT), Confederated Tribes of the Umatilla Indian Reservation (CTUIR), Washington Department of Fish and Wildlife (WDFW), Washington Department of Ecology (WDOE), Columbia County Weed Board, Pomeroy Conservation District (PCD), Columbia Conservation District (CCD), and Ecopacific. Their role of the subbasin team is to provide input and expertise on the status, needs and management strategies for fish, wildlife and their associated habitats and to assure consistency with other planning efforts.

Columbia Conservation District is the Tucannon subbasin team leader ensuring the summary submitted to the NPPC includes the elements necessary to protect, mitigate, and enhance fish, wildlife and habitats.

Subbasin Description

General Description

Subbasin Location

The Tucannon River subbasin (Figure 1) is located in southeastern Washington State encompassing approximately 503-square miles (321,900 acres) of Garfield and Columbia counties. Of the subbasin's total area, the Tucannon River watershed covers 318 square miles (207,734 acres) and the Pataha Creek watershed contains 185 square miles (114,166 acres). The Tucannon River drains into the Snake River and Pataha Creek is the largest tributary to the Tucannon River (Figure 2). There are eight constructed lakes along the Tucannon River; six are filled from the Tucannon River and two are fed by springs. The mouth and lower 2 miles of the Tucannon River has become a marshland as a result of the reservoir formed by Lower Monumental Dam, 20 miles downstream on the Snake River (Kelley *et al*. 1982).

The upper Tucannon subbasin is located within the Umatilla National Forest and the Wenaha-Tucannon Wilderness (Figure 3). The middle subbasin area includes the W.T. Wooten Wildlife Recreation Area, (WDFW) and the Wooten Environmental Learning Center, a year-round full service environmental education camp. Private rangelands, along with cultivated and grazed farmlands, dominate the lower subbasin.

An estimated total population of 2,750 people resides within the Tucannon subbasin. The principal communities are Starbuck and Pomeroy, and the main marketing and trading centers of Dayton, Walla Walla, Clarkston, and Lewiston, Idaho. Agriculture is the largest contributor to the economy, followed by forest products and recreation.

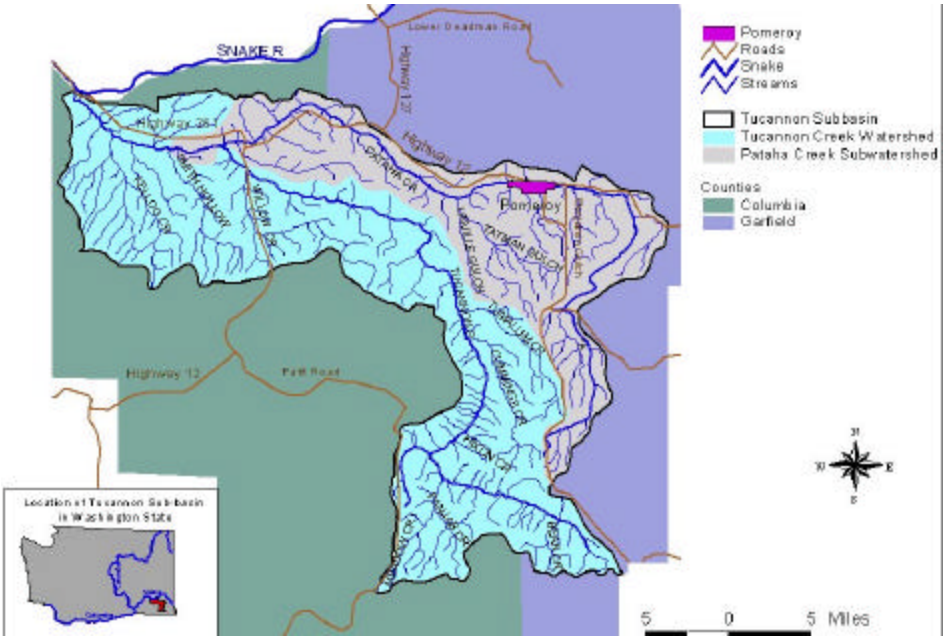

Figure 1. Location of Tucannon subbasin including towns, counties, major roads and streams (ICBEMP data source, Map by Ecopacific).

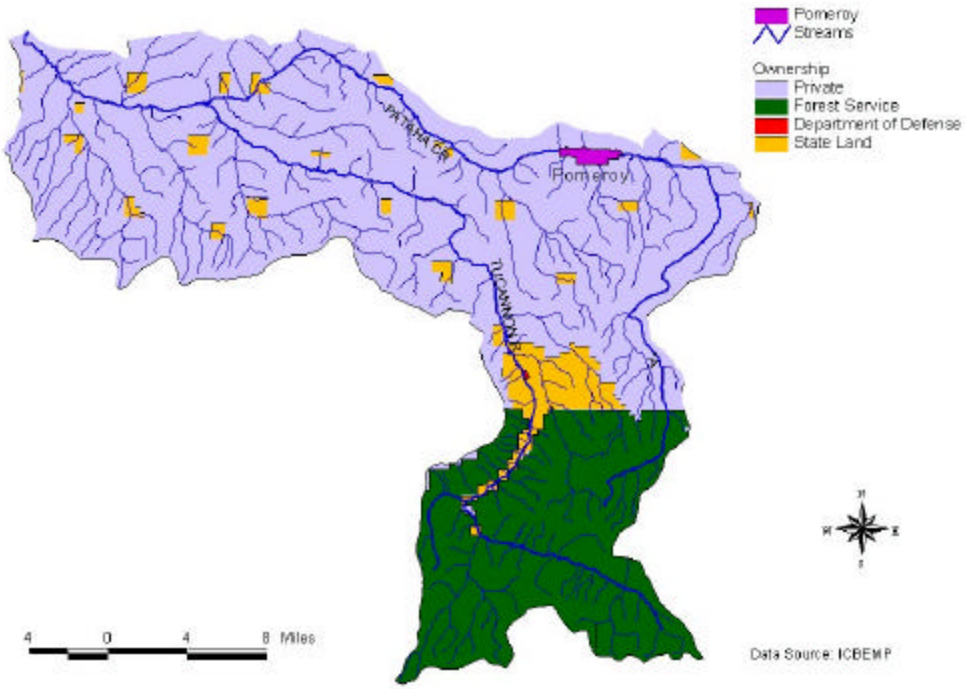

Figure 2. Land ownership within the Tucannon subbasin, Washington. (Map by Ecopacific)

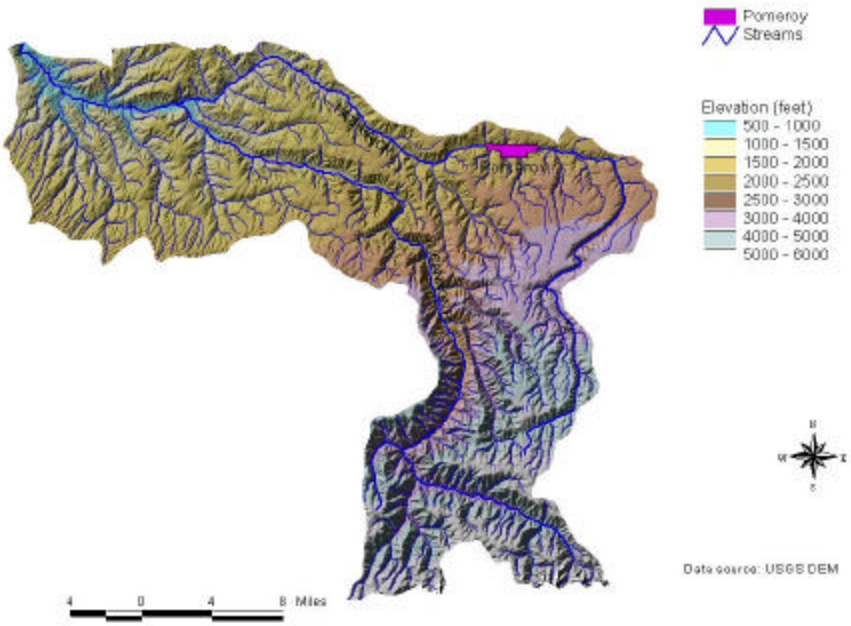

Figure 3. Elevations within the Tucannon subbasin, Washington. (Map by Ecopacific)

Drainage Area

The Tucannon River has two major drainages, the mainstem and Pataha Creek. The mainstem drains 207,734 acres (318 mi^2) and flows into the Snake River at river mile (RM) 62.2, three miles upstream of Lyons Ferry State Park, near the mouth of the Palouse River. Besides Pataha Creek, the major tributaries to the mainstem include Willow Creek, Kellogg Creek, Cummings Creek, Little Tucannon River, Panjab Creek, Sheep Creek, and Bear Creek (see Figure 1).

Pataha Creek drains 114,166 acres (185 mi^2) and enters the Tucannon River at RM 11.2. Major tributaries of Pataha Creek are seasonal streams that include Dry Pataha Creek, Sweeney Gulch, Balmaier Gulch, Linville Creek, Tatman Gulch, and Dry Hollow (see Figure 1).

Climate

The Cascade Mountains to the west, the Pacific Ocean beyond the mountains, and the prevailing westerly winds, influences the climate of the region. The subbasin receives a mean annual precipitation of 23 inches including a mean annual snowfall of 65 inches (Figure 4).

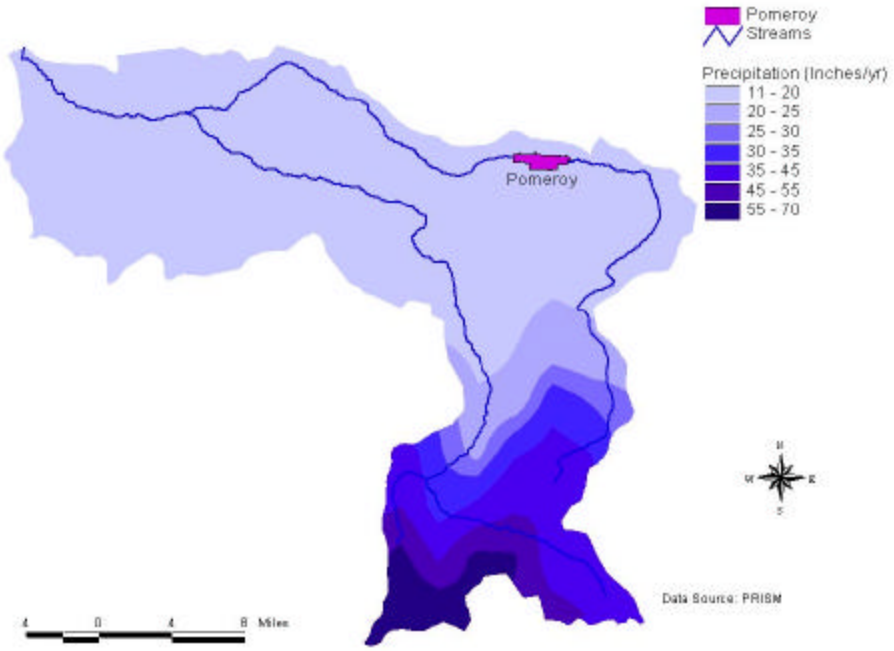

Figure 4. Precipitation trends of the Tucannon subbasin, Washington. (Map by Ecopacific)

Rainfall ranges from more than 40 inches in the higher elevations to 10 to 15 inches in the lower elevations. Ninety percent of the precipitation occurs between September and May with 30 percent of the winter's precipitation in the form of snow. Snowfall at elevations less than 1,500 feet seldom lingers beyond three or four weeks, occasionally melting quickly enough to produce severe erosion (Kelley *et al.* 1982; Fuller 1986).

The southern portion of the Tucannon River watershed is comprised of 48,149 acres of forestland. The USFS manages the Umatilla National Forest, which comprises 48,611 acres (89) percent) of the forestland in the subbasin and includes 12,000 acres of wilderness. Washington State Department of Natural Resources (WDNR) manages approximately 4,948 acres, which includes 9 percent of the forestland. Non-industrial private forestland owners and corporate forestland owners control approximately 1,108 acres or 2 percent of the forest.

The 16,728 acres managed by WDFW is mostly forested, but is not included in the forest category because it is managed primarily for wildlife habitat. Recreational use is very high on forested lands and may represent the dominant use of some forested lands, especially in the wilderness within the National Forest and on WDFW lands.

The WDFW owns and manages the 16,728-acre W.T. Wooten Wildlife Area in the upper Tucannon subbasin (WDFW 2000). These lands are used to preserve, protect, and perpetuate Washington's diverse wildlife and wildlife habitats, and to maximize the recreational and aesthetic benefits of wildlife for all citizens (RCW 77.04.055, RCW 77.12.010).

The agricultural industry utilizes most of land in the Pataha Creek watershed. Area farmlands take up over 325,000 acres (ESD, 1992) (Figure 7). Winter wheat, spring wheat and barley, and small

acreages of bluegrass seed are the major crops grown on non-irrigated cropland in the watershed. Most of the irrigated cropland, located in bottomland areas along Pataha Creek, is used for hay, small grains, and some rotation pasture. Raising cattle is also practiced in the watershed.

A total of 13,960 acres of forestland are in the southern portion of the Pataha Creek watershed. The U.S. Forest Service (USFS) manages 8,236 acres of public forest in the Umatilla National Forest, or 59 percent of the forestland. Non-industrial private forestland owners and corporate forestland owners control approximately 5,724 acres, or 41 percent of the forestland. Most of the forest is used for summer livestock grazing.

Transportation System

Road construction and maintenance have the potential to significantly impact water quality in the Tucannon subbasin. There are 150 miles of dirt, gravel, and paved roads within the Tucannon watershed. An additional 189 miles of roads are within the Umatilla National Forest. Columbia County maintains 118.5 miles of roads, and private landowners and the state maintain the rest (Gasaway 1995). Seventeen bridges span the Tucannon River, (Figure 5). Many of the bridges have been replaced since the 1964-65 floods, as well as, replacing approaches and repairs following the 96-97 floods.

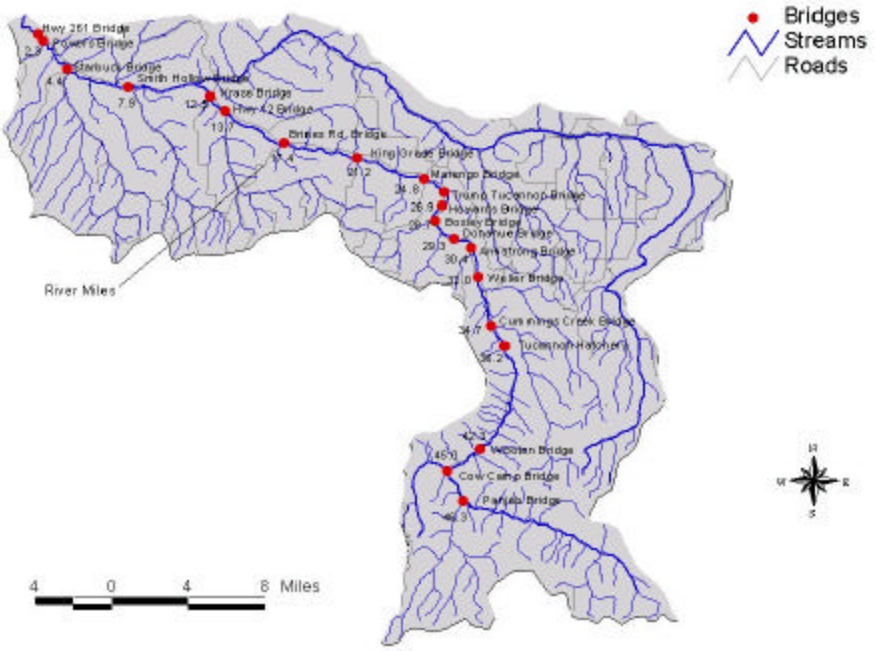

Figure 5. Bridge and River Mile locations along the Tucannon River, Washington. (Map by Ecopacific)

Pomeroy Ranger District records show that the Tucannon River watershed has a total of 152 total miles of forest road. Eighty-two miles are open year around and 70 are seasonally closed. This equates to an open road density of 0.56 miles of open road per square mile. Pataha Creek watershed has a total of 56 miles of road. Thirty-six miles are open year around and 20 are seasonally closed. This equates to an open road density of 1.37 miles of open road per square mile.

Both drainages have roads that traverse the river bottoms due to steep side slopes. Once roads connect with side drainages, there are several that climb to reach flat, rolling ridge top systems. The Forest Service is continually looking for old roads that are no longer needed for long term land management and obliterating where feasible and cost effective.

Recreation

The Tucannon subbasin affords a variety of recreational opportunities on private, state, and federal lands. Recreational activities include camping, hunting, fishing, hiking, backpacking, snowmobiling, horseback riding, bird watching, cross-country skiing, and a host of other outdoor activities.

Camping, fishing, hunting, wildlife viewing, and hiking are enjoyed by nearly 400,000 visitor days per year; during major holidays between 3,000 and 5,000 visitors enjoy the area. Recreational use is very high on forested lands and may represent the dominant use of some forested lands, especially in the wilderness area within the National Forest and on WDFW lands. Recreation, and the impacts of recreational use of forestlands, is described in further detail in other sections of this report.

WDFW currently manages seven campgrounds, averaging approximately one acre in size on state land. Implementation of the Wooten Wildlife Management Plan includes efforts to re-locate campgrounds greater distances from the stream and this will continue to occur to protect sensitive riparian zones. The Forest Service currently manages five campgrounds located near the Tucannon River. Federal planners are considering an additional campground near the Tucannon guard station, which is the oldest contract built guard station remaining in the Region 6 Forest Service System. There are approximately 50.5 miles of trail maintained for non-motorized use and 6.1 miles of trails that permit access and use by off road recreational vehicles on National Forest lands within the Tucannon watershed. Eight trailheads, located both in the bottom and along the ridge top, access many more miles of maintained trail across the District.

WDFW constructed lakes along with the Tucannon River provide the water resources for the WDFW trout stocking program in the subbasin. Prior to the listing of the Tucannon chinook, approximately 110,000 resident trout were stocked in the river and lakes annually. Presently, trout are planted only in the lakes (though they were not stocked in some lakes in 1996 and 1997 due to flood damage), and the in-river fishery has been increasingly curtailed. Salmon and steelhead smolts are also released into the Tucannon River to return as adults for the steelhead sport fishery and to maintain native runs. All of these fish are raised and supplied by the Lyons Ferry Hatchery Complex, which includes the Tucannon Hatchery.

Due to the physiography of the area, most of the recreational use occurs along the riparian area. Camp Wooten, an environmental learning center, is also located within the Wooten Wildlife Area. This 160-acre camp is leased and operated by the Washington State Parks Department. Thousands of school and 4-H children visit the camp every year to learn about natural resource conservation topics.

Pataha Creek has one dispersed campground managed by the USFS. It is composed of four camping areas, one vault toilet, several picnic tables and fire rings and a small impoundment. This low elevation campsite receives use early in the spring and late into the fall, particularly during hunting seasons.

Agriculture

Cropping systems in the Tucannon subbasin are adjusted to the precipitation available. The most common systems include summer fallow in rotation with small grains in the lower rainfall zones and annual crops in the higher rainfall zones. Alfalfa hay, corn and small grains are raised in rotation on approximately 2,835 acres of irrigated bottomlands along the Tucannon River. There is also a small amount of irrigated pasture and asparagus in these bottomlands.

Winter wheat, barley, peas, and bluegrass seed are grown on 67,930 acres of dry cropland. Winter wheat, spring wheat and barley, and small acreages of bluegrass seed are the major crops grown on non-irrigated cropland in the Pataha Creek watershed. Dry cropland is located on ridge tops that have long slopes of 10 to 45 percent. Ninety percent of the dry cropland is classified as highly erodible land.

Farming practices used in the early part of this century produced high erosion rates and resource degradation. Fields were burned and plowed and fallow was included in the rotation. Since 1950, many conservation practices have been adopted by farmers and have significantly reduced erosion rates and sediment transport. Practices such as annual cropping, crop residue use, and strip cropping have reduced erosion rates, while terraces and sediment basins have reduced sediment transport. Despite these changes, under farming conditions that were used in 1986, over 1,060,000 tons of soil was eroded from cropland fields each year by sheet and rill erosion at an average of 17 tons per acre (USDA 1986). The implementation of no-till farming using annual cropping methods and alternate crops in rotation continues to grow each year in the Tucannon subbasin. Economic conditions may be forcing the producers into this practice but at the same time, the environment is benefiting from the continued adoption of reduced tillage practices.

Rangeland

Grazed rangeland comprises 75,725 acres in the Tucannon subbasin. Livestock produced on rangeland in the Pataha Creek watershed is a major source of agricultural income. Rangeland occupies approximately 44,922 acres in the Pataha Creek watershed. Eighty-five percent of the grazed rangeland occurs on canyon side-slopes between cropland and the river valley bottom. These canyon slopes average 50 percent with a range of 20 to 100 percent. The remaining 15 percent of grazed rangeland occur as small areas inside cropland. Annual precipitation for grazed rangeland varies from 8 to 24 inches. Seventy percent of grazed range soils are over 20 inches deep.

Heavy grazing pressure, combined with a tradition of little emphasis on range management, has seriously deteriorated rangeland condition (SCS 1991). Range transects conducted since a 1991 survey has confirmed the degraded condition of rangeland in the subbasin (Smith 1995). Native bluebunch wheatgrass, *Agropyron spicatum*, and Idaho fescue, *Festuca idahoensis*, as well as a variety of forbs dominated the original native plant communities. Few shrubs were present in these plant communities except on moist north and east slopes and in riparian areas. Bottomlands were dominated by basin wildrye, *Leymus cinereus*, with a mixture of shrubs and cottonwood, *Populus trichocarpa*, becoming dominant in and near the moist riparian zone.

The U.S. Forest Service (USFS) regulated grazing on the Tucannon Allotment in 1939. In 1967 merging the Tucannon, Pomeroy, and Charlie-Pataha Allotments formed the Pomeroy Allotment. This merger was made to improve deteriorating range conditions in the upper reaches of the Tucannon subbasin. Since the merger, the upper reaches of the Tucannon within the Pomeroy allotment have not

been grazed (USFS 1994) and there has not been livestock grazing in the Tucannon bottomlands since 1996. Efforts have been made below federal lands to encourage streamside management through fencing, off-site water source development, and water gaps.

In Pataha Creek, the riparian area is fenced, and although there is an active allotment on federal lands, the permittees have been cooperating by monitoring forage utilization, and riding on a regular basis to keep cattle out of the riparian area. On federal lands in Pataha Creek there are still many opportunities to reduce effects on streamside vegetation and stabilization.

The present plant production potential on upland rangeland varies from about 400 pounds of air-dry herbage per acre to over 2,200 pounds per acre. Production on bottomlands can be as much as 5,000 pounds per acre.

In 1981 about 69 percent of the private rangeland was in poor to fair condition (USDA SCS 1982). Mediterranean annuals such as cheatgrass, *Bromus tectorum*, Japanese brome, *Bromus japonicus*, and medusa-head ryegrass, *Taeniatherum caput-medusa*, dominate the vegetation. Noxious weeds, including yellow starthistle, *Centaurea solstitialis*; musk thistle, *Carduus nutans*, and knapweed, *Centaurea spp.*, are invading the areas of better soils, which are in poor to fair range condition. The production of desirable forage plants varies from about 10 to 50 percent of the potential, depending on condition. Bottomlands that remain in rangeland are in extremely poor condition and are dominated by annual and biannual weeds. Production of these bottomland areas is less than 10 percent of potential (USDA SCS 1982).

Topography/Geology

Elevations in the subbasin range from 540 feet at the confluence of the Tucannon and Snake Rivers to 6,400 feet at Oregon Butte in the Wenaha-Tucannon Wilderness located in the Umatilla National Forest. Long slopes intersected by steep canyons characterize topography in the Tucannon subbasin. Most of the non-forested land with slopes of 45 percent or less is under cultivation.

The Tucannon River drains the Blue Mountains, a broad anticline arch uplifted during the last 20 million years. The Blue Mountains are comprised of a core of Paleozoic and Mesozoic metamorphic rocks mantled by flows of the Columbia River Basalt Group. The bedrock of the Tucannon watershed consists nearly entirely of lava flows 6 to 16.5 million years old (Miocene) and belongs to the Grande Ronde and Wampum formations. The flows are composed of black to dark gray basalt of basaltic-andesine. Average flow thickness is about 90 to 120 feet (Columbia Basin System Planning 1990).

Once the Columbia River Basalts ceased to flow, the area climate became colder. Fine glacial and erosion material carried by wind was deposited as eolian (wind blown) silt and sand. This combination is commonly known as loess and covers much of eastern Washington State. This loess caps the basalts and ranges in thickness from 200 to 300 feet.

With the cold climate, glaciers in northeastern Washington dammed up drainages and formed large lakes. When these ice-dam lakes breached, the land was flooded, leaving a scoured landscape with deposits of slack water clays (rhythmites) and cobble to boulder-size material. These deposits occur in the lower reaches of both Pataha Creek and the Tucannon River. Landslide and gully wash deposits are evident at the mouths of canyons. This material eventually moves down slope into the major drainages.

One of the most notable geologic features in the Tucannon subbasin is the Hite Fault. This fault system forms the western margin of the Blue Mountains between Pomeroy, Washington and Pendleton, Oregon, and has been the focus of many historic earthquakes (U.S. Department of Energy 1988). This fault is 135 kilometers (83.9 miles) in length and crosses both the Tucannon River and Pataha Creek at right angles. The Hite Fault is still active and may be the cause of elevated ground water temperatures well above the standard geothermal gradient recorded in local wells (Covert *et al.* 1995).

Settlement History

The Tucannon River valley is rich with Native American and homesteading history. The Tucannon subbasin is part of the aboriginal range of the Nez Perce, Walla Walla, Cayuse, and Palouse Tribes. The tribe that most frequently inhabited the Tucannon watershed was the Palouse Tribe (Trafzer and Scheuerman 1986).

The Tucannon River is the western boundary of ceded land to the Nez Perce in the Treaty of 1855 (Josephy 1965). The river is also the northern ceded territory boundary for the Cayuse, Umatilla, and Walla Walla Tribes and the site of a number of skirmishes between the Cayuse and American soldiers during the Cayuse War of 1848 (Ruby and Brown 1972). The tribes have retained the right to take fish at all usual and accustomed places and to hunt, gather, and pasture livestock on open and unclaimed land.

The Tucannon River valley, and associated valleys, provided natural pathways for traffic between Walla Walla and Lewiston. The existing road system was largely developed from these pathways. Homesteading settlement began in the 1860's near the confluence of the Tucannon and Panjab Creek. Diverse agriculture production, sheep and cattle management, and logging were the main means of living, along with low yield mining of gold, silver and copper ore.

The Washington State Historical Preservation Archaeologist is consulted on archaeological resources prior to project activities. The Nez Perce Tribe agrees that professional cultural resources surveys are conducted prior to project activities.

Hydrology

Precipitation and ground water augmentation (ground water that flows directly into the river) provide the only water sources that form the Tucannon River and associated tributaries. Measurements taken by Washington Department of Ecology (WDOE) in 1994 suggest that virtually all of the base flow in the Tucannon watershed comes from ground water discharge. Summer thundershowers elevate stream flow for only short periods of time. These measurements also indicate that the Tucannon River is a gaining stream throughout its length (Covert *et al.* 1995).

Melting snow in the Blue Mountains of the Umatilla National Forest provides much of the annual runoff in the Pataha Creek watershed, producing peak flows in May or June. Severe runoff events lead to sediment problems in Pataha Creek and lower Tucannon River. On occasion, Bihmaier Springs provides approximately one half of the flow to Pataha Creek during the summer months if mountain snow pack is less than normal and drought conditions persist during May and June. Some sections of Pataha Creek have been known to go subsurface during periods of drought conditions.

Stream Flow

Forty-one years of stream flow data have been recorded for the Tucannon River from gauge number 13344500, located 3.3 miles downstream from the mouth of Pataha Creek (USGS 1994). The area drained is approximately 431 mi^2. A maximum discharge of 7,980 cubic feet per second (cfs) was recorded on December 22, 1964, while the minimum stream flow recorded was 15 cfs on July 11 and 12, 1930. The 1990 water year was the lowest Snake River flow on record, and the maximum flow in the Tucannon River was 462 cfs on May 6, with a minimum of 38 cfs during August 14-16th. It appears that the mid-reach of the Tucannon River in 2000 was a losing reach. In its first year of data collection, the CEEd (2001) documented that the Tucannon River experiences greater summer base-flows at the USGS gauge station near RM 9 than at mid-reaches (Marengo) upstream from that location. Stream flows in upper reaches near the Hartsock area have greater flows than the mid-reach at Marengo.

A frequency analysis of annual peak flows from the area above the gauge is displayed in Table 1 for the sampling period of October 1914 to September 1917, August 1928 to September 1931, and October 1958 to September 1990. The lowest mean monthly flow was during the month of August for all years, and the highest mean monthly flow was during the month of May (Table 2). The mean annual flow at the gauge was 166.3 cfs.

Table 1. Peak Flows: Tucannon River, near Starbuck, Washington (River Mile 7.9).

Frequency	2 years	5 years	10 years	25 years	50 years	100 years
Flow	1,490 cfs	3,120 cfs	4,540 cfs	6,690 cfs	8,560 cfs	10,600 cfs

Table 2. Mean monthly flows: Tucannon River (River Mile 7.9).

Month	January	February	March	April	May	June
Flow	218.6	270.6	248.9	275.0	298.0	200.6
Month	July	August	September	October	November	December
Flow	84.1	61.2	70.4	8223	108.3	163.7

In 1994, the Washington Department of Ecology (WDOE) established several river transects and made accurate flow measurements to determine whether the Tucannon River was a “gaining” river - a stream recharged by ground water. Covert *et al.* (1995) observed during the summer of 1994 that the baseflow, summer low flow, of the Tucannon River comes primarily from groundwater. This flow averages 60 cfs (adjusted for the estimated irrigation influence) at U.S. Geological Survey (USGS) gauge number 13344500 and 30 cfs at the Tucannon Hatchery. At river mile (RM) 9 in 2000, the Tucannon River had a base flow of 47 cfs (CEEd 2001). Between 1976 and 1984, the average flow at that point was 57 cfs. MacIntosh (1989) states “It was estimated in the tailrace of the Starbuck dam (located about RM 7) in 1935 that the discharge was 60 cubic feet per second. The section of the river between the power house intake and outlet is virtually dry during the summer.” Tailrace volume and instream volume, added together, was at least 65 cfs during the summer of 1935. Currently, the long-term average flow at that location is 61 cfs (Table 2); since 1935, there appears to be no significant

long-term change in the amount of water in the Tucannon River. The State of Washington has already issued water rights that would allow the removal of a total of 60 cfs of surface water from the Tucannon River.

The Center for Environmental Education (CEEd) at Washington State University (WSU), has been conducting an ongoing water quality monitoring project on the Tucannon River and Pataha Creek since September 1998. One of the parameters they have been measuring is stream discharge. The discharge rates for the Tucannon River have ranged from 35 cfs to 750 cfs (measured at Station 4 in May 1999, during a storm event) (CEEd, 1999).

Pataha Creek does not have any current USGS gaging station to record continuous stream flow. The WDOE has monthly flow measurements from water year 1996. Washington State University's Center for Environmental Education (CEEd) began taking monthly discharge measurements in September 1998 and continues to do so. Flow measurements near the confluence of Tatman Gulch at Marengo Road Bridge ranged between 5 to 27 cfs during September 1998 to March 1999 (CEEd). The flow data shows that peak flow in the Pataha Creek mostly occurs either during winter or spring snowmelt periods.

Temperature and pH were significantly affected when flows were below 9 cfs. Flow augmentation through water storage in the upper portion of the watershed would increase summer flows and decrease water temperatures. Such low flows have adversely affected the fish and other aquatic habitat conditions in the watershed. While Pataha Creek itself is characterized as having fair to poor fisheries enhancement potential, it contributes significantly to the water quality of the Tucannon River (Mendel 1981).

Water Demand

The WDOE records for the subbasin indicate 68 State-issued surface water rights and 54 State-issued ground water rights. The instantaneous flow and annual volume of water diversion for active permits and certificates are summarized in Table 3 (Covert *et al.* 1995).

Table 3. Water rights: Tucannon subbasin, Washington.

Water Source	Flow (cfs)	Volume (acre-ft/year)	Irrigated acres
Ground	24	6,922	1,177
Surface	60	4,982	1,147

Of the subbasin totals, the surface water rights existing on Pataha Creek constitute a total of 3.08 cfs, (658.1 acre-feet per year), for irrigation of 204.1 acres.

Since 1995, the WDOE completed processing pending applications in the Tucannon subbasin. All new water right applications have been denials, except for one approval for in-house domestic supply on Pataha Creek. As of December 2000, the WDOE had one pending surface water application on file within the subbasin requesting 0.67 cfs and 485 acre-feet per year.

Claims: WDOE records show 766 water right claims on file. Claims may represent valid water rights, but the extent, priority, and validity of these claims can only be determined through a superior court process known as a general adjudication. The WDOE has limited legal authority to regulate

claims. Subbasin adjudication would provide some degree of certainty as to the legal authorization to divert surface waters and allow the WDOE to better manage surface and ground water allocations.

Most water rights issued by the State of Washington have been assigned a water duty equivalent to that recommended by the *WSU Irrigation Research Bulletin XB-0925* (James *et al.* 1982). However, the claims filed by individuals during the claims registry period were not always consistent with this seasonal guide, and the annual and instantaneous quantities filed were, in many cases, incorrectly stated. In an attempt to realistically quantify the annual duty for the 766 claims on file with the WDOE, a water duty of 3.69 acre-feet per acre was assigned to each of the irrigated acres. Domestic and stock water uses were assigned 2 acre-feet per year (Table 4).

Table 4. Water claims to date: Tucannon subbasin, Washington.

Water Source	Flow (cfs)	Volume (acre-ft/year)	Irrigated acres
Ground	11	1,246	156
Surface	137	24,575	6489

According to the WDOE, a large percentage of the claims were invalid because they did not meet the statutory requirements of the Claims Registration Act. The Superior Court of Garfield County, on June 28, 1915, entered a decree adjudicating surface water claims on Pataha Creek. While the decree did not specify the amount of water that may be diverted, the Court did require that all diversions for purposes other than stock water and domestic use on the lands affected by the decree cease between July 1 and October 1 of each year. Irrigation diversions were allowed to continue through July 15, provided sufficient flows are available to satisfy all existing rights, after which such diversions are not to begin again until October 1 (Jackson *et al.* vs. Owsley *et al.* 1914). The lack of specificity regarding water allocations to individuals involved in this case has made it difficult to implement its provisions.

Actual Water Use: To date, a total of 232 cfs in State-issued rights and claims registries have been allocated for surface and ground water within the Tucannon subbasin. These figures represent "paper" water rights. Actual quantities diverted under authority of the rights and claims are unknown, although estimates have been made.

In 1995, there were 30 known irrigation pumps lifting water from the Tucannon (Blomgren 1995). Using estimates of net positive suction head, operating head, and operating efficiency, it is possible that these pumps are capable of diverting 34 cfs from the Tucannon River. However, it is unlikely that all the pumps would operate at the same time.

Very small acreages of pasture, hayland, and cropland are irrigated from small pumps located in the mid-section of the Pataha Creek watershed. There are water rights claims indicating a potential for 699 irrigated acres within the Pataha watershed. A stream inventory of Pataha Creek found 17 pumps capable of diverting 5.89 cfs (PCD 1998). None of the irrigation systems in the Pataha Creek watershed have been evaluated for efficiency, but based on the results from evaluations done on the Tucannon River there may be an opportunity to improve efficiency by 10 to 20 percent (James *et al.* 1982).

Minimum Flows

In 1949, the Washington State Legislature amended the fisheries code (Chapter 75.20 RCW) to require consultation between state agencies managing fish and water resources. In 1972, the State Department of Fisheries recommended that any new water right issued on the Tucannon River be conditioned to a 50 cfs low flow near the mouth of the Tucannon, and that no new permits be issued upstream from the confluence of Cummins Creek with the Tucannon. This recommendation led the WDOE to condition or deny all subsequent water right applications.

Using the Instream Flow Incremental Methodology (IFIM), the WDFW, on April 12, 1995, recommended minimum flows at gauge number 13344500 (Table 5). Any water right issued after April 12, 1995 is subject to the recommended minimum flows. Except for several exceptionally wet years in the 1970's, the lowest mean flows over seven consecutive days were below the IFIM recommendation almost every year. River flows are below the recommended IFIM flows more than 50 percent of the time during late July, August, and early September (Covert *et al.* 1995)

Table 5. WDFW recommended minimum streamflows at USGS gauge number 13344500, Tucannon River, Washington.

Time Period	Recommended Minimum Flow (cfs)
December 1 - February 28	75
March 1 - June 14	105
June 15 - August 14	75
August 15 - November 30	85

Water Quality

The water quality of streams and rivers is one of the foremost concerns for protecting fish habitat. In the State of Washington water quality criteria are scientifically determined values that imply suitability for a particular beneficial use such as fish rearing, irrigation, drinking water, and recreation.

The 1997 Washington State Administrative Code (WAC) 173-201 A-030 list several criteria for determining a stream classification. Physical, chemical, and biological parameters commonly used to evaluate water quality are pH, temperature, dissolved oxygen (DO), nutrient concentrations (nitrogen and phosphorus in their various forms), turbidity, fecal coliform, toxics and benthic invertebrate diversity (see Appendix A). Washington Department of Ecology (WDOE) is currently in the Public Comment Period of a rule that will alter the state's Surface Water Quality Standards. Appendix B details WDOE's proposed changes to the surface water quality standards.

Below is Washington's current criterion for stream classification:

- Class AA (extraordinary) is water of extraordinary quality that uniformly surpasses all requirements for characteristic uses (i.e., domestic needs and salmonid migration).
- Class A (excellent) is water of excellent quality that surpasses all requirements for characteristic uses but does not meet Class AA's stricter standards.
- Class B (good) is water of good quality that meets or exceeds the requirements for most uses.

- Class C (fair) is water of fair quality that meets or exceeds requirements for selected or essential uses.

WDOE lists the Tucannon River, Pataha Creek, and their tributaries outside the Umatilla National Forest, as Class A (Excellent) surface waters. Waters within the National Forest are considered Class AA (Extraordinary). According to WDOE, both classes of water "shall meet or exceed requirements for all beneficial uses."

Total Maximum Daily Load (TMDL) & 303 (d) Listing

The federal Clean Water Act of 1972 requires states to establish and administer numeric and narrative standards for specific pollutants in water bodies. When water bodies do not meet these standards, the Clean Water Act requires states to identify them on a list (303d List), which is now accomplished every four years (recently changed from every 2 years). Total Maximum Daily Loads (TMDLs) are then required to be developed for each water quality standard not met for each impaired water body.

In Washington, TMDLs are developed on a five-year rotating watershed-based process where watersheds are divided into Water Quality Management Areas (WQMAs). Each year several WQMAs undergo the TMDL scoping process. The Upper and Lower Snake River WQMAs in eastern Washington are currently undergoing WDOE's 2001 scoping process. The entire Tucannon River and Pataha Creek are being considered for TMDLs in the Upper Snake WQMA.

Tucannon River

The Tucannon River is on the current 1998 303(d) list of impaired water bodies for temperature for the segment that extends from the mouth at the Snake River to Tumalum Creek at river mile (RM) 32.7 (see Figure 1). WDOE is proposing to establish a temperature TMDL for this segment for the 2001 watershed cycle. Tumalum Creek is referenced as being descriptive of the defined Tucannon water body segment that is impaired.

The Tucannon River was also listed on the 1996 303(d) list for temperature. Ten excursions that were found beyond state water quality criterion out of 38 samples (26%) at WDOE's Powers Bridge ambient monitoring station (River Mile 2.3), between September of 1991 and September of 1996, resulted in the listing. Table 6 summarizes the monthly ambient stream monitoring results from the Powers Bridge station between 1974 and 1995 (see Figure 5).

The Tucannon River was previously listed on the 1996 303(d) list for fecal coliform exceedance based on one excursion at Powers Bridge station. The Tucannon River was not listed again in 1998 because the data (from WDOE samples taken between 1991 and 1996 at Powers Bridge) did not meet the criterion for listing.

Pataha Creek

Pataha Creek is on the 1998 and 1996 303(d) list of impaired waters for fecal coliform bacteria. WDOE is proposing a bacteria TMDL on the segment of Pataha Creek from the mouth at the Tucannon River (RM 11.2) to the headwaters for the 2001 watershed cycle.

WDOE's Limited Class II water quality inspection of the Pomeroy Wastewater Treatment Plant (WWTP), and the receiving water study on Pataha Creek (Cusimano 1992), was the basis for listing consideration. Grab samples were taken by the WDOE in 1980, 1989 and 1992 between RM 18.9 and RM 28.0 to determine if effluent from the Pomeroy Wastewater Treatment Plant (WWTP). Two excursions exceeding the upper bacteria criterion were observed and documented on October 15th and

16th, 1991, and at RM 22.9, 150 feet below the Pomeroy WWTP outfall. The effluent did not affect downstream temperature, but it did lower the dissolved oxygen (DO) and pH levels and raised the nutrient level of the stream (Cusimano 1992).

A WDOE ambient monitoring station (35F070) located at Archer Road (RM 5.2), in the lower reaches of the Pataha River above the confluence of Chard Gulch, provided sampling data for water year 1997. From 1993-1995 the U. S. Forest Service measured turbidity, dissolved solids, suspended solids and conductivity in the headwaters of Pataha Creek near Forest Road 040 in the Blue Mountains.

Table 6. Summary of monthly ambient stream monitoring data taken at Powers Bridge, (RM 2.3) Tucannon River, Washington, 1974-1995.

PROPERTY/ CONSTITUENTS	90-PERCENTILE VALUES	50-PERCENTILE VALUES	10-PERCENTILE VALUES	RANGE	CLASS A STREAMS	CLASS AA STREAMS
Stream temperature (203)	18.0	10.2	3.6	0.0 - 25.3	18.0	16.0
Dissolved oxygen (198)	13.0	10.8	9.1	4.1 - 16.1	8.0	9.5
DO Saturation percent (196)	106.3	98.4	90.2	33.0 - 167.5	110.0	110.0
Turbidity (191)	78.0	7.0	2.0	1.0 - 680.0	5[1]	5[1]
Fecal coliform (182)	346.0	74.0	20.0	2.0 - 3900.0	100[2]	50[2]
pH (201)	8.2	7.8	7.1	6.8 - 9.0	6.5 - 8.5	6.5 - 8.5
Ammonia, total as N (191)	.130	.026	.010	0.005 - 0.799	-[3]	-[3]
Nitrate, as N (78)	.545	.175	.040	0.010 - 0.76	none[4]	none[4]
Streamflow (195)	325.0	119.0	60.0	33.0 - 690.0	none	none
Conductivity (202)	169.0	141.0	105.0	75.0 - 500.0	none	none
Suspended solids (160)	111.0	20.0	6.0	1.0 - 1900.0	none	none
Chemical oxygen demand (29)	31.0	10.0	4.0	4.0 - 79.0	none	none
Nitrite+Nitrate as N (83)	.458	.150	.070	0.006 - 1.5	none	none
Phosphorus, total as P (188)	.213	.080	.050	0.010 - 1.9	none	none
Orthophosphate, dissolved as P (189)	.080	.041	.023	0.0010 - 0.140	none	none
Alkalinity as calcium carbonate (25)	73.6	57.0	36.6	28.0 - 78.0	none	none

90-percentile value indicates that 90 percent of the values were less than or equal to the listed value;
50-percentile value indicates that 50 percent of the values were less than or equal to the listed value;
10-percentile value indicates that 10 percent of the values were less than or equal to the listed value;
Concentrations are expressed in milligrams per liter except as follows:

Stream temperature in degrees Celsius
Stream flow in cubic feet per second
Turbidity in NTU (nephelometric turbidity units)
Conductivity in micromhos per centimeter at 25 degrees Celsius
pH in standard units

[1] Not to exceed 5 NTU above background levels
[2] Geometric mean not to exceed 100 and 50 colonies per 100 milliliters for Class A and Class AA waters, respectively.
[3] For groundwater - 10 mg/l; no State standard for surface waters
[4] State standard varies with temperature and pH
Source: WDOE, Environmental investigations and Laboratory Services Program, Olympia, Washington [1992 version updated by Hopkins (1995)

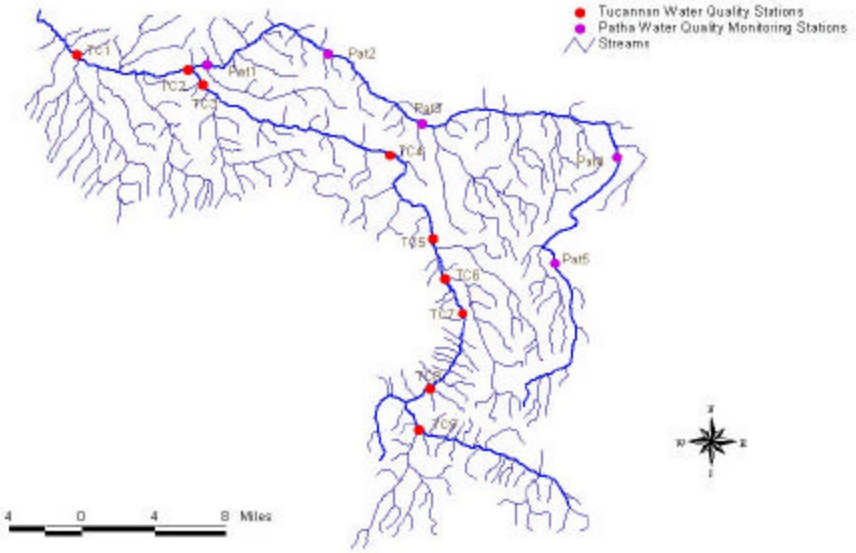

Figure 6. Center for Environmental Education (CEEd), Washington State University, water quality monitoring stations in the Tucannon subbasin, Washington. (CEEd, 1998)

Other Water Quality Monitoring Efforts

Beginning in April 1999, the Center for Environmental Education (CEEd) at Washington State University (WSU), has been conducting an ongoing water quality monitoring project on the Tucannon River for the Columbia Conservation District. The project will be concluded in March 2001.

This project includes sampling at nine stations (Figure 6) for suspended sediments, temperature, stream discharge, and coliform levels every two weeks. Rain events are monitored accordingly. Ammonia, nitrate, total Kjeldahl nitrogen, and total phosphorus parameters were sampled every two months for the first year and a half.

The Pomeroy Conservation District (PCD) identified Pataha Creek as water quality impaired in 1998 due to high stream temperatures, bacteria levels and turbidity during periods of runoff. PCD contracted with the CEEd to conduct water quality monitoring on the Pataha Creek from September 1998 to June 2001. Suspended sediments, temperature, discharge and coliform levels are sampled every two weeks at five stations. Rain events are monitored accordingly. Ammonia, nitrate, total Kjeldahl nitrogen, and total phosphorus were sampled every two months in the first year and a half. A Macroinvertebrate Community Analysis was done for Pataha Creek and the Tucannon River from fall 1998 to fall 1999. Table 7 summarizes parameter averages for the CEEd Pataha stations from 1998 to 2000.

Table 7. Pataha Creek water quality averages from September 1998 through November 2000, (CEEd, 2000).

Sample Date	Fecal Coliform (cfu/100ml)	Total Suspended Solids (mg/L)	Temp (deg C)	Temp (deg F)	Ammonia (ppm)	Nitrate (ppm)	Total Kjeldahl Nitrogen (ppm)	Total Phos (ppm)	Discharge (cfs)
Pataha #1	315.0	50.3	11.1	52.0	0.3	0.3	1.0	0.3	13.8
Pataha #2	456.2	53.7	10.7	51.2	0.2	0.7	1.0	0.1	
Pataha #3	788.9	44.4	10.4	50.7	0.3	0.9	1.2	0.3	14.3
Pataha #4	474.3	66.7	7.7	45.8	0.3	0.2	1.2	0.2	
Pataha #5	380.0	17.7	6.2	43.1	0.2	0.0	0.6	0.1	7.6

Temperature

Water temperature controls the diversity of aquatic life that resides in a stream, and influences the metabolism, behavior, and mortality of fish and other organisms in their environment. Average temperatures above 64.4 °F (18°C) are commonly associated with severe infections and potentially catastrophic outbreaks of many fish diseases (Hicks 1999).

Tucannon River

Surface water from the Tucannon River is diverted to six of the eight artificial lakes on the W.T. Wooten Wildlife Area. Water passes through the lakes and returns to the river. During the summer months the water returning to the river is warmer than the diverted water, exacerbating water temperature problems experienced in the Tucannon River.

Elevated water temperatures were first documented as a limiting factor for Tucannon River salmon production in 1981 (Mendel). Figure 7 shows the average daily maximum, minimum and median water temperatures, and their relationship to the “zone of critical temperature”, based on samples taken by WDFW between July-August, 1986-1994 (TRMWP, 1997). Since 1986 WDFW and the USFS have used self-recording devices to measure water temperatures at various locations in the Tucannon River drainage (see bridge Figure 5).

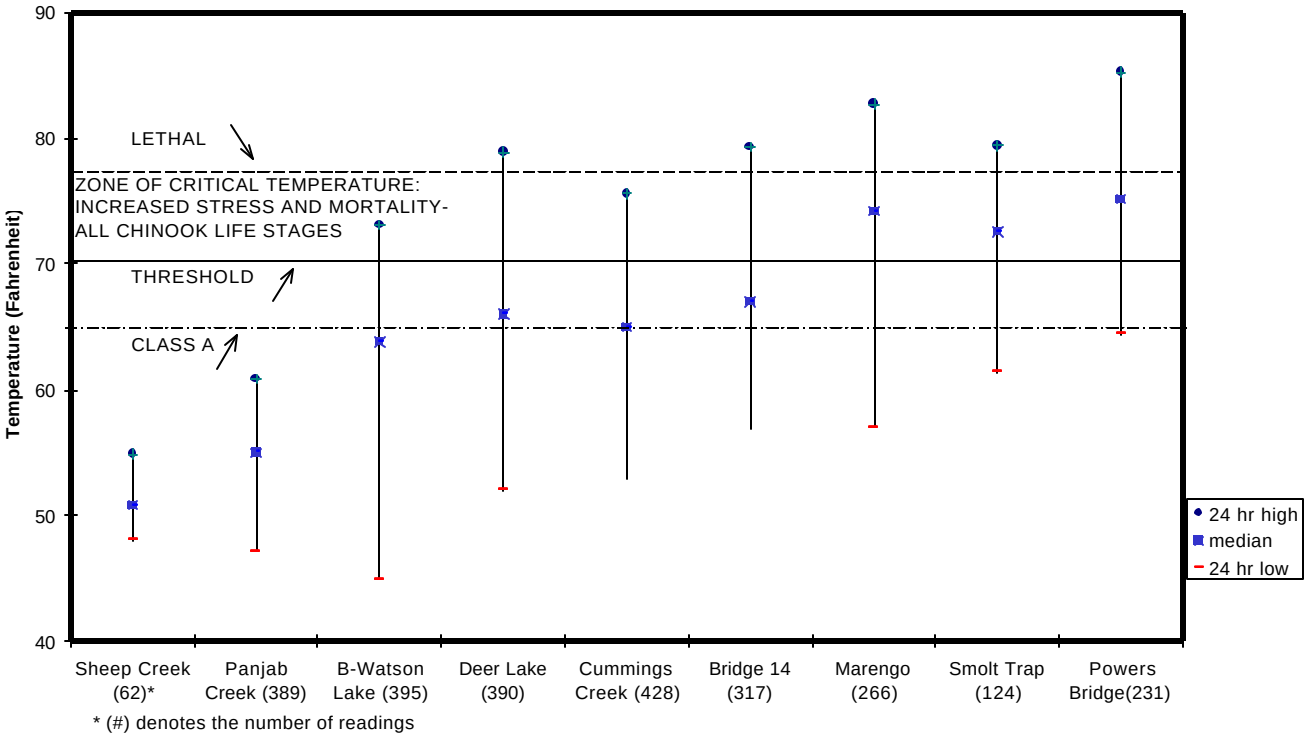

Figure 7. Zone of Critical Temperature for the Tucannon River, Washington, July and August, 1988-1994 (WDFW & USFS). (Tucannon MWP, 1997)

Tucannon River spring chinook start spawning when temperatures drop below 60°F (15.6°C) (Edson 1960). Mendel *et al.* (1993), and Burck *et al.* (1980), noted that few juveniles were found in sections of the Tucannon and John Day Rivers where the maximum daily water temperature exceeded 73°F (22.8°C) and 74°F (23.3°C), respectively. Since 1986, the average temperature for the Tucannon River has risen to 65°F (18.3°C).

Beginning in 1992, the WDFW began surveying the Tucannon River prior to the September spawning season to locate radio-tagged spring chinook adults that were holding downstream of known spawning areas. In the 12-mile section between Marengo and the Deer Lake outlet (Figure 8), they found 81 carcasses of adult fish that had died before they could spawn. These losses occurred during the time of year when the water temperature had risen into the zone of critical temperature. During the same time period in 1993, WDFW counted 56 un-spawned Chinook carcasses, even though the water temperature was noticeably cooler than in 1992.

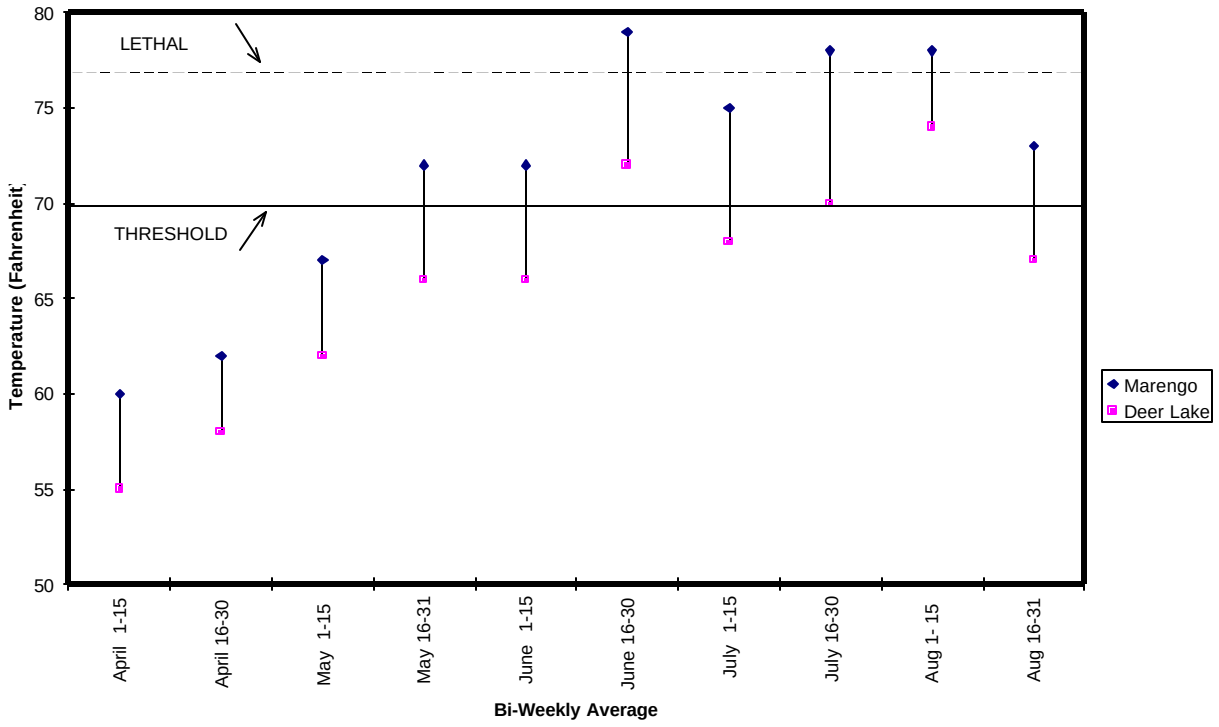

Figure 8. Bi-weekly averages of daily maximum temperatures in adult holding areas (RM 25-37) prior to spawning in the Tucannon River (1992). (Tucannon MWP, 1997)

All of the temperature data for the Tucannon River from June 1986 to August 1994 was reviewed and grouped by river segments designated by WDFW in 1990. The relative importance of each of the strata; Lower Stratum (RM 0.0-11); Marengo Stratum (RM 11-26); Hartsock Stratum (RM 26-34); HMA Stratum (RM 34-47); and Wilderness Stratum (RM 47-53)] for salmonid fish is shown in Table 8 (also see Figure 5 for bridge locations).

Wilderness Stratum (Sheep, Panjab sites) - The river at Sheep Creek, near RM 50 at 3,500 ft. elevation, is the upper limit of spring chinook spawning and rearing in the Tucannon River. The average channel width is 25 ft. (Bumgarner *et al.* 1994) with good riparian vegetation and adequate shading.

The temperature data at the Panjab and Sheep Creek sites is similar but differences possibly related to increasing channel width and lower elevation are evident (Table 9). The air temperature rises 5.5°F (-14.7°C) for every 1,000-ft. drop in elevation (National Wildfire Coordinating Group 1981).

From 1986-1994, the Tucannon River temperatures at the Panjab site exceeded the Class AA temperature standard only 17 percent of the time. During that time, the Class A standard was exceeded only 3 days. Conversely, during the winter of 1988, the river in the Sheep Creek area froze for 34 days, but remained above freezing at the Panjab site. Only five days of freezing have ever been recorded at

the Panjab site. There have been many more winter readings taken at the Panjab site than at the Sheep Creek site.

In 1994, 71.6 juvenile chinook per 100 m^2 (33 percent) were found in side-channel rearing areas.

Table 8. Comparison of Spring Chinook salmon redd densities in redds/km (redds/ha) and total redds by stratum and year, Tucannon River, Washington, 1990.

Stratum	1985 redds/ km (/ha) redds	1986 redds/ km (/ha) redds	1987 redds/ km (/ha) redds	1988 redds/ km (/ha) redds	1989 redds/ km (/ha) redds	1990 redds/ km (/ha) redds	1991 redds/ km (/ha) redds	1992 redds/ km (/ha) redds	1993 redds/ km (/ha) redds
Wilder-ness	7.10	4.49	1.27	1.53	2.46	1.69	0.25	1.44	2.88
	(9.45)	(5.96)	(1.69)	(2.02)	(3.26)	(2.25)	(0.34)	(1.91)	(3.82)
	84	53	15	18	29	20	3	17	34
HMA	5.33	6.16	7.37	4.16	2.84	4.95	2.95	7.95	6.47
	(4.78)	(5.32)	(6.37)	(3.59)	(2.46)	(4.28)	(2.55)	(6.87)	(5.59)
	105	117	140	79	54	94	67	151	123
Hartstoc k	-- [a]	1.86	1.92	1.28	1.47	4.10	1.86	1.99	2.18
		(1.51)	(1.56)	(1.04)	(1.20)	(3.33)	(1.51)	(1.61)	(1.77)
		29	30	20	23	64	18	31	34
Marengo	-- [a]	0.00	-- [a]	-- [a]	-- [a]	0.34	0.34	0.17	0.17
						(0.26)	(0.26)	(0.13)	(0.13)
		0				2	2	1	1
Total redds	189	200	185	117	106	180	90	200	192

[a] No survey conducted in these strata that year. (Bumgarner *et al*., 1994)

Table 9. Temperature comparisons between the Wilderness Stratum and the Hartsock Stratum, Tucannon subbasin, Washington, July and August 1987.

Site Location	River Mile	Site Elevation (ft.)	Average Minimum Temperature (°F)	Highest Temperature (°F)	Average Maximum Temperature (°F)
Sheep Ck	50	3,500	46	55	51
Panjab Ck	46	3,000	46	57	53
Bridge 10	27	1,600	57	75	69

HMA Stratum (Beaver-Watson, Deer, Cummings sites) - Most of the spring chinook spawning in the Tucannon subbasin occurs in this reach, which includes two natural springs enlarged to form lakes. The channel averages 38 ft. wide. The reach includes five man-made, partially spring-fed lakes that receive water from the Tucannon River through screened diversion structures. The WDFW built these lakes during the 1950's. Over the years, these lakes filled in with sediment and became "heat-sinks," adding warmer water back to the river. The WDFW excavated three of the river-fed lakes and installed outlet structures that return cooler water to the river.

The water temperature increases at each site from Panjab Creek downstream 9 miles to Deer Lake, and again from Bridge 14 to the Marengo Bridge (RM 25). At the Cummings Creek site, however, the river is noticeably cooler. According to Schuck (1995), the river flow near the mouth of Cummings Creek increased by at least 15 percent. Biologists suspect a large spring that supplies water at 50-55°F (10°C-12.8°C) causes the increase in temperature.

In 1994, 79.3 juvenile chinook per 100 m^2 (36 percent) were found in side-channel rearing areas.

Hartsock Stratum (Bridge 10, Bridge 14 sites) - The temperature consistently increases downstream from Cummings Creek. Through July and August 1990, the temperature at both sites exceeded the Class A standard during 44 of the 62 days, though Deer Lake had 4 more days (25 total) of temperatures exceeding 70°F (21°C). Elevated temperature readings at the Bridge 10 site are a result of lower elevations and lack of shading.

The Columbia Conservation District excavated a large, shallow sediment basin at the mouth of Hartsock Creek in late summer 1995. Preliminary observations by WDFW indicate that this pond heats up to over 75°F (24°C), and may have a perennial outlet flow of 0.33-0.50 cfs. The pond empties into a larger, spring-fed channel that enters the river 300 ft. downstream. Although it will probably not result in a noticeable increase in the river temperature, the outlet will be modified so that juvenile fish cannot continue to enter the pond. In 1994, 62.1 juvenile chinook per 100 m^2 (27 percent) were found in side-channel rearing areas.

Marengo Stratum (Marengo, Smolt Trap sites) - This area is the farthest downstream site at which spring chinook spawning has been recorded and accounts for less than one percent of the total redds in

the Tucannon River. The channel averages 61 feet in width and is shallow with few pools and poor shade cover. Temperatures at the Marengo Bridge have consistently exceeded the Class A standard. The primary temperature impact to juvenile fish is that 193 (73 percent) of the 266 readings through July and August 1992 exceeded 73°F (23°C) resulting in a low juvenile chinook population compared to other areas upstream (see Figure 7).

There may be a large groundwater influence in the vicinity of the Smolt Trap site because the water at this site is noticeably cooler (see Figure 10 and Figure 12). The nearest surface water inflow would be from Willow Creek, located 1/2 mile upstream, but it may be dry during July and August. Irrigators think this groundwater intrusion may be irrigation return water that becomes cooler as it infiltrates through the soil, but there is no data to support this hypothesis. In 1994, 9.8 juvenile chinook per 100 m^2 (4 percent) were found in side-channel rearing areas.

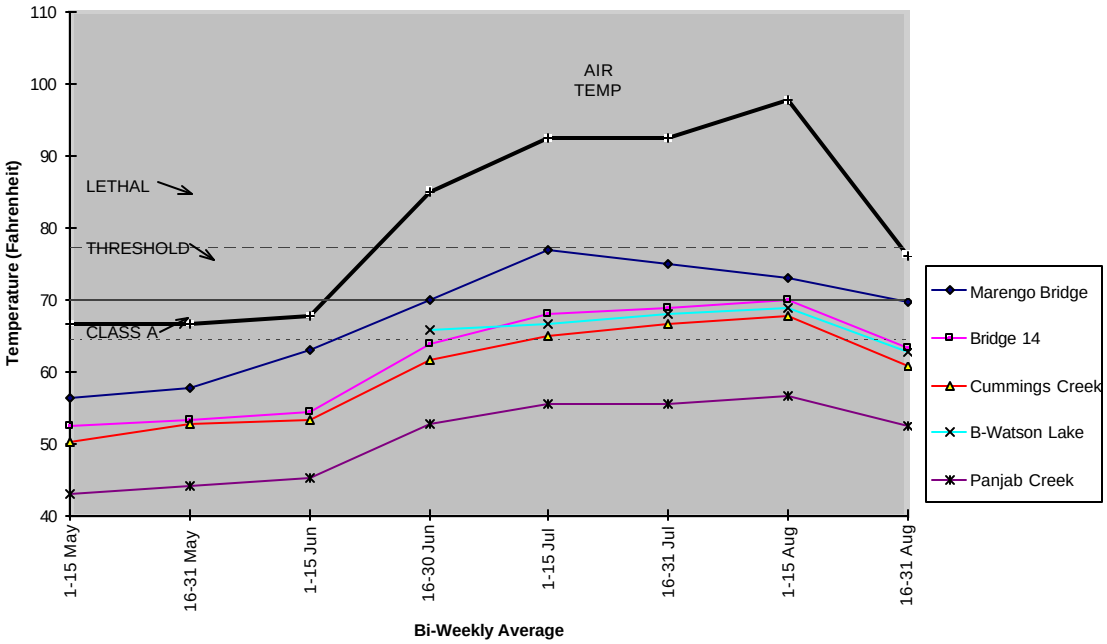

Figure 9. Bi-weekly averages of daily maximum temperatures: Tucannon River (1990)

Lower Stratum (Powers Bridge) - Although this section of the Tucannon River contains the highest percentage of large pools, it is the most degraded reach for salmonid fish due to extremely high summer water temperatures (see Figure 7). There are at least six warm water springs that flow into the river (Schuck 1995). According to Covert *et al.* (1995), the springs in the area are between 68°F (20°C) and 71°F (22°C). While this temperature range is warmer than would be expected for a ground water spring, it is still within the safe range for salmonids. The spring temperature is significantly less than that of the adjacent Tucannon River during the summer months.

In the winter, these springs may benefit juvenile fish seeking refuge from anchor ice or ice flows in the main channel. No spring chinook, steelhead, bull trout or whitefish have been found rearing or holding in this part of the Tucannon River during the summer months (Kelley *et al.* 1982; Mendel 1994).

Pataha Creek

Pataha Creek temperatures are well above the upper limits recommended for salmonid survival during the summer months, especially in the middle and lower reaches. Reductions in the number of pools due to sedimentation, degraded riparian vegetation, and low flows are believed to be the major contributing factors to this condition. While high temperatures may not be directly lethal to the fish, they do limit their available habitat in the upper watershed. Figure 10 illustrates monthly variation in temperature between the lower, middle, and upper sections of Pataha Creek between September 1998 and June 2000 (see Figure 10).

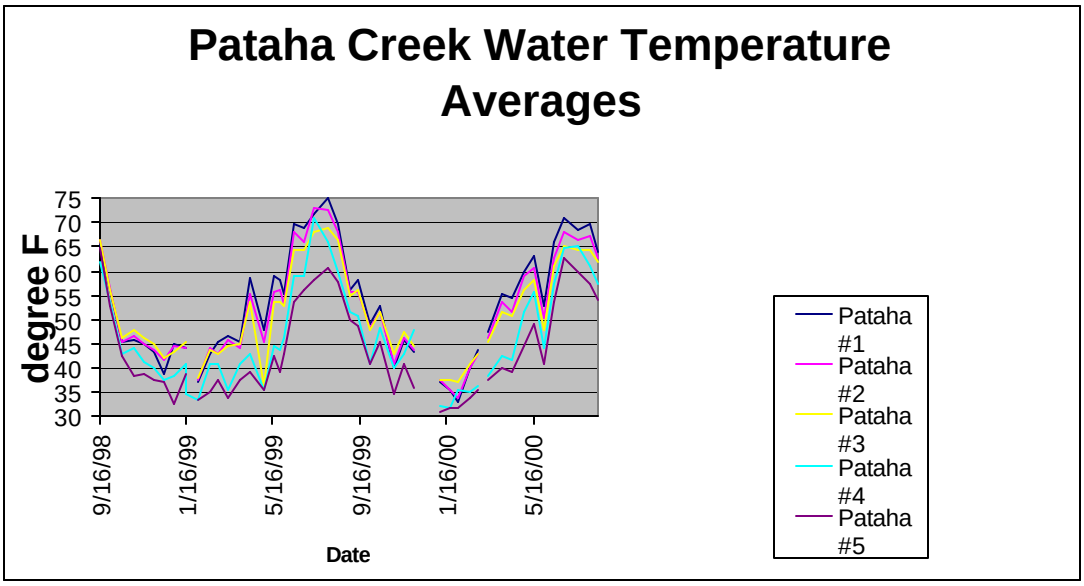

Figure 10. Average water temperatures of Pataha Creek, Washington, 1998-2000 (CEEd, 2000).

In a WDOE ambient monitoring survey conducted from 1994-1998 on Pataha Creek, the average temperature in the upper reaches during July was only 58.3°F (14.6°C), but in the middle and lower reaches the temperature was 66.0°F (19.0°C) and 73.8°F (23.2°C), respectively (WDOE,1998).

During 1992 and 1993, personnel from the USFS-Pomeroy Ranger District (PRD) used continuous-recording devices to monitor water temperatures at the forest boundary (RM 45.2), and at the USFS PRD office in Pomeroy (RM 21). According to records from the Lewiston, Idaho airport, summer air temperatures in 1992 averaged 8°F (-13.3°C) hotter than those in 1993. These differences were also evident in the water temperature data. Table 10 shows the number of days water temperatures exceeded the state standard.

Table 10. Number of days that Pataha Creek water temperature exceeded the Washington temperature state standard of 18°C (64.4°F) for Class A and AA waters (USFS 1994).

Site	Year	May	June	July	August
USFS (RM 45.2)	1992	0	6	4	8
Class AA (60.8^0 F)	1993	0	0	0	0
Pomeroy (RM 21)	1992	5	19	20	15
Class A (64.4^0 F)	1993	3	8	3	11

Pataha Creek water temperatures ranged from 31.1°F to 70.7°F (-0.5°C to 21.5°C) from September 1998 to August 2000. CEEd's Pataha station 1 (located near the confluence with the Tucannon River), had temperature readings from 64.0°F to 70.7°F (17.8°C to 21.5°C) between June and August 2000. CEEd's Pataha stations 2 through 5 all had water temperatures ranging from 53.6°F (12°C) to 67.1°F (19.5°C) during the same time period.

General Trend

Since 1986 in the Tucannon subbasin, average daily maximum water temperatures for July and August generally increase from the upper watershed to the mouth despite variability in air temperatures. This relationship also exists during May, June, and September (see Figure 7 and Figure 8). All of these figures indicate that at any given time the river is warmer at downstream sites. During the summer of 1990, there was an average of 18°F (-8°C) difference between the Panjab and Marengo sites.

Water temperature throughout the summer follows the general trend of the air temperature (Figure 9). Due to a lack of flow data specific to any of the temperature-monitoring sites, a direct relationship between river discharge and stream temperature cannot be determined for the Tucannon River.

Temperatures ranged from 37.0°F to 75.2°F (2.8°C to 24.0°C) from April 1999 to September 2000 in the Tucannon River (CEEd's ongoing water monitoring results). CEEd stations 1 & 2 (Lower Stratum) continued to have the highest continuous temperature readings during the summer months (12.8°C - 23°C). In the Marengo Stratum (CEEd's stations 3 & 4), the temperatures were also high (13.0°C – 24.0°C), but not as consistently high as for the Lower Stratum. The Wilderness Stratum (CEEd station 9) had the lowest temperature range of 6.5°C – 13.6°C for the months of July through September. Temperatures exceeded the Washington state temperature standard of (18 °C) for Class A streams during the months of July and August in the lower watershed.

Pataha Creek water temperatures ranged from 31.1°F to 70.7°F (-0.5°C to 21.5°C) from September 1998 to August 2000. CEEd's Pataha station 1 (located near the confluence with the Tucannon River), had temperature readings from 64.0°F to 70.7°F (17.8°C to 21.5°C) between June and August 2000. CEEd's Pataha stations 2 through 5 all had water temperatures ranging from 53.6°F (12°C) to 67.1°F (19.5°C) during the same time period.

Suspended Solids

High concentrations of particulate matter can cause increased sedimentation and siltation in a stream, degrading habitat conditions for fish and other aquatic life. Total suspended solid (TSS) concentrations

and turbidity both indicate the amount of mineral (e.g., soil particles) or organic (e.g., algae) solids suspended in water (Michaud, 1991). However, TSS measures the actual weight of material per volume of water (mg/l), while turbidity measures the amount of light scattered from a sample (more suspended solids, more scattering).

Turbidity, sediment delivery, and sediment deposition are generally inter-related, but the relationship varies from drainage to drainage. While there is no Washington State numeric water quality standard for TSS, the U. S. Fish and Wildlife Service (1995) suggests the upper limit of continuous exposure for the optimum health of salmonids is 80 mg/l.

Tucannon River

Since April 1999, TSS levels in the Tucannon River have all been below the upper limit of 80 mg/l at the CEEd nine monitoring stations. The exception being when TSS levels reached 417.6 mg/l (Station 1), and 351.6 mg/l (Station 3), on May 26, 1999 (CEEd, June 1999).

Hecht *et al*. (1982) identified the Tucannon River as having high sediment and high turbidity levels. They estimated that soil erosion and runoff contributed up to 309,200 tons of nutrient-laden sediment to the river each year (Hecht *et al*., 1982). Since their study, the level has likely been reduced due to the implementation of the Food Security Act, Public Law-566 and change in agricultural practices.

The Hecht study also noted that many of their test sites below Pataha Creek became covered with layers of sediment that resulted in a 7-inch surface layer of gravel that was "cemented" with fine sediment downstream of the Powers Bridge (Hecht *et al*., 1982).

According to Table 6, turbidity readings exceeded the state standard at least 50% of the time between 1974 and 1995 at WDOE's ambient monitoring station at Powers Bridge.

Pataha Creek

Pataha Creek has been identified as a major contributor of sediment to the Tucannon River, causing braided stream formations in the Tucannon below the junction of the Pataha confluence (Cusimano, 1994). In the Southeast Washington Cooperative River Basin Study (USDA 1984) Pataha Creek was estimated to transport up to 205,200 tons of sediment annually to the Tucannon River. The Natural Resources Inventory (NRI) conducted in 1992 estimated the sediment load at 77,930 tons per year, a 46% reduction.

Based on available data, turbidity and TSS are also potential limiting factors to salmonid rearing in the lower and middle portions of Pataha Creek. Data collected between 1994 and 1997 on the Pataha showed that the middle and lower reaches of the creek repeatedly exceeded the 80 mg/l limit between the months of December and May.

Peak TSS levels measured during water year 1996 included 2,300 mg/l on June 1, 1,350 mg/l on February 2, and 927 mg/l on March 2. Turbidity levels on these dates also indicated very high values, ranging from 370 to 950 NTU (WDOE, 1998).

Results from the recent CEEd sampling program indicate that TSS levels still exceed the recommended standard. On October 3, 2000, a TSS level of 570 mg/l was measured at station 2 and 138 mg/l at station 3 (CEEd, January 2001).

Fecal Coliforms

The presence of fecal coliform bacteria in the water indicates a potential health hazard due to the transmission of microorganisms found in fecal contamination from warm-blooded animals (including humans). Primary sources of fecal coliform bacteria in rural rivers are typically wastewater treatment plant (WWTP) discharges, failed septic systems, and animal waste.

Tucannon River

Over the last two years fecal coliform levels have greatly declined in the Tucannon watershed due to improved livestock management, fencing, and campground improvements. Fecal coliform levels at all CEEd monitoring sites have been below the state standard (CEEd, 1999-2000). For Class A streams, state water quality standards require levels to be below 100 colonies/100 ml of the geometric mean.

An evaluation of 182 fecal coliform bacteria determinations at Powers Bridge from 1974 to 1992 water years indicates approximately 36% of the samples exceeded the state standard of 100 colonies per 100 milliliters (TRMWP, 1997). Colonies ranged from 2 to 3,900 per 100 milliliters

Pataha Creek

Due to the small data set available between July-October 1994-1999, geometric mean coliform levels were not calculated for each station on Pataha Creek. Instead, the average fecal coliform level was determined for stations in the upper, middle, and lower stream reaches.

Generally, fecal coliform levels in Pataha Creek were elevated throughout the summer and fall (July-October) between 1994 and 1999 (WDOE, 1998 and CEEd, 1999). The monthly geometric mean fecal coliform levels in Pataha Creek during this time peaked in August with recordings of 425 cfu/100ml. July and September were slightly lower at 370 cfu/100ml and 350 cfu/100ml respectively. February had the lowest concentration at 25 cfu/100ml.

Results from the WSU monitoring program over the last two years show that fecal coliform levels are still elevated throughout the Pataha system (see Figure 11 for fecal coliform counts only, not geometric mean).

Since the sources of coliform range from failed septic tanks to runoff from feedlots, and wastewater effluent from the city of Pomeroy, it is difficult to determine the particular source of pollution without comprehensive lab analysis. Based on past studies (Cusimano 1992), and field reconnaissance, likely sources include feedlot operations and wastewater effluent.

Dissolved Oxygen

Dissolved oxygen (DO) concentrations must exceed 8.0 mg/l for Class A streams. The minimum DO concentrations recommended for spawning fish is at least 80 percent of saturation, and not less than 5.0 mg/l (Bjornn and Reiser 1991).

Tucannon River

According to WDOE Powers Bridge data (Table 6), DO concentrations at the Powers Bridge ranged from 4.11 to 16.1 mg/l, with a median concentration of 10.8 mg/l (TRMWP 1997). Dissolved oxygen levels were less than the state standard only 3% of the time. This suggests that DO is not a limiting factor for fish survival in the lower Tucannon River.

The Powers Bridge figure also shows the percent saturation of dissolved oxygen ranged from 33.0 to 167.5 %, exceeding the state standard of 110 mg/l only 3% of the time. The highest reading

occurred in August when the DO concentration reached 16.1 mg/l. High dissolved gas saturation and low DO concentrations occur due to such factors as: excessive biological activity from algal photosynthesis, spilling at hydropower dams, and discharge from power-generated sites and other thermal sources (EPA 1986).

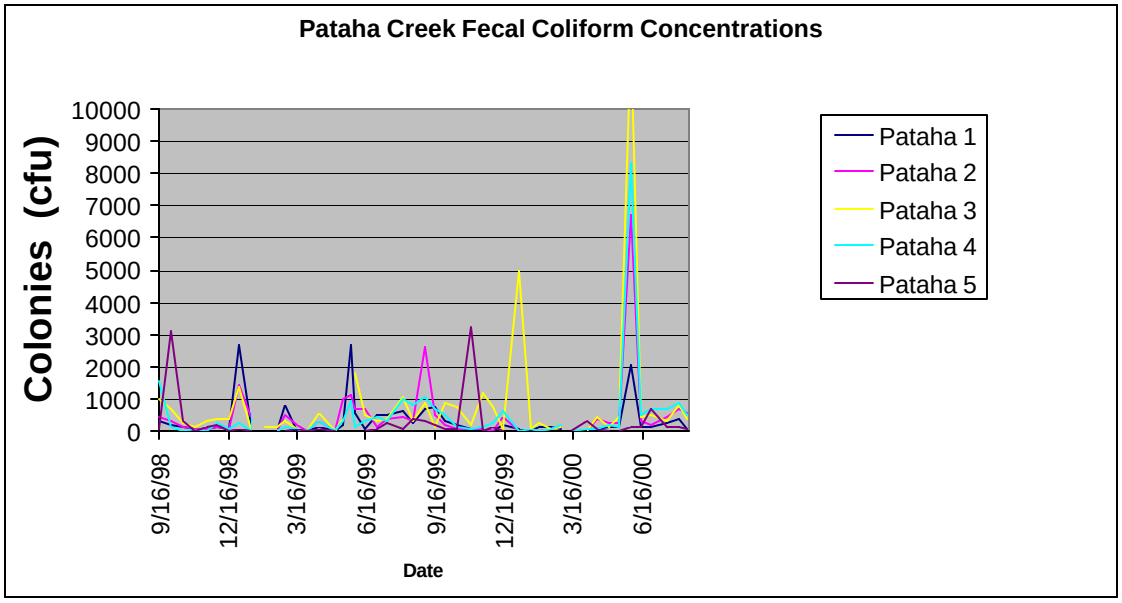

Figure 11. Fecal coliform concentrations (coliform counts only) at Pataha Creek CEEd stations, 1998-2000 (CEEd 2000).

Pataha Creek

During the 1992 sampling of lower Pataha Creek by the WDOE, DO levels were barely within the state standard and thus considered a limiting factor for aquatic resources during summer low flows (Cusimano, 1992). Dissolved oxygen results ranged from 8.5 to 13.8 mg/l, and averaged 11 mg/l for samples taken during water year 1996 (WDOE).

Nutrient Loading

The major growth-limiting nutrients in water are phosphorus and nitrogen. Nitrogen loading is of primary concern for groundwater. Nutrient source inputs to riverine systems occur naturally and as a consequence of human activities. Sewage from wastewater treatment plants, failing septic systems, fertilizers from agricultural and home use and animal waste (e.g., cattle feedlots) are artificial sources of nitrate.

Phosphorus contributes greatly to algae (periphyton) growth. The main natural source of phosphorus in watersheds is soil erosion (Horne and Goldman 1994), which is amplified in agricultural watersheds such as the Tucannon and Pataha. Phosphorus inputs also occur as a result of human, animal, and industrial wastes, and human land disturbances. The concentration at which total phosphorus (TP) becomes harmful varies, depending on whether it is determined for fish, humans, or the

water body in general.A desired goal for the prevention of plant nuisances in flowing waters not discharging directly to lakes or impoundments is 0/100 mg/l TP (Mackenthun 1973, cited in EPA 1986). Total phosphorous concentrations in excess of this level may interfere with coagulation in water treatment plants (EPA 1996). Estimated optimum phosphorus concentrations can vary between 0.01-3.0 mg/l for trout (U. S. Fish and Wildlife Service 1995).

Tucannon River

Nutrient samples taken at Powers Bridge by WDOE (Table 6) indicated only small concentrations of total phosphorus and dissolved orthophosphate, with median values less than or equal to .080ppm and .041 mg/l, respectively. Total phosphorus sample results from the ongoing CEEd's monitoring are all below 0.62 ppm for the last year and a half.

Total Kjeldahl nitrogen (TKN) levels for the Tucannon watershed ranged from 0 ppm to 2.27 ppm at CEEd station 2. Nitrate levels ranged from 0.01 ppm to 0.28 ppm.

Pataha Creek

Based on the WSU study, TP concentrations in Pataha Creek are within suggested levels for fish (0.01-3.0 mg/l). TP varied between 0.13 and 0.48 mg/l during water year 1996 (WDOE 1998). In 1998, TP in the upper Pataha was later reduced, to the median value of 0.09 mg/l, while in the lower reaches it was 0.16 mg/l (CEEd 1999).

TKN sample levels from September 1998 to November 2000 ranged from 0.6 ppm to 111.2 ppm. Nitrate levels have all been below 0.9 ppm (CEEd 2000). (see Table 7).

pH

The pH measures the concentration of hydrogen ions in a water sample. The pH of water determines the solubility and biological availability of chemicals such as nutrients and heavy metals (Michaud 1991). The pH of most natural waters ranges between 6.5 and 8.5, which is the State standard set by WDOE for Class AA and Class A streams.

Tucannon River

The median pH at Powers Bridge (Table 6) was consistently on the alkaline side and ranged from 6.8 to 9.0 units (WDOE 1995). Approximately 99.5% of the pH measurements met the state standard. Conductivity was relatively low, ranging from 75 to 500 micrommhos per centimeter indicating that there was little dissolved substance in the water.

Pataha Creek

According to the WDOE water quality standards for Water Resource Inventory Area 35 (Tucannon subbasin), Pataha Creek exceeds the optimum pH range, especially during summer. During the summer months in 1997 (July-September), the pH ranged from 8.8 in September to 9.1 in August (WDOE 1999).

Ammonia

Many fish species have varying tolerances to ammonia concentrations starting at 0.2 mg/l, with 2.0 mg/l being directly lethal (Norris *et al*. 1991). Short-term exposures of ammonia below 0.2 ppm may still

cause adverse physiological effects in fish. The Tucannon system contains small concentrations of total ammonia (N).

From 1998-2000, the Tucannon River's ammonia levels have been below 0.61 ppm at the CEEd monitoring stations (CEEd 2000). Between 1974-1995, total ammonia (N) concentrations varied from 0.005 to 0.740 mg/l at Powers Bridge, RM 2.3(WDOE, 1995). Both acute and chronic ammonia toxicity increased with decreasing pH, so it is not likely a problem in the Tucannon River.

For Pataha Creek total ammonia levels ranged from 0.01 to 0.3 ppm from September 1998 to January 2001 at the CEEd's sampling sites (CEEd 2000). See Table 7 for Pataha station averages from September 1998 to August 2000.

Benthics

A Macroinvertebrate Community Analysis was conducted from fall 1998 to fall 1999 for Pataha Creek and the confluence of the Tucannon River by the Center for Environmental Education, WSU. The study's main objective was to determine the water quality effects of Pataha Creek on the Tucannon River, and to assess salmonid habitat quality by comparing the biological communities. Biological integrity was measured by a number of biological metrics, including total taxa richness, stonefly, mayfly, and caddisfly *[Ephemeroptera, Plecoptera,* and *Trichoptera* (EPT)] taxa richness, percent EPT, Hilsenhoff Biotic Index (HBI 11131), percent dominance, percent collector feeders, percent scrapers and shredders, and percent hydropsychinae of *Trichoptera* (CEEd, April 2000).

The clearest downstream observation of macroinvertebrate data from Pataha Creek, is the decline of EPT richness and increased number of tolerant species (CEEd 2000). The data shows increasingly poor water quality and habitat conditions downstream. A high percent of collector species occurred at all stations indicating a presence of fine particulate matter in the running water.

There is little significant difference in any of the biological metrics between the Upper (above the confluence with Pataha Creek), and Lower (below the confluence) Tucannon River sampling stations. Percent collectors was high for both sampling years, while shredders and scrapers were consistently low (CEEd 2000).

Since macroninvertebrate communities of the upper and lower Tucannon River were quite similar, it was assumed the Pataha Creek had no apparent effect on the lower Tucannon River.

Identified Point Sources

Tucannon River

The town of Starbuck, located on the north bank of the Tucannon River in Columbia County, has constructed a comprehensive sewer system in 1999. Along with the new Wastewater Treatment Plant (WWTP), they have upgraded on-site sewer systems.

The treatment system is designed with a capacity of 20,000 gallons per day. (Richard Koch PE, WDOE). Current water usage records indicate an average of approximately 14,700 gallons per day of water consumption in Starbuck.

The distribution system consists of a drip irrigation system. The treated effluent is discharged to a 20,000-gallon dosing tank supplying the subsurface system. The dosing tank includes a management system, which monitors all the internal operations.

The design goal for the treatment system is 10 mg/l total nitrogen (TN). Even if the effluent TN concentration rises to 20 mg/l the drip application and soil treatment reduces the TN concentration leaving the drip irrigation zone to 6.5 mg/l. Based on the limited groundwater sampling a TN concentration of 6.5 mg/l entering the groundwater would be protective of the background groundwater quality.

There are at least two aquifers present in the area: a shallow partially confined aquifer located in the flood-deposited sand and gravel and several confined water bearing zones within the underlying Grande Ronde basalt (according to Richard Koch PE, WDOE). Static levels in the shallow aquifer in the vicinity of the treatment site range from about 5 to 22 feet below ground surface. Recharge to this aquifer is from the infiltration of precipitation and surface water runoff from the surrounding hillsides.

Based on the hydrogeologic analysis of the site by GeoEngineers, the shallow groundwater appears to flow toward the west and northwest beneath the site. The ground water gradient across the site ranges from about 0.001 to 0.01 feet/foot. The shallow aquifer likely discharges to the Tucannon River in local areas.

The majority of wells identified by the consultant in the site vicinity are completed in the Grande Ronde Basalt and are more than 100 feet deep. Static water levels reported range from about 35 feet to 100 feet below ground surface in the site vicinity. Ground water appears to flow toward the northwest within the saturated zones of the Grande Ronde Basalt.

Pataha Creek

The Pomeroy Waste Water Treatment Plant (WWTP) was identified as one of the point sources of pollution for Pataha Creek. A limited Class II inspection and receiving water survey was conducted at the Pomeroy WWTP in October 1991 to determine the efficiency of the WWTP and assess the impacts of effluent discharge on Pataha Creek. Biochemical oxygen demand, TSS, total residual chlorine, and pH were found to be within permissible limits at the WWTP. However, fecal coliform levels above and below the WWTP exceeded water quality criteria.

Although the WWTP did not affect downstream temperature, DO, pH, and nutrient concentrations were altered by the effluent. Instream ammonia concentrations below the plant exceed the chronic water quality criterion (WDOE 1998). The WDOE recommended improving the treatment of ammonia and land application of effluent during summer to mitigate the effects of ammonia and BOD on water quality.

The EPA accepted a TMDL based on the 1991 Class II inspection report. New water quality limits were included in the city of Pomeroy's WWTP NPDES discharge permit, partially based on data collected from Pataha Creek for a revised TMDL. In order to meet the new limits, the city plans to upgrade the treatment plant, including enhancement of nitrification for lower ammonia nitrogen concentrations.

Vegetation

The vegetative regime in the Tucannon subbasin has changed markedly over the past 100 years (Figure 12 and Figure 13). Cropland and pasture encompass 138,425 acres within the Tucannon subbasin.

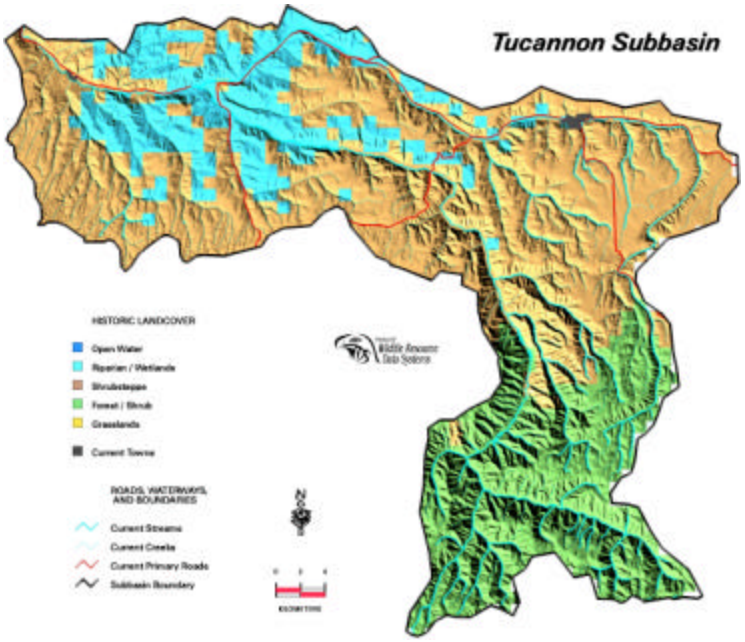

Figure 12. Historic vegetation types in the Tucannon subbasin, Washington (WDFW).

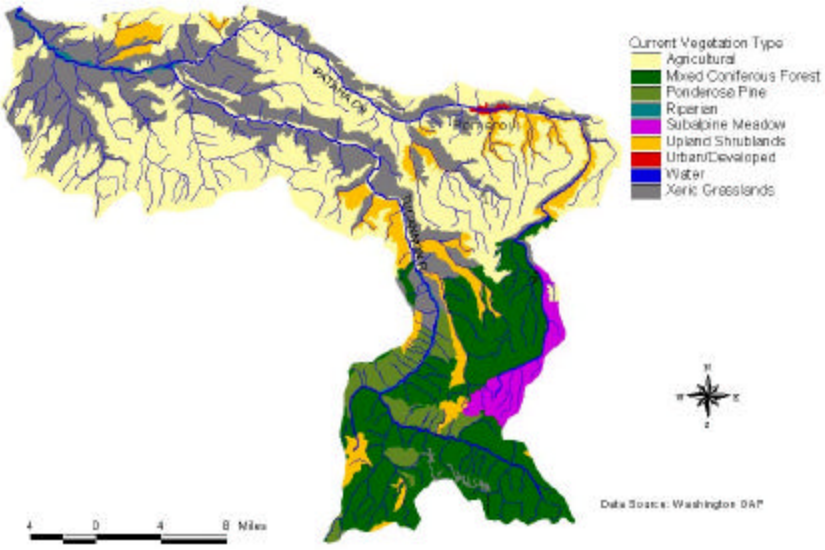

Figure 13. Current vegetation types within the Tucannon subbasin. (Map by Ecopacific)

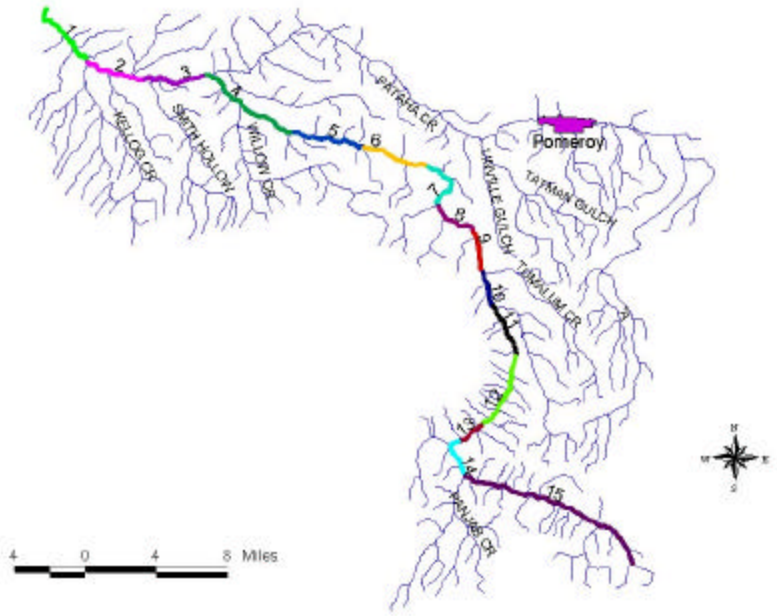

Figure 14. Assessment and inventory reaches on the Tucannon River, Washington. (Map by Ecopacific)

During the summer of 1994, 53.3 miles of riparian area of the Tucannon subbasin was inventoried to determine dominant overstory species, percent canopy cover, and dominant age class. The inventory procedures closely followed those described in Bauer and Burton (1993) for a reconnaissance level survey. Age class values were from Hankin and Reeves (1988). The riparian plant community was inventoried by dominant plant community complex type similar to Winward and Padgett (1987) and Burton (1991). No community type classification was available for the area. In addition to this inventory, the USFS conducted a modified Hankin and Reeves (1988) inventory in 1992 of 6.8 miles of stream within the Umatilla National Forest. The two inventories were combined to provide one inventory of the stream system (Tucannon River - Table 11 and Pataha Creek – Table 12). Figure 14 shows the corresponding reaches on the Tucannon River.

Table 11. Riparian vegetation inventory, Tucannon River, Washington, summer 1994.

REACH	LENGTH (MI)	CANOPY COVER	DOMINANT VEGETA-TION	DOMINANT AGE CLASS	DOMINANT STREAM TYPE	POOL/ RIFFLE/ GLIDE or POOLS/MI.	LWD
1	4.6	30	Alder	Small trees (8.0”-20.9” dbh)	C4/B4c	* 5/80/15	N/A
2	3.3	60	Alder	Small trees	B4c/F4	* 5/80/15	N/A
3	2.8	56	Alder	Small trees	C4/B4c	* 20/60/20	N/A
4	6.0	32	Alder/Cotto nwood	Large trees (21.0”-31.0”dbh)	B4c/C4	* 10/70/20	N/A
5	2.9	35	Cottonwood /Alder	Large trees	B4c/D4	* 5/85/10	N/A
6	3.7	66	Alder	Small trees	F4/B4c	* 5/85/10	N/A
7	3.2	33	Alder	Small trees/ Large trees	B4c	* 5/95/0	N/A
8	2.6	81	Alder/Cotto nwood	Large trees/ Small trees	C4/B4c	* 5/95/0	N/A
9	2.3	1	Alder	Shrub	B4c/C4	* 2/98/0	N/A
10	1.9	13	Alder	Small trees/ Large trees	C3/B4c	* 2/98/0	N/A
11	3.0	31	Cottonwood /Alder	Large trees/ Small trees	B3/B3c	* 5/95/0	N/A
12	4.6	15	Cottonwood /Alder	Large trees/ Small trees	B3/C3	* 5/95/0	N/A
13	2.0	49	Alder	Large trees/ Small trees	B3/B3c	* 5/95/0	N/A
14	1.9	17	Alder	Small trees	B3c/C4	N/A	N/A

REACH	LENGTH (MI)	CANOPY COVER	DOMINANT VEGETA-TION	DOMINANT AGE CLASS	DOMINANT STREAM TYPE	POOL/ RIFFLE/ GLIDE or POOLS/MI.	LWD
15	2.8	43	Grand fir/Alder	Small trees/ Small poles	N/A	12/5 [a]PPM	N/A
16	11.8	57	N/A	N/A	N/A	N/A	N/A
18	2.1	46	Grand Fir/ P. Yew	Small trees	N/A	7.6 PPM	175
19	2.2	42	P. Pine/ Grand Fir	Small Pole/ Small trees	N/A	9.1 PPM	292
20	0.5	20	Grand Fir/	N/A	N/A	14	342

			Alder			PPM	
21	4.5	66	Grand Fir/ Alder	Grass/Forb	N/A	N/A	N/A
22	0.8	N/A	Alder	N/A	N/A	N/A	40
23	1.9	56	Grand Fir/ Alder	Large trees	N/A	10.9 PPM	442
24	2.5	42	Grand Fir/ Alder	Large trees	N/A	5 PPM	387
25	1.3	50	Grand Fir/ Alder	Large trees	N/A	7.7 PPM	570
26	3.5	55	Grand Fir/ Alder	Large trees	N/A	8.9 PPM	499
27	1.8	84	Grand Fir/ Alder	Large trees	N/A	2.4 PPM	631
28	3.0	21	Douglas Fir/ P. Yew	N/A	N/A	9.7 PPM	122
29	0.3	N/A	Alder/Maple	N/A	N/A	*30/70/0	32
30	1.9	53	Grand Fir/ Alder	Large trees/ Small trees	N/A	5.8 PPM	408
31	1.1	60	Grand Fir/ Alder	Small trees	N/A	17.5 PPM	914
32	3.0	56	Grand Fir/ Maple	Large trees	N/A	16.9 PPM	383
33	2.7	90	Grand Fir/ Alder	Large trees/ Small trees	B3c/B4c	4.2 PPM	289
34	1.5	76	Grand Fir/ Alder	Large trees	N/A	4.2 PPM	289

*** - Estimated pool/riffle/glide** **a - pools per mile** **N/A - Not Available**

Table 12. Riparian Vegetation Inventory, Pataha Creek, Washington, summer 1994.

REACH	LENGTH (feet)	REACH DESCRIPTION	CANOPY COVER (percent)	DOMINANT AGE CLASS [a]	DOMINANT PLANT COMMUNITY	DOMINANT STREAM CLASS [b]
1	11,200	Confluence of Pataha and Tucannon to section 20 railroad crossing.	5	GRASS/FORB	CANARYGRASS	E6 in an F6 channel, G4c, G6c
2	15,600	Section 20 railroad bridge crossing to Jackson road bridge in section 10.	5	GRASS/FORB	CANARYGRASS	G4c, E4
3	18,200	Jackson road bridge (section 10) to Chard road bridge (section 7).	5	GRASS/FORB	CANARYGRASS	E4 in an F6

4	9,400	Chard road bridge (section 7) to highway 12 bridge at Dodge.	15	GRASS/FORB	CANARYGRASS	E4 in an F6
5	18,000	Dodge highway 12 bridge to Houser.	10	GRASS/FORB	CANARYGRASS	G4c, E4 in an F6
6	29,400	Houser road bridge to Tatman road bridge in Zumult (section 4).	5	GRASS/FORB	CANARYGRASS	Not Surveyed
7	23,600	Tatman road bridge in Zumult to first bridge in Pomeroy (section 31).	15	GRASS/FORB	CANARYGRASS	G4c, B4c
8	18,000	First bridge in Pomeroy (section 31) to Hutchin Hills road bridge.	37	LARGE TREE (21.0”-31.0”dbh)	COTTONWOOD ALDER	G4c, C4, B4c
9	22,000	Hutchin Hills road bridge to Gary Cole bridge (section 7).	9	SHRUB/ SEEDLING	COTTONWOOD CANARYGRASS	G4c, E4 in an F6
10	11,000	Gary Cole bridge (section 7) to Davis stream crossing (section 18).	19	SMALL TREE (8.0”- 20.9”dbh)	COTTONWOOD CANARYGRASS	G4c, G3c, F4
11	27,000	Davis stream crossing (section 18) to power transmission lines (section 35).	5	GRASS/FORB	CANARYGRASS	F4, G4c
12	14,800	Power transmission lines in section 35 to Columbia Center.	30	SMALL TREE	ALDER/ HAWTHORN	B3, B4, B4c
13	28,800	Columbia Center to Forest Service boundary.	27	LARGE TREE	ALDER DOUGLAS FIR	B3, F4
14	21,800	Forest Service boundary to section 16 stream crossing.	85	LARGE TREE	ENGELMANN SPRUCE,GRAND FIR	B4, C4
15	13,200	Section 16 stream crossing to headwaters.	38	SAPLING/POLE (5.0” - 8.0” dbh)	ENGELMANN SPRUCE, GRAND FIR	Not Surveyed
TOTALS	281,200 (53.3 mi.)					

[a] From Hankin and Reeves 1988
[b] From Rosgen 1994

The dominant riparian plant species along 29 miles of streambank was Reed canarygrass, *Phaluris urundinacea*. A mixture of Reed canarygrass and black cottonwood dominated 6.3 miles of

streambank. White alder and Douglas fir dominated 5.5 miles and Douglas fir and grand fir dominated 4.1 miles. Inventory results also indicated that black cottonwood and white alder was dominant on 3.4 miles while white alder and Douglas hawthorn, *Crataegus douglasii*, dominated 2.8 miles of streambank and 2.5 miles was dominated by Engleman spruce, *Picea engelmannii*, and grand fir, *Abies grandis*. Common tree species in the riparian plant community include western larch, *Larix occidentalis*, ponderosa pine, *Pinus ponderosa*, golden willow, *Salix alba*, and locust, *Robinia psuedo-acacia*. Common shrub species include chokecherry, *Prunus virginiana*, coyote willow, *Salix exigua*, rose, *Rosa spp.*, sticky current, *Ribes spp.*, and snowberry, *Symphoricarpos albus*. Few-flowered spike rush, *Elaochris panciflora*, various sedge species, and a variety of weedy forbs are common. Conifer species were dominant in the higher elevations and deciduous species were dominant in the lower elevations. See Appendix C for a more detailed species list.

Percent canopy cover ranges from 1 percent to 85 percent and tends to increase with increased elevation. Agricultural land uses result in areas with less percent canopy cover.

The grassland/forb age class is most common on 29 miles of the Tucannon River streambank. Large trees were most common on 13 miles of streambank. Small trees occupied 4.9 miles of streambank. Shrub/seedling age class was common on 4.2 miles of streambank. Small poles were most common on 2.5 miles of streambank. Height of vegetation tended to increase with elevation, as trees were more dominant in higher elevations.

Exotic Noxious Weeds

The Columbia County Weed Board (Weed Board) visually surveyed approximately 48 miles of the Tucannon River, including private and public lands. Approximately 20 percent of the riparian areas are infested with yellow starthistle, *Centaurea solstitialis*, and knapweeds (*Centaurea diffusa*, *Centaurea biebesteinii*, *Acroptilon repens*). Eighty percent of rangelands are infested with yellow starthistle. The Weed Board found limited amounts of rush skeletonweed, *Chondrilla juncea*, and is attempting to contain leafy spurge, *Euphorbia esula*.

Yellow starthistle is a member of the Asteraceae family. It is a winter annual with yellow flowers. About 60 percent of the seeds produced by yellow starthistle survive dispersal (Sheley and Larson 1994). Birds, wildlife, humans, domestic animals, whirlwinds, and vehicles may transport the seeds. A single plant may produce up to 150,000 seeds. Studies show that 90 percent of the seed falls within 2 feet of the parent plant (Roche 1991). Of these seeds, 95 percent are viable, and 10 percent can remain viable for 10 years (Callihan *et al.* 1993). Yellow starthistle can grow more rapidly than most perennial grasses. It is deep-rooted and will grow twice as fast as annual grasses (Sheley and Larson 1995). Yellow starthistle displaces native plant communities and reduces plant diversity. It can accelerate soil erosion and surface runoff (Lacey *et al.* 1989). Yellow starthistle forms solid stands that drastically reduce forage production for wildlife.

Knapweeds are also members of the Asteraceae family. Spotted knapweed is a deep tap rooted perennial that lives up to nine years (Boggs and Story 1987). Seed production ranges from 5,000 to 40,000/m^2 (Shirman 1981). Seeds can germinate in the spring and fall when moisture and temperature are suitable (Watson and Renney 1974). Spotted knapweed is able to extend lateral shoots below the soil surface that can form rosettes next to the parent plant (Watson and Renney 1974). Diffuse knapweed is a biennial that grows from a deep taproot. Seed production ranges from 11,200 to 48,000/m^2 (Shirman 1981). Wind, animals, and vehicles spread knapweeds. Diffuse knapweed reduces

the biodiversity of plant population, increases soil erosion (Sheley *et al.* 1997), threatens Natural Area Preserves (Schuller 1992) and replaces wildlife forage on range and pasture. Spotted knapweed also reduces wildlife forage. Watson and Renney (1974) found that spotted knapweed infestations decreased bluebunch wheatgrass by 88 percent. Elk use was reduced by 98 percent on range dominated with spotted knapweed compared to bluebunch-dominated sites (Hakim 1979). Spotted knapweed also increases surface runoff and stream sediment (Lacey *et al.* 1989).

Rush skeletonweed is in the Asteraceae family. It can be a perennial, a biennial, or a short-lived perennial, depending on its location. Seed production ranges from 15,000 to 20,000 seeds. The seeds are adapted to wind dispersal but are also spread by water and animals. Rush skeletonweed can also spread by its roots. Rush skeletonweed reduces forage for wildlife. Its extensive root system enables it to compete for the moisture and nutrients that grasses need to flourish.

Leafy spurge is a perennial belonging to the Spurge family. The root system can penetrate the soil 8 to 10 feet. The plants will also produce horizontal roots that enable colonies to enlarge. The seeds are in a capsule and, when dry, the plant can project the seeds as far as 15 feet. Seeds may be viable in the soil up to 8 years. Vehicles, mammals, and birds spread leafy spurge. Leafy spurge root sap gives off a substance that inhibits the growth of grasses and reduces forage for wildlife. It also spreads by seed and root, which crowd out desirable forage species.

Soils

Soils in the Tucannon subbasin consist mostly of silt loams formed from loess or water deposited material, ranging from 40 inches to over 60 inches deep (Fuller 1986). All drainages contain thin deposits of river alluvium along the present-day floodplains. The alluvium consists of gravel, sand, and silt derived from erosion of flood deposits, loess, and basalt (Columbia Basin System Planning 1990). Sedimentary interbeds and lava flows within the Columbia River Basalt Group are known to make good aquifers and may contain substantial ground water resources.

Major soil series in the Tucannon subbasin included Walla Walla, Asotin, Chard, Athena, Palouse, Couse, Larkin, Tolo, and Gwin. The Walla Walla, Asotin, and Chard soils are associated as a group and found on moderate to steeper slopes. Where these soils exist, small grain and pea production are common land uses. Rangeland is located on the steeper slopes.

Land Uses

The economy in the Tucannon subbasin is dependent on natural resources of which agriculture is the largest contributor (Figure 15). Forest products and recreation also contribute significantly to the local economic base.

There are 83 full-time farm and ranch operators that own or lease agricultural lands, and most are subbasin residents. The size of agricultural holdings varies from 160 acres to 5,000 acres, with the average landowner owning or leasing 1,400 acres. There are a number of smaller non-commercial farms located along the river corridor. These farms are often used for recreational purposes rather than agricultural production.

The major land uses in the Tucannon River watershed are related to agricultural purposes (SCS 1991). Crop, forest, rangeland, pasture, and hay comprise over 90 percent of the watershed (Figure 16). Grazed rangeland includes approximately 40 percent of the Tucannon watershed (75,725 acres)

and supports livestock production. Dry and irrigated cropland produces winter wheat, barley, peas, and bluegrass (SCS 1991).

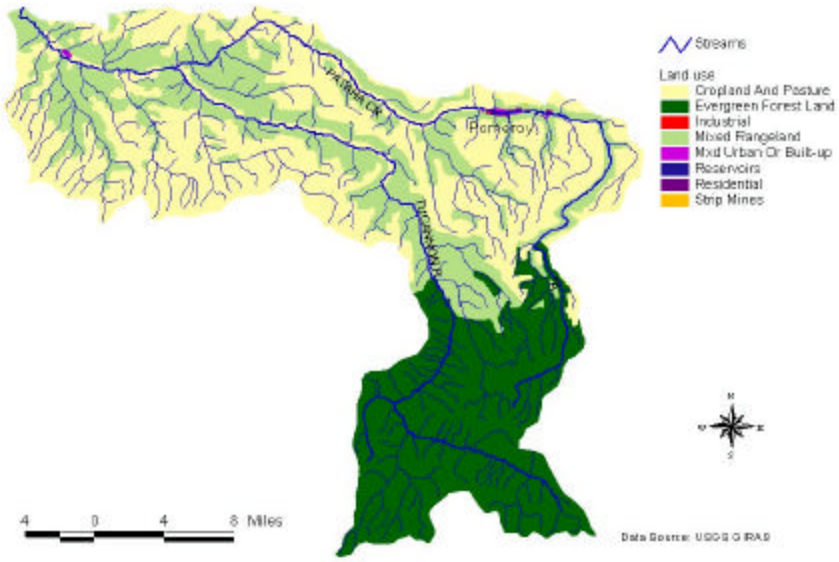

Figure 15. Land use within the Tucannon subbasin, Washington. (Map by Ecopacific)

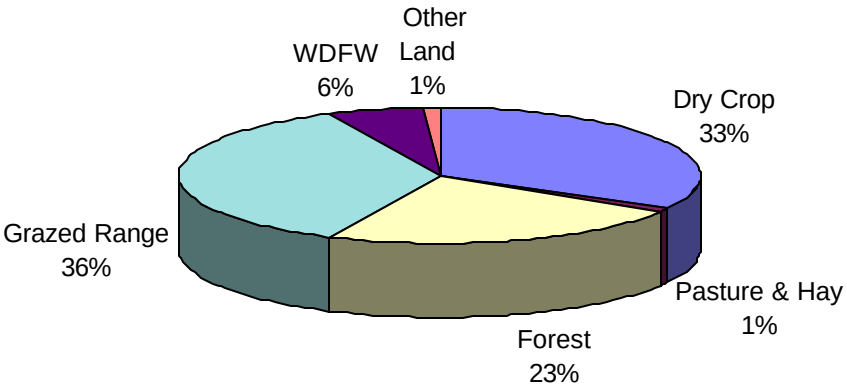

Figure 16. Land uses in the Tucannon River watershed, Washington. (Tucannon MWP 1997)

Fish and Wildlife Resources

Fish and Wildlife Status

A variety of wildlife including large and small mammals, reptiles, amphibians, passerines, raptors, upland birds, and waterfowl are associated with the various habitat types within the subbasin. Population status varies by species and area. Species associated with shrub steppe habitat such as the ferruginous hawk, loggerhead shrike, whitetail jackrabbit, and Washington ground squirrel are listed as state threatened or species of concern. Elk, bighorn sheep, goshawk, and spotted frog inhabit the upland areas of the subbasin.

Fish

The Tucannon River supports a diverse collection of anadromous and resident fish species throughout the subbasin (

Table 13).

Spring Chinook

Prior to the late 1800's there was an annual spawning return (escapement) of Snake River spring/summer chinook salmon that may have exceeded 1.5 million fish (Bevan *et al*. 1993). By 1975, escapement was down to only 122,500 in the Columbia River (WDW *et al*. 1990), or 8 percent of the historic run. The 1994 return of 1,822 fish, 0.12 percent of the historic run, was the lowest ever recorded, to that time. The estimated escapement into the Tucannon River was 140 fish that year. In 1995, the return to the Tucannon River was only 54 fish (Figure 21). These counts set new record low numbers. Since then, returns have varied from 144 to about 250 each year (Bumgarner *et al*. 2000). All Snake River spring/summer and fall chinook were officially listed by the National Marine Fisheries Service (NMFS) as "threatened" species on April 22, 1992. A petition to further list them as endangered is pending based on the outcome of proposed changes to the Endangered Species Act (ESA) (Griffin 1995), even though the 2001 spring chinook return to the Snake River is expected to be the highest in many years (greater than 100,000 fish into the Snake River).

The U.S. Bureau of Fisheries, now NMFS, recorded the first scientific documentation of chinook in the Tucannon River, and conducted fish habitat surveys in February and June of 1935 (Parkhurst 1950). In 1938, the Columbia River Investigation Team attempted to trap and count all adult chinook that entered the river. Unfortunately, the trap washed out after only 24 fish were trapped. The sport fishery claimed another 26 fish. Later that year, surveyors failed to find any sign of spawning. Parkhurst (1950) cites local residents as saying that the last large run of spring chinook occurred in 1915, at which time, "It was reliably estimated that an average of 500 salmon per day entered the river during the spawning migration, which lasts through May and June." These figures indicated annual returns, prior to 1916; of up to 30,000 spring/summer chinook may have occurred in the Tucannon River.

By 1935, the chinook run in the Tucannon River was already so depleted that surveyors commented, "The Tucannon is apparently of little value as a salmon producer at present. However, it has excellent potential value, and could support a good run if provisions were made for passage of fish over existing obstructions, and all diversions were adequately screened to prevent the destruction of downstream migrants."

Table 13. Fish species present in the Tucannon subbasin, Washington (Mark Schuck, WDFW per. com., 2001)

Species	Origin	Status
Bull trout (*Salvelinus confluentus*)	N	C/I
Steelhead trout (*Oncorhynchus mykiss*)	N	C/D
Spring Chinook salmon (*Oncorhynchus tshawytscha)*	N	C/D
Fall Chinook salmon (*Oncorhynchus tshawytscha)*	N	O/S
Mountain whitefish (*Prosopium williamsoni)*	N	O/U
Brook trout (*Salvelinus fontinalis)*	E	O/U
Pink salmon (*Oncorhynchus gorbuscha*)	E*	O/U
Northern pikeminnow (*Ptychocheilus oregonensis)*	N	C/S
Longnose dace (*Rhinichthys cataractae*)	N	C/U
Speckled dace (*Rhinichthys osculus)*	N	C/U
Redside shiner (*Richardsonius balteatus*)	N	C/U
Chiselmouth (*Acrocheilus alutaceus*)	N	O/U
Peamouth (*Mylocheilus caurinus*)	N	O/U
Largescale sucker (*Catostomas macrocheilus*)	N	O/U
Longnose sucker (*Catostomas catostomas*)	N	C/U
Bridgelip sucker (*Catostomas columbianus*)	N	C/U
Pacific lamprey (*Entosphenus tridentatus*)	N	O/S-D
River lamprey (*Lampetra ayresi*)	N	O/S-D
Torrent sculpin (*Cottus rhotheus*)	N	O/D
Margined sculpin (*Cottus marginatus*)	N	C/S
Piute sculpin (*Cottus beldingi*)	N	C/S
Brown bullhead (*Ictalurus nebulosus*)	E	O/U
Smallmouth bass (*Micropterus dolomieui*)	E	O/S
Bluegill (*Lepomis macrochirus*)	E	O/U
Crappie (*Pomoxis spp.*)	E	O/S
Channel catfish (*Ictaluris punctatus*)	E	O/S
Grass pickerel (*Esox americanus vermiculatus*)	E	O/U
Pumpkinseed (*Lepomis gibbosus*)	E	O/U
Carp (Cyprinus carpio)	E	O/S

E=Exotic, N=Native, A=Abundant, C=Common, O=Occasional, U=Unknown, S=Stable, I=Increasing, D=Decreasing

* This species has been documented only one year.

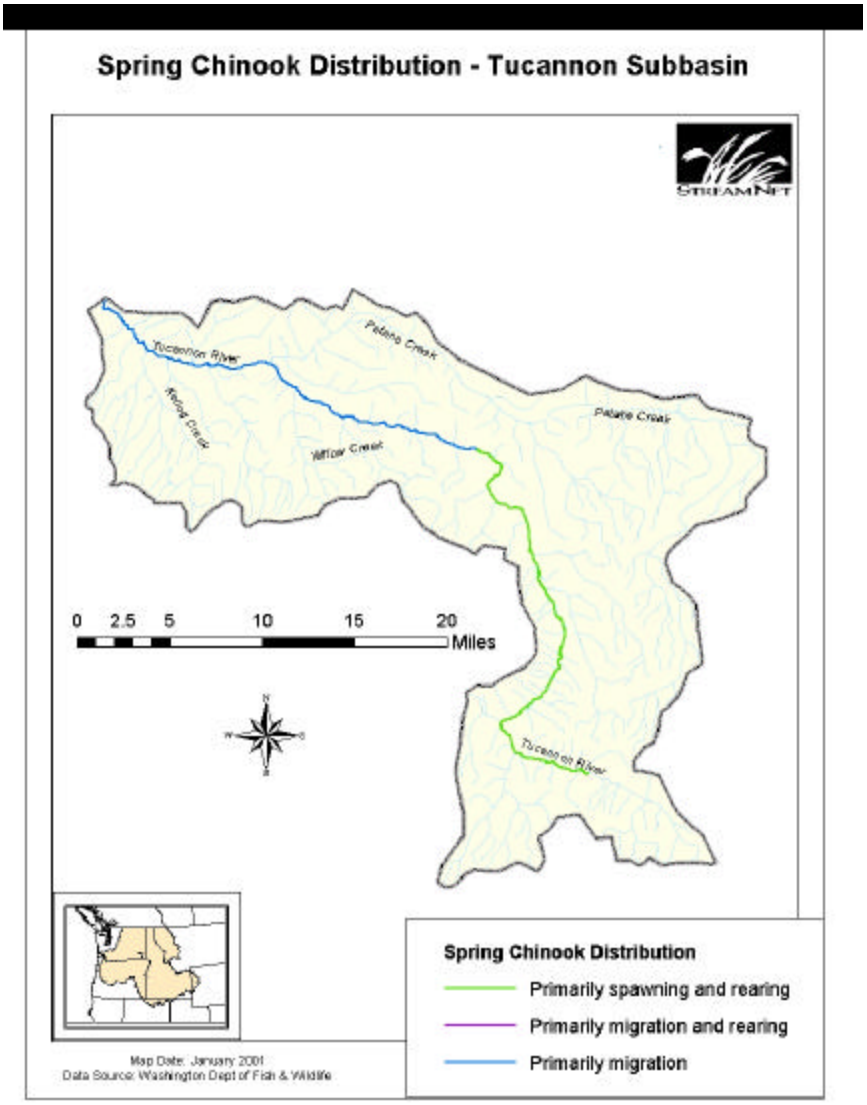

Figure 17. Spring Chinook Distribution within the Tucannon subbasin.

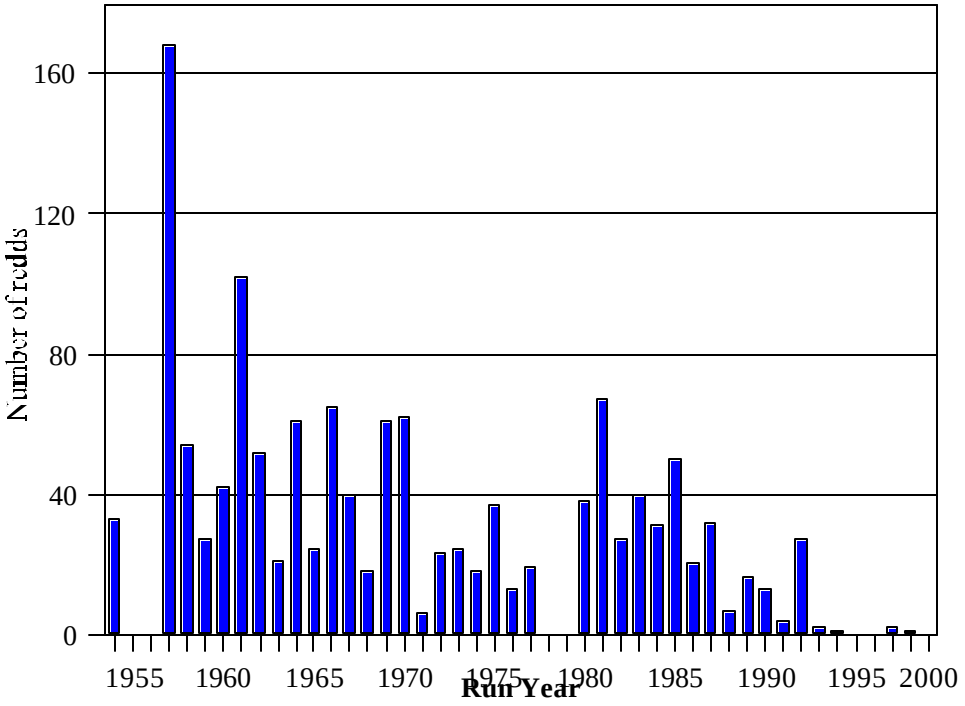

Figure 18. Spring chinook redds in historic index (RM 42-45) (Bumgarner *et al.* 2000).

The Washington Department of Fisheries (WDF) estimated that from 100 to 3,000 chinook still entered the river each year prior to 1954 (Edson 1960). The WDF first began yearly surveys in 1955 to count redds between the Camp Wooten Bridge and the Cow Camp Bridge. These redd counts were used to show the relative escapement trend over the years. This trend in the historic index reach has been downward since surveys began (Mendel 1995) (Figure 18), but since 1985 the abundance of redds in the index areas have been influenced by downstream broodstock collection for the hatchery program. In 1984, the entire river was surveyed in order to better relate the redd counts from the 3-mile index reach to the rest of the river. Since then, this counting method has been refined and the index areas have been expanded.

In 1985, the WDF installed a temporary trap near the Tucannon Hatchery to capture upstream-migrant adults and a juvenile trap at RM 13 to capture downstream-migrant juvenile fish (see Figure 19 for hatchery locations). The adult trap was made permanent in 1990. These traps have been used for annual adult counts and tagging studies involving native and hatchery fish, resulting in a more detailed summary of chinook utilization for the entire river.

The earlier redd counts reflect only the number of adults that made it to the upper river to spawn. Historically, the entire mainstem, including all of the shallow spawning areas, was open for sport fishing from late May to mid-July, with a six-fish limit, only two over 20" long. According to information gathered by Johnson (1995), much of this "sport catch" was taken illegally by snagging, gaffing or spearing. The DeRuwe dam was a favorite gaffing site until it was destroyed in the 1964 flood (DeRuwe

1995). Many fish were also taken by using wire-mesh "nets" strung across the river. Johnson (1995) documents a long history of intense salmon poaching in the Tucannon River which had a negative impact on the population and a direct effect on the redd counts. During more recent spawning surveys, WDFW personnel have noted that poaching is still evident (Bumgarner *et al.* 1994). In 1958, WDF changed its sport fishing regulations so that chinook fishing was not allowed upstream of the Tucannon Campground Bridge. Prior to 1964, when WDF first required a sport salmon punchcard, the size of the sport catch in the Tucannon River was unknown. Between 1964 and 1974, annual estimates ranged from over 900 fish in 1966 down to 77 in 1972. Because of the decline in both the sport catch and the number of redds, WDF closed the entire river for chinook sport fishing in 1974. In 1977, WDF closed the entire Snake River for both commercial and sport fishing for adult spring chinook, though sport fishers were still allowed to take jacks, less than 24", until 1985, when all chinook fishing was closed.

The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) and Nez Perce Tribe closed their historic Tucannon River ceremonial and subsistence fishery in 1984. This fishery allowed salmon to be gaffed in their spawning areas. The tribes did not keep a record of their catch, but biologists for the CTUIR estimated the catch at less than 50 fish per year (WDF *et al.* 1990).

The historic numbers of Tucannon River spring/summer chinook had already declined before Bonneville Dam was constructed. Since there is very good documentation of fish losses at these dams, it can be assumed there was a further decline with the completion of McNary Dam in 1953, The Dalles in 1957, and the John Day in 1968. The run was again reduced as a result of the construction and operation of Ice Harbor Dam in 1961 and Lower Monumental Dam in 1969 (see Figure 17).

The *Lower Snake River Fish and Wildlife Compensation Plan* (LSRCP) was completed in 1976. Mitigation for lost anadromous fish resources was based on escapement estimates derived from counts of adult fish at each dam. In 1996, agencies determined that the Tucannon River accounted for only 3.4 percent, 2,400 adults, of the spring/summer chinook that returned to the Snake River. Two percent of the estimated historic run of 1.5 million fish is 30,000, which supports the pre-1915 run size described by Parkhurst (1950). The Tucannon spring chinook hatchery program began in 1985 in an effort to supplement the native population. However, poor ocean conditions and other out-of-basin factors have caused the population to continue to decline.

Tucannon River spring chinook runs were relatively stable from 1985 to 1993 with a mean run of 550 fish. However, between 1994 and 1999, the average run declined to 196 fish, with record lows in 1994 and 1995. In addition to the poor adult returns, floods during the winters of 1996 and 1997, coupled with relatively low redd counts because of the depressed runs, left the river well below historical carrying capacity. The number of natural smolts from brood years 1994-1996 averaged less than 3,000 fish annually (Bumgarner *et al.* 1998; Bumgarner and Schuck 1999). Conversely, an average of 42,000 natural smolts migrated from the 1985-1993 brood years (Bumgarner *et al.* 1998). Adults returning from the three depressed brood years are estimated at only 50-60 total fish.

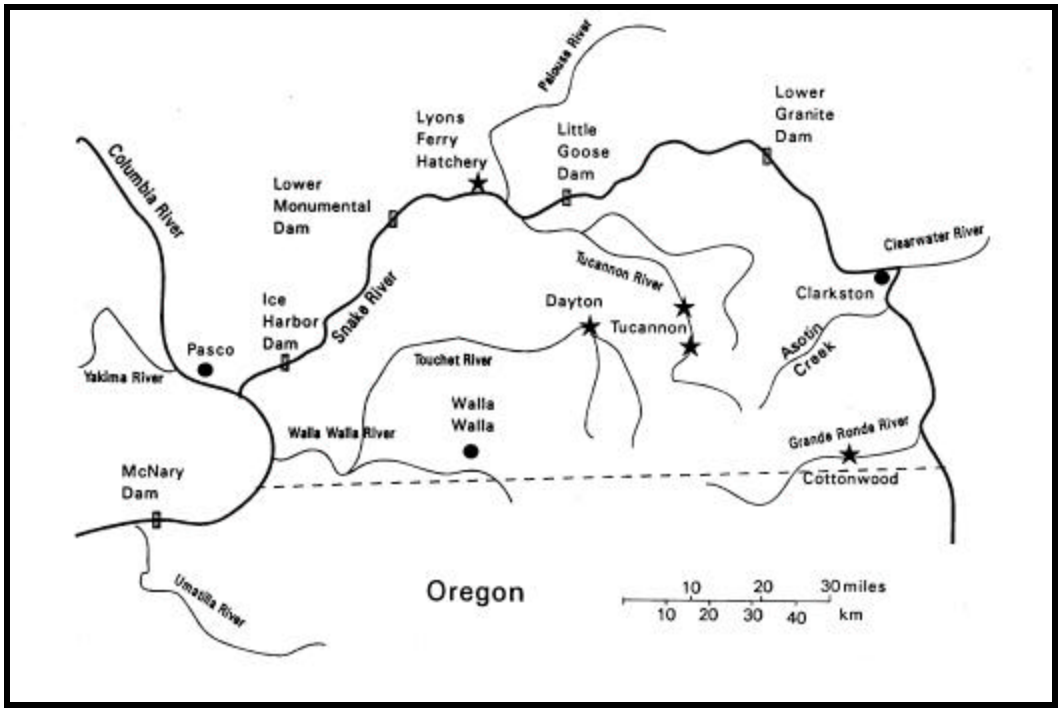

Figure 19. Lower Snake River dams and hatcheries (Mendel *et al.* 1995).

Fall Chinnok

In 1935, local residents told surveyors that until 1922-23, there was a run of chinook that entered the river in the fall, but this run had been "greatly depleted." According to Kelley (1982), WDF thought this run had disappeared prior to 1960, but Lyle Gilbreath, who grew up on the Tucannon River, remembers seeing chinook spawning in late fall below Starbuck Dam during the 1970's. The WDF *et al.* (1990) documents counts made by NMFS that ranged from 20 to 200 redds between 1976 and 1980 near the mouth of the river (Figure 18). The WDFW has used standardized redd surveys since the fall of 1985 to compare annual spawning densities in the stream reach between the mouth and Starbuck Dam (Table 14). 1990 extended these surveys extended to include areas upstream of this dam (Figure 19).

During the 1990-1993 surveys, 88 carcasses were found, of which only 21 were tagged hatchery fish (Bugert *et al.* 1991, Mendel *et al.* 1992 and 1994). Although many of these adult fish are natural, stray hatchery fall chinook from Lyons Ferry Hatchery and the Umatilla River have been documented in the river for several years (Mendel *et al.* 1996, Wargo *et al.* 1999). Even though no hatchery fall chinook have been released into this river. Sediment deposition in the lower Tucannon River is expected to have caused poor survival for progeny from fish that had previously spawned in the lower river. Fall chinook have been seen spawning upstream of Starbuck Dam since 1992, when WDFW and BPA constructed a fish ladder (Mendel *et al.* 1994).

Table 14. Fall chinook spawning surveys below Starbuck Dam (Milks *et al*. 2000).

Year	Redds	Redds/Mile	Year	Redds	Redds/Mile
1985	0	0	1993	21+7**	3.5
1986	0	0	1994	25	4.2
1987	16	2.7	1995	28+1**	4.7
1988	26	4.4	1996	31+12**	6.9
1989	48	8.0	1997	24+3**	3.3
1990	61	10.2	1998	38+2**	8.5
1991	50	8.4	1999	18+3**	4.0
1992	21+2**	3.5	2000	15+4	3.3

** redds found above the dam *only for redds below the dam

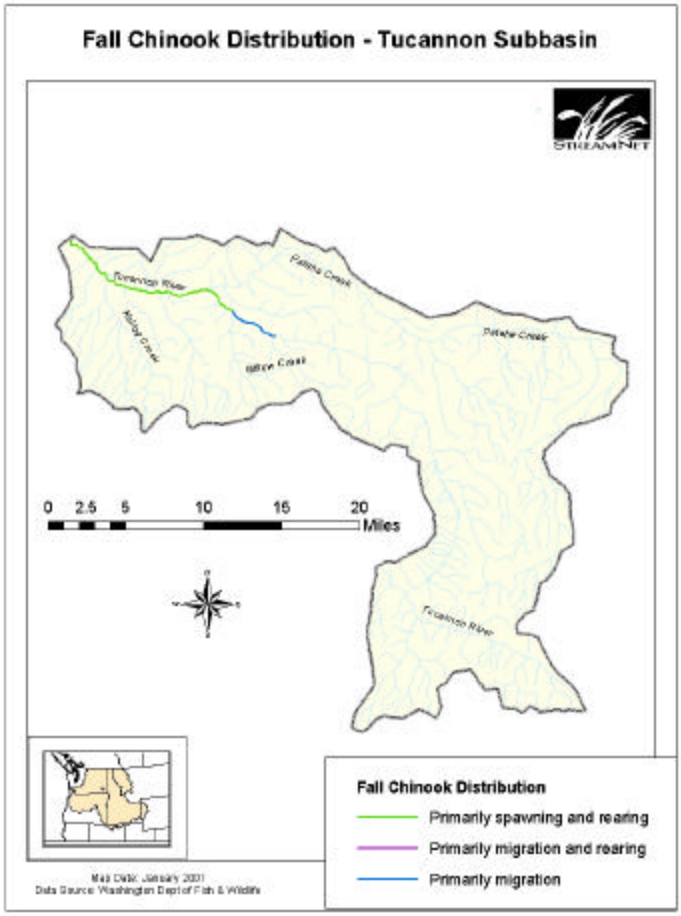

Figure 20. Fall Chinook distribution within the Tucannon subbasin.

Coho Salmon

Parkhurst (1950) noted that, according to local residents, the last run of silver (coho) salmon entered the river in October 1929, although "a small number of these fish probably still appear." The Tucannon River coho may have become extinct by 1955 (Kelley *et al.* 1982), though coho were still found within the Snake River system until at least 1986 (Wortman 1993). Edson (1960) reported that sporadic returns of up to 100 adults were still occurring after the Snake River coho sport fishery had been closed during the 1950's. He thought the river could still support a sizeable run of coho. Stray hatchery origin fish, suspected to have originated from smolt releases into the Clearwater River in Idaho, or elsewhere, have recently been observed spawning in the river below RM 5.0 (Wargo *et al.* 1999). Juvenile coho smolts were identified at a WDFW outmigrant trap located on the lower Tucannon River, which may have been produced from redds identified the previous year.

Pink Salmon

Pink salmon have been documented in the Columbia River since at least 1941, but only a few times in the Snake River, most recently in 1975 and 1991. During surveys for fall chinook in the fall of 1975, one male and four female carcasses were found in the Tucannon River, downstream of Starbuck Dam. They appeared to have spawned in the area where fall chinook had spawned (Basham and Gilbreath 1978). There are no records of hatchery releases of pink salmon into the Tucannon or Snake rivers.

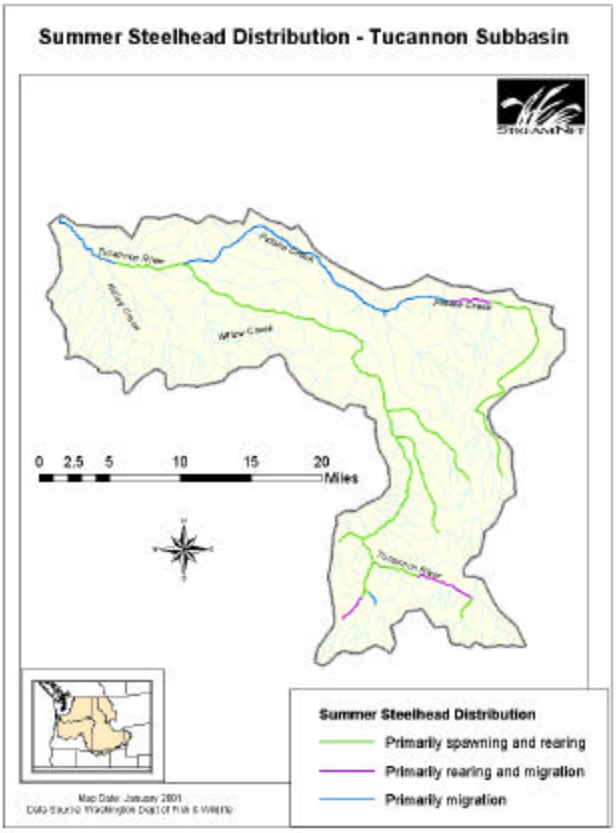

Figure 21. Summer Steelhead distribution within the Tucannon subbasin.

Steelhead/Rainbow trout

According to Parkhurst (1950) at the time of the 1935 survey, a considerable run of steelhead was believed to still enter the river, but not as abundantly as in the past. Unfortunately, they made no estimate of run size at the time, but other researchers estimate the steelhead run could have been between 3,400 and 4,000 adults (Eldred 1960; USACE 1975). Kelly *et al.* (1982) estimated the Tucannon drainage would be capable of producing 280,000 steelhead smolts under improved conditions (Figure 21). Production at this level in the past may have returned as many as 14,000 adults. Parkhurst reported finding only resident rainbows (likely, young steelhead) in the upper portions of tributary streams during the 1935 survey.

Prior to 1970, returns of native steelhead to the Tucannon River were estimated to average 3,400 or 3 percent of the total Snake River return (WDF *et al.* 1990). Using harvest report card data since 1947, Washington Department of Game (WDG) estimated "in-river" sport catches ranged from a high of 689 in 1957 down to 24 in 1973. The sport fishery was closed in 1974, but has been open since 1985 with a requirement that all “wild” (native) fish be released. Other restrictions may be needed as the estimated number of returning wild fish has steadily declined since 1988 (Table 15).

Table 15. Steelhead escapement, Marengo to Sheep Creek (Schuck *et al.* 1997).

Year	Wild	Hatchery	Total	Year	Wild	Hatchery	Total
1987	521	750	1,271	1994	151	96	247
1988	525	787	1,312	1995	147	230	377
1989	319	388	707[1]	1996	71	322	393[2]
1990	416	343	759[1]	1997	no data		
1991	210	256	466[1]	1998	no data		
1992	166	513	679	1999	85	340	425
1993	94	475	679	2000			

[1] estimated from juvenile index counts of "fry" that resulted from uncounted spawners

[2] Panjab Creek not included

Escapement estimates are based on redd counts, sport catch, juvenile population and adult counts at the hatchery trap. Steelhead redd counts are not always reliable population indicators, however, because these fish spawn during the spring runoff when the flows are high and turbid, making both the fish and their redds difficult to see. The index does not include fish that spawn in tributaries or downstream and upstream of the spawning-index reach, which starts at Marengo and ends at the mouth of Sheep Creek. Although the escapement of wild fish into the system to spawn has fluctuated greatly in recent years (WDF and WDW 1993), the stock is considered depressed based on chronically low spawner escapement. Juvenile e densities remained reasonably stable for the period 1985-1994 (Schuck *et al.* 1998). The origin of the stock is likely a mixture of native and non-native stocks due to hybridization with hatchery stocks. Improved sampling methods were initiated in 1992 for spawning surveys with good results and they will be continued in the future.

In addition to steelhead redds, trout sized redds have been identified during spring steelhead surveys and late summer spring chinook surveys. These redds often cannot be associated with bull trout, and WDFW biologists believe that they are made by resident trout. This increase in the observation of trout spawning may be the result of more restrictive fishing regulations and stream reach closures allowing resident fish to mature to spawning age.

Sporadic outplants of hatchery steelhead from several other rivers were made between 1936 and 1980. Since 1983, hatchery production for the Tucannon River has been produced under the LSRCP program at the Lyons Ferry Hatchery.

A consumptive hatchery steelhead fishery occurs on the Tucannon River between September 1 and April 15. Since 1985, approximately 250-840 fish annually have been harvested (WDFW harvest report cards).

A summer trout fishery (June-October) concentrated angling effort on WDFW's Wooten Wildlife Area until the 1990s. Then, fish stocking was moved down stream to minimize potential impacts

to listed spring chinook and the fishery became more dispersed. Between 1983 and 1991, 20,000 to 42,000 catchable size rainbow trout (≥ 8”) were stocked each year. Considerable hooking and releasing of wild rainbow and juvenile steelhead occurred in the fishery, although in 1985 direct harvest of wild fish in the fishery was estimated to be only 0.6 percent (279 fish) of total harvest (Schuck and Mendel 1987). Actual mortality due to hooking is unknown. Sixty-six percent of Tucannon River anglers use some form of bait (A. Viola, WDFW, per. com., 1993), and Mongillo (1984) estimated that 50 percent of fish hooked with bait and released could eventually die. Stocking of rainbow trout, was decreased until 2000 when it was terminated, along with bait restricted fishing and increased minimum size limits in the upper river, were put into effect to protect naturally producing populations of trout and spring chinook salmon. All tributaries to the Tucannon River, except Pataha Creek, are closed to fishing. All stocking of resident rainbow trout was terminated in 2000.

Lamprey

Pacific lampreys have life histories and survival problems similar to salmon. They were once an abundant commercial fish in the Columbia River system. Kelley (1982) reported seeing only juvenile Pacific lampreys. As few as 40 adults were counted passing Ice Harbor Dam in 1993. Bumgarner (per. com., 1999) reported that juvenile lampreys had been captured in the smolt trap located at RM 1.9 every spring since 1986. A few adults have been seen each year in the smolt trap by WDFW staff since 1995. The NMFS lists the Pacific lamprey as a species of concern, and the CTUIR has begun investigations on the status of lamprey in the Snake River and Walla Walla systems. River and brook lamprey may also exist in the Tucannon River, but their presence is uncertain.

Bull trout

Bull trout spawn and rear in the upper portions of the river and adults and subadults migrate to the lower Tucannon and Snake rivers in the winter months (Figure 22). They return to the upper river each spring to spawn. Bull trout spawning ground surveys were initiated in 1991 and have continued intermittently (Table 16). Bull trout were listed as threatened under the ESA in June 1998. No hatchery program is currently planned for bull trout in the Tucannon subbasin. However, the release of brook trout into the subbasin several decades ago resulted in the establishment of a self-sustaining population in upper Pataha Creek. These fish represent a potential threat to the population stability of bull trout and they may be a competitive population for food and space with native steelhead/rainbow.

Table 16. Tucannon River bull trout spawning survey redd counts, 1991 – 2000 (G.Mendel, WDFW per. com., Jan. 2001).

Year	Number of redds	Miles surveyed	Redds/mile
1991	57	12.9	4.4
1992	66	10.8	6.1
1993	NA	NA	NA
1994	131	8.5	15.4
1995	114	11.5	9.9
1996	184	16	11.5
1997	78	18.5	4.2
1998	108	17.25	6.3
1999	222	30.65	7.2
2000	151	17.65	8.6

The WDFW initiated several actions to protect and restore the Tucannon River bull trout population. Historically, the entire mainstem Tucannon was open to harvest of bull trout during the general trout season (June 1 to October 31). Beginning in 1996, the upper river above Panjab Creek was closed to all fishing, and in 1999 the river was closed to bull trout harvest. The bull trout population appears to be responding positively to these actions as the number of redds has increased in the spawning grounds.

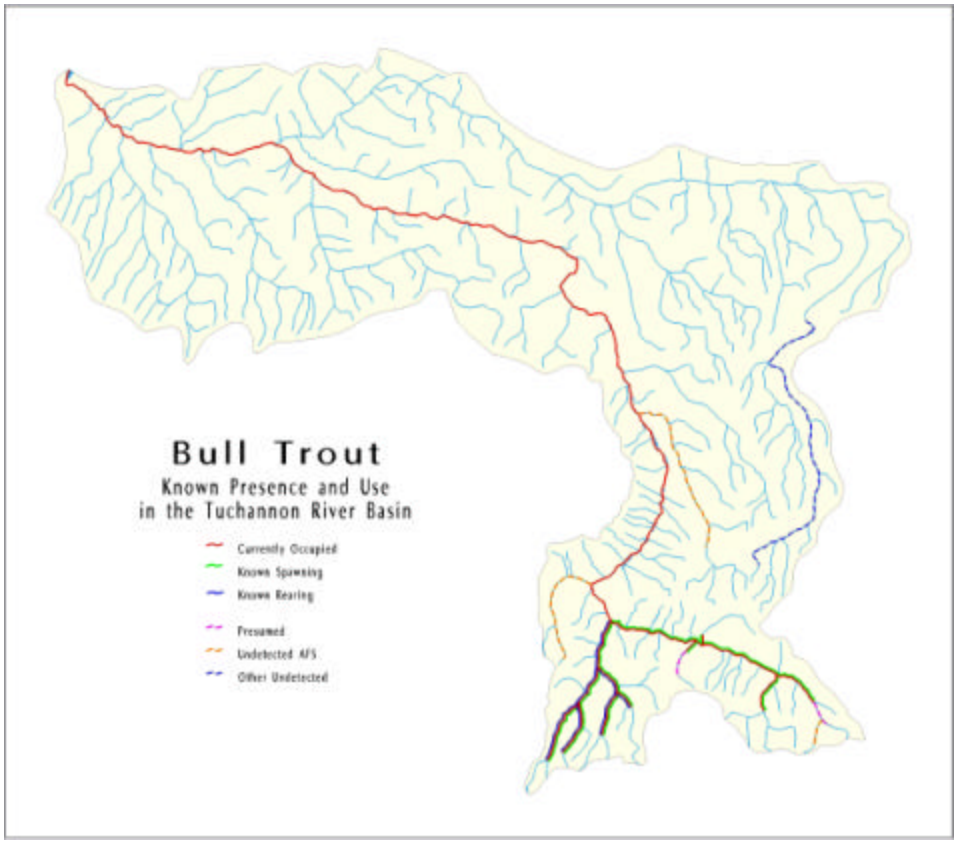

Figure 22. Bull trout distribution within the Tucannon subbasin, Washington (WDFW).

Mountain whitefish

Whitefish are native to the Tucannon subbasin and known to exist throughout the mainstem river. Although there is a season for whitefish that runs concurrently with the steelhead season, their status is unknown.

Miscellaneous Species

Several introduced species of fish inhabit the Tucannon subbasin. Brook trout were introduced into the Pataha Creek drainage in the 1970's (WDFW planting records). A small self-sustaining population of brook trout remains in the upper reaches of Pataha Creek (G. Mendel, WDFW, per. com., 1999). Brown trout were reared at the Tucannon Hatchery for release into the Touchet River and local lakes from 1970 to 1999. Brown trout were once mistakenly stocked into the Tucannon River in the 1980's. There have been a few confirmed catches of brown trout from the Tucannon River. Presumably, they were fish that had escaped from the hatchery or from the one known stocking event. The population is believed to be very small or non-existent now, with no successful natural reproduction having been documented for several years. Warm water species inhabit the lower Tucannon River up to highway 12, with the greatest number of fish concentrated in the first few miles above the Snake River impoundment. Smallmouth bass and channel catfish are abundant in the Snake River and, therefore, represent a significant predatory threat to outmigrating juvenile salmonids from the Tucannon. Grass pickerel

apparently have accessed the Tucannon from the Palouse River where their presence has been documented (Wydoski and Whitney 1979).

The Tucannon River supports a population of Margined sculpin and reportedly may also have populations of Umatilla and Leopard dace, although these have not been confirmed. Little work has been directed at assessing the status of these species, which are identified as either candidate or sensitive species in Washington. A complete list of both the federal and state threatened, proposed, candidate and priority species that may be found in the subbasin is included in Appendices D and E. The state list of priority habitats is also included.

Wildlife

The Tucannon River and Pataha Creek watersheds are important wildlife areas in Eastern Washington, both in terms of wildlife populations and wildlife-based recreation.

The Tucannon subbasin contains 276 species of wildlife. The species list is continuously being revised to reflect the change in populations due to habitat loss, harvest numbers, updated wildlife surveys and introduction of exotic species. (Appendix F).

Population status varies by area and species. Some species are doing well, while others are listed as state threatened, candidate, or species of concern. State and federal agencies manage big game, upland birds, diversity species, furbearers, and waterfowl.

WDFW maintains a list of Priority Species of fish and wildlife species that includes all animals presently listed in the Federal Register as *endangered, threatened, sensitive, or candidate* (Appendices D and E) (Figure 23). It also includes wildlife species, which WDFW feels are vulnerable to future listing (*monitor* species) or important for recreation (*game* species). WDFW also developed a list of Priority Habitats which support either unique or a wide diversity of wildlife species. The Washington Natural Heritage Program compiles a Washington plant list. The U.S. Fish and Wildlife Service make Federal determinations for all other plant and animal species.

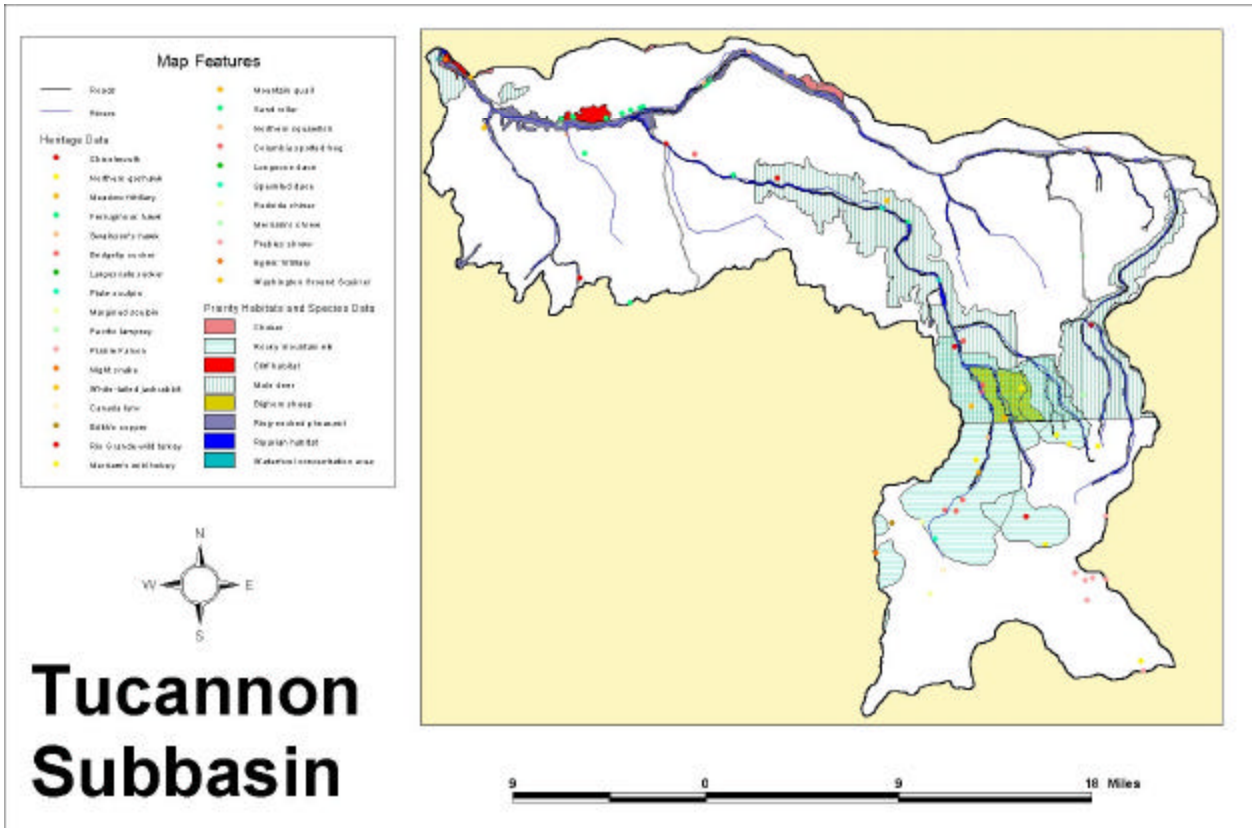

Figure 23. Priority Habitat Species in the Tucannon subbasin, Washington (WDFW data, S. Martin per. com., 2001).

State threatened species include the ferruginous hawk and sharp-tailed grouse (Table 17). State candidate species include the Washington ground squirrel, burrowing owl, and white-tailed jackrabbit. Mule deer populations are at management objective in the lowlands, and below management objective in the mountains. The elk population is below the management objective by approximately 250 animals. The bighorn sheep population has declined from a high of 60+ sheep to approximately 20-25 over the last two years (P. Fowler, WDFW, per. com., 2001).

Table 17. Status of Priority Habitat Species in the Tucannon subbasin, Washington (WDFW 2001).

Species	State Status	Population
Bald eagle *(Haliaeetus leucopareia*)	T	Wintering 4-5
Bighorn Sheep (*Ovus Canadensis*)	PHS Species	Declining (20)
Blacktailed jackrabbit (*Lepus californicus*)	C	Very low
Burrowing Owl (Athene cunicularia)	C	2 nesting pairs
Elk (Cerrvus elaphus)	PHS - Game	MO
Ferruginous hawk *(Buteo regalis)*		
Flammulated owl *(Otus flammeolus)*		
Goshawk *(Accipiter gentilis)*	C	Unknown
Lewis woodpecker *(Melanerpes lewis)*		unknown
Loggerhead shrike (*Lanis ludovicianus*)	C	unknown
Mule Deer (*Odocoileous hemionus)*	PHS - Game	MO lowlands
Pileated woodpecker *((Dryocopus pileatus)*		
Pine marten *(Martes Americana)*		unknown
Ringneck pheasant (*Phasianus colchicus)*	Game	declining
Sharp-tailed grouse (*Tympanuchus phasianellus)*	T	extirpated
Spotted frog *(Rana pretiosa*)	C	low
Vaux's swift *(Chaetura vauxi)*		
Washington ground squirrel (*Spermophilus washingtoni)*	C	unknown
Whitetail Deer (*Odocoileous virginianus*)	G	MO
Whiteheaded woodpecker *(Picoides albolarvatus)*		unknown
Whitetailed jackrabbit (*Lepus townsendii*)	Candidate	unknown
Wild Turkey (*Meleagris gallopavo*)	G	stable
Wolverine *(Gulo luscus)*		unknown

C=Candidate Species, G=Game Species, PHS=Priority Habitat Species, T=Threatened, MO=Management Objective

Wildlife habitats within the subbasin consist of three types: shrub steppe, riparian/floodplain, and timbered uplands. Agriculture, invasion of noxious weeds, silvicultural management, logging, road building, and fire suppression have altered these ecosystems and negatively impacted wildlife populations.

The shrub steppe habitat encompasses much of the subbasin and consists mostly of agricultural croplands, rangeland, and Conservation Reserve Program lands (CRP). The riparian/flood plain habitat lies along the Tucannon River and its tributaries. The timbered uplands occur on north slopes and ridges, with shrub/grass communities on the south and west slopes (Kuchler 1964). Portions of the uplands lie within the W.T. Wooten Wildlife Area, Wenaha Tucannon Wilderness Area, and Upper Tucannon Roadless Area.

Shrub Steppe Habitat

Shrub steppe habitat consisting of sagebrush (*Artemisia spp.*), rabbitbrush (*Chrysothamnus spp.*), and various bunch grasses (*Agropyron spp.*), covered nearly all non-forested lands east of the Cascade Range in Washington, of which only 50% remains (Daubenmire 1970).

Agricultural development in this habitat resulted in rapid and extensive loss of vegetation, while the impact from livestock grazing has been slower in changing the composition and structure of native vegetative communities (Dobler and Eby 1990). Some shrub steppe habitat dependent wildlife species populations have been severely depressed or extirpated are listed below:

Ferruginous Hawk

The ferruginous hawk is listed as a state threatened species, and is dependent on large areas of shrub steppe habitat. Prey species such as rabbits, hares, ground squirrels, pocket gophers, and kangaroo rats make up 94.6% of the prey base for ferruginous hawks (Olendorff 1993). Due to the declining shrub steppe habitat in lowland areas of the subbasin, the availability of habitat for these prey species is limited. Ferruginous hawk nests in the sub-basin are usually located on basalt cliffs. Only 4-5 nesting pairs were documented within the subbasin in 1997 (WDFW 1997).

Flammulated Owl

The current status of the flammulated owl in the Tucannon subbasin is unknown, but they are well distributed throughout the Blue Mountains. The flammulated owl prefers late and old montane forest and young forests (Wisdom *et al*. 2000).

Whitetail Jackrabbit

The whitetail jackrabbit is listed as a PHS and state candidate species. The loss of shrub steppe habitat has contributed to the dramatic decline in jackrabbit populations. Agricultural development and livestock grazing have modified and destroyed much of the shrub steppe habitat on which the whitetail jackrabbit was dependent.

Washington Ground Squirrel

The Washington ground squirrel is PHS and state candidate species. The loss of shrub steppe habitat has resulted in the loss of Washington ground squirrel colonies. Historical colonies were surveyed in 1997, but no ground squirrels were observed.

Ringneck Pheasant

The ringneck pheasant is the primary upland game bird species in southeastern Washington. The loss of both shrub steppe/grassland and riparian habitat has resulted in a tremendous decline in the pheasant population within the subbasin.

The annual pheasant harvest peaked in Columbia and Garfield counties during late 1970's and early1980's at nearly 25,000 birds. By 1999, the pheasant harvest had declined 44% to 14,000 (WDFW 1999).

A number of factors can impact the pheasant harvest. First and foremost is the abundance of the pheasant population, nesting success, or the level of hunter participation, and weather during the hunting season. The dramatic decline in the pheasant harvest is a direct reflection of pheasant abundance. Hunter effort increases and hunter numbers decline as pheasant population decline.

Riparian/Flood Plain

Riparian habitat is limited and highly vulnerable to degradation from various human activities and development. Riparian habitat within the subbasin contains cottonwoods, willows, and various shrub species. Since the arrival of settlers in the early 1800's, from 50%-90% of riparian habitat in Washington has been lost or modified.

Agriculture has fragmented the riparian/flood plain habitat (including wetlands), along the Tucannon River and Pataha Creek. Agricultural operations have increased sediment loads, and introduced pesticides into streams. These developments have negatively impacted water dependent species such as the Spotted Frog.

Spotted Frog

Spotted frog populations have declined in the subbasin due to lose of wetlands and standing water. The current estimated population of the spotted frog is unknown.

Timber Uplands

The timbered uplands provide habitat for large ungulates and other wildlife species dependent on this habitat. Logging, livestock grazing, invasion of noxious weeds, fire suppression, and silvicultural practices have modified the structure and composition of the forest community, which has a negative impact on wildlife species dependent on early-seral stage communities. The timber/uplands consist of the following forest types; Western ponderosa (*Pinus poderosa*), Douglas fir (*Pseudosuga menziesii*)-Grand fir (*Abies grandis*), and Western spruce (*Picea* spp.)

Fuel loads have increased due to fire suppression increasing the risk of devastating wildfire. The lack of fire within the ecosystem has resulted in significant changes to the forest community and has negatively impacted wildlife species due to reduced availability, quality and ability to utilize important habitat. Timber uplands dependent species found in the Tucannon subbasin include: Pileated woodpecker, whiteheaded woodpecker, Lewis woodpecker, flammulated owl, wolverine, snowshoe hare, vaux swift, pine marten.

Bighorn Sheep

Bighorn sheep were re-established on the W.T. Wooten Wildlife Area in 1960. The population has fluctuated between 20 – 75 head over the last 40 years. The herd increased to approximately 60 head during the mid-1990's, but declined dramatically over the last two years due to scabies (*Psoroptes ovis*), and predation by mountain lion. Mortality of adults and young has been high, and the herd may be in jeopardy of declining to the point of no return. Domestic goats that run loose north of the Wooten Wildlife Area are a potential disease threat to this population.

Rocky Mountain Mule Deer and White-tailed Deer

Rocky mountain mule deer are a PHS and primary big game species within the sub-basin. Mule deer populations in the lowland habitat increased significantly over the last 15 years, while mule deer numbers in the upland habitat have declined. The percentage of mule deer bucks harvested declined from 65% in 1985, to 53% in 1999, while the percentage of whitetail bucks increased (P. Fowler, per. com., 2001).

White-tailed deer populations and inter-specific competition have increased in the subbasin over the last 15 years, but not as much as in other subbasins in southeastern Washington. White-tailed deer in the lowland areas are susceptible to Epizootic Hemorrhagic Disease (EHD), and outbreaks occur with varying severity every 4-5 years (P. Fowler, per. com., 2001). An outbreak in the lowlands in 1998 was severe, resulting in a significant decline in white-tail deer numbers from the Snake River to Highway 12 near the Tucannon River.

Potential limiting factors for mule deer include the lack of fire to stimulate browse species on the winter range, noxious weed invasion, and inter-specific competition with whitetail deer and elk (Hamlin *et al*. 1984, Unsworth *et al*. 1999, Whitaker and Lindzey 1999). Predation by cougar, black bear, and coyote also may be a significant factor in the population decline.

Rocky Mountain Elk

Elk populations in the subbasin are below the management objective of 700 elk (WDFW Elk Plan 2000). Surveys in March 2000 produced a count of 420 elk within the subbasin (P. Fowler, per. com., 2000). However, there is a significant difference between herd levels east and west of the Tucannon River. The sub-herd west of the river is at management objective, and has actually increased over the last five years. The sub-herd east of the river has declined significantly.

Mortality rates on adult cows and calf elk appear to be significant factors in depressing the population east of the Tucannon River. The high level of mortality on adult bulls is keeping the post-season bull ratio well below management objective.

Calf mortality factors were identified between 1992-98 (Myers *et. al*. 1999). The study showed that calves suffered an annual minimum mortality rate of $\geq$58%, with predation accounting for a minimum of $\geq$78% of the mortality. Cougar and bear were the primary predators involved.

Habitat conditions are deteriorating for elk within the subbasin due to land subdivision, silvicultural management, logging, road building, off highway vehicles (OHV), trail construction, livestock grazing, noxious weeds, and fire suppression. OHV trails routed through historical calving areas and prime summer habitat are a continuing problem. Elk may be forced to spend more time in agricultural areas causing increasing conflicts with landowners.

Habitat Areas and Quality

The contemporary character of the habitat in the Tucannon subbasin has been shaped through natural disturbance and human use of the land and water. Road building and maintenance, urban and agricultural development, rural development, grazing, tilling, deforestation, water regulation, and flood control structures have combined to alter vegetation, soil properties, topography, runoff, water temperatures, instream flows and sedimentation. Changes to the watershed processes have yielded a mosaic of aquatic habitat ranging from high quality to severely degraded in the subbasin. The most severely degraded fish and wildlife habitat areas tend to be in the lower portions of the Tucannon and Pataha watersheds where most development and human alteration of the landscape has occurred.

Fish

Habitat has been degraded as a result of farming, grazing, logging, road development, concentrated recreation, and catastrophic floods, which have occurred with greater frequency in recent years.

Agricultural and livestock management practices coupled with the local soil types and climate have contributed to increased sedimentation and a general reduction of riparian vegetation and instream cover. Loss of riparian vegetation, and water withdrawal has likely contributed to the elevated stream temperatures observed in the lower half of the subbasin. Channelization of the stream has likely impacted fish production as well by reducing pool-riffle ratios and riparian vegetation.

Fish production restraints occur primarily in the lower 20 miles of the Tucannon River, which is too warm in the summer to provide suitable rearing areas for juvenile chinook. Steelhead rearing also decreases below Marengo. Elevated stream temperatures can be largely attributed to loss of riparian vegetation from overgrazing, and historic and recent flood damage. The upper Tucannon River on state and federal land has good to excellent spawning and rearing habitat for spring chinook, steelhead, bull trout and whitefish. Stream volume reductions associated with irrigation also have an impact on water temperature, and that quantity and quality of instream habitat.

The Tucannon River is an adjusting and evolving stream. Many of these changes are related to land uses in the subasin. During the past several decades, the Tucannon River has undergone fundamental changes in flow regime, bed conditions, water quality, and habitat values. The form of the Tucannon River below Willow Creek is still undergoing long-term adjustment. Most channel changes in the lower part of the river pre-date extreme floods that occurred in the 1960's and 1970's. Changes in Pataha Creek seem to have occurred in the first 30 to 50 years following establishment of the region's agricultural economy, and changes observed above Willow Creek took place during the 1964 to 1978 interval (Hatcht *et al*. 1982). Hecht *et al*. (1982) identified an evaluated change in the riparian area and streambed channel conditions of the Tucannon River between 1937 and 1978. These changes suggest a 33 to 55 percent decrease in riparian woodland during this time period, much of which was attributed to major floods after 1964. Flood periods were determined to have had their greatest impacts in the middle and upper reaches of the river, while alterations below Marengo pre-date these events. The authors attributed some of the woodland loss to encroachment of other land use practices, principally irrigated fields, and pasturelands. As wooded riparian zones were replaced with open areas, shade was diminished and the riverbanks likely became less stable. The authors could not determine whether the biggest influence in the loss of riparian woodland was flooding or land use practices (Hecht *et al*. 1982)

Stream geomorphology

Changes in stream geomorphology have contributed to the Tucannon River's degraded condition. Some of those changes include: (Tucannon MWP 1997)

- The width-to-depth ratio has been increased, causing increased exposure of water surface to solar radiation and high summer air temperatures.
- Large woody material is lacking in the channel for pool formation and fish habitat and on the streambank for future recruitment of pool building materials.
- The stream length has been reduced and has changed from a meandering, narrow and deep channel to a straighter, sometimes braided and/or wider and shallower, entrenched channel form, which has an overall increased velocity. These changes have resulted in the loss of quality fish habitat.
- Streambank stability has been diminished due to the loss of root systems of woody material growing on the streambank and an increase in streambank erosion.

Table 18 summarizes and compares pool habitat with geomorphic potential. Most reaches on the Tucannon River have a fraction of the natural pools they had in pre-settlement times. The number of pools that should exist in this stream type is one pool for every 5 to 7 bankfull discharge widths. This relationship between the number of pools and bankfull discharge width is described in Leopold (1994). This relationship only applies to the pool-riffle morphology, which comprised about 99 percent of the 12 reaches inventoried on the Tucannon River. A river this size in a stable geomorphic condition could support and maintain this number of pools.

Following the severe flood stage events of the 1960's and 1970's, there was an increase in the size and frequency of peak flow events (Hecht *et al*. 1992). The summary (Hecht *et al*. 1992) states, "We concluded that the channel form is adjusting to increased runoff, much-diminished bank stability and the related major increase in coarse sediment loads. Unlike most streams adjusting to greater or more frequent peak flows, hydraulic roughness of the Tucannon River has apparently decreased as riparian woodlands were lost and as the bed filled with gravel from the banks."

Both the 1982 and 1995 stream inventories support the conclusion that the Tucannon River is in an unstable condition. Past flood control projects have resulted in diked channels in many areas, which do not allow the river to dissipate its flood energy across a floodplain, as it would have in the past. Road construction and maintenance, channel realignment after flooding, agricultural production, forest management, and urban development has caused changes in the natural flow characteristics of the river.

Flooding

On February 7 and 9, 1996, a rain-on-snow event with strong warm winds following two weeks of cold weather caused the Tucannon River to reach a flood crest stage of 5,580 cfs (provisional). This flood flow was followed by two other flood flows on April 25, 1996 (1,230 cfs) and on January 1, 1997 (3,500 cfs). The highest previously recorded flow was recorded on December 22, 1964 and measured 7,980 cfs, which was eight times the bankfull dimension. The February 1996 flow was equivalent to five and a half times the established bankfull flow (Leopold 1994). After the flood, stream corridor conditions were compared with conditions recorded prior to the flood.

Changes In Geomorphic Condition

As bankfull and higher flood events occurred after the channelization efforts of the 1960's and 1970's, bedload gradually accumulated in the system, which raised the channel bed. Consequently, when large flow events occurred three times in an 11-month period, the river changed locations in several places and developed braided channels in other areas. This caused extensive damage to improved property and structures, particularly around bridges and in areas where the river had a high width-to-depth ratio.

Table 18. Tucannon River summary of Hankin and Reeves pool riffle data and geomorphic stream inventory, (Tucannon MWP 1997).

Reach	Reach Description	Length	Large Pool/ mile	Large Pools	Large Pools with LWD	Small Pools	Small Pools with LWD	BFDW	Geo-morphic Pools	Dominate Stream Types
1	Snake R. Con-fluence to Kellogg Hollow Road Bridge	2.5 (4.6)*	20	50	14	28	9	52 (312)	42	C4 F4
2	to Smith Hollow Road Bridge	3.2 (3.25)**	10	32	6	21	2	50 (300)	72	B4c F4
3	to Pataha Confluence	3.7 (3.71)**	16	59	22	36	10	45 (270)	72	B4c, D4, C4
4	to section 2 Bridge	5.7 (5.9)**	13	74	32	75	27	43 (258)	117	B4c, F4 D4 some C4
5	to King Grade Bridge	4.0 (4.0)**	10	42	16	37	11	41 (246)	85	B4c, F4, D4
6	to Marengo Bridge	3.4 (3.75)**	9.4	32	12	27	11	40 (240)	82	B4c, D4, F4
7	to section 25 Bridge	3.1 (3.2)**	7.1	22	1	12	1	39 (234)	72	B4c, C4 D4 and F4
8	to Hartsock Grade Bridge	1.8 (2.5)**	3.3	6	2	9	0	39 (234)	56	B4c and B3c C4 D4 and F4
9	to Tumalum Creek Confluence	1.7 (2.27)**	7.1	12	3	9	0	37 (222)	54	B4c&B3c C4 split D4
10	to Cummings Creek Confluence	(2.1)**	12.4	26	2	16	1	35 (210)	52	B4c and B3c C4 & F4
11	to USFS boundary sections 35 & 2	3.0 (3.0)**	7.7	23	6	20	3	32 (192)	83	B3c, B3, C3 C4, F3 some B2
12	to bridge at Tucannon Campground	4.3 (4.4)**	11	47	12	61	6	32 (192)	121	B3c, F3 C3, D4 some B2

* Distance from snake River Confluence to Smith Hollow Road Bridge is 4.6. Hankin & Reeves inventory starts at old railroad bridge instead of confluence.

** NRCS Reach distance - the values in parenthesis

Major changes in the Tucannon River since the flood include increased width-to-depth ratios, decreased streambank stability, increased bedload mobility and deposition, and increased frequency of large pools with large woody debris. Braided channel reaches and degraded channels, with center bars are more common since the floods. Streambank stability has been decreased significantly by increased bedload movement, which has deposited gravel bars in the channel. These bars, especially center bars reduce streambank stability by increasing the amount of water being directed at the stream banks.

Changes in Riparian Condition

The stream banks are especially susceptible to streambank erosion because many of the trees and shrubs have been undercut and have fallen into the channel. The amount of unvegetated stream banks has increased by 15 to 25 percent in some areas. Reproduction of seedling cottonwoods, alder and willow species has been successful in some areas where bare stream banks are open to colonization. Due to the loss of trees along the stream corridor, canopy cover has been reduced by 5 to 15 percent in different stream reaches. This will negatively affect the stream temperature for several years until larger trees are established along the streambank.

In some areas above Marengo, large woody debris has been reestablished in the stream corridor. This material has contributed to an increase in pool formation since the floods.

Table 19 summarizes some important geomorphic and riparian changes that occurred during flood stages of 1996 and 1997.

Changes in Fish Habitat and Impacts to Fish

In addition to the re-inventory of the river conducted by the Technical Advisory Committee (TAC), the WDFW conducted habitat surveys during June 1996 to compare pre- and post- flood habitat conditions for selected sections of the river. In order to be consistent with surveys conducted by WDFW in past years, a “pool” was defined as an area where the velocity of the river thalweg becomes noticeably slower and the water is at least 0.5 feet deep with a surface area less than or equal to one square foot. Though these criteria result in much smaller pools than required by adult chinook, the ratio of total pool surface area to that of riffle and run (or glide) within each section should be comparable for pre- and post-flood conditions since riffles and runs were defined similarly by the TAC. For chinook habitat, only “large pools” at least 3 feet deep and 25 square yards were considered by the NRCS and USFS (MacIntosh 1993).

There was too much flow to count large pools in the lower sections of the river when the TAC surveyed it in November 1996. The upper sections were surveyed in colder weather and large pools were more easily recognized. According to raw data collected by WDFW (Bumgarner, WDFW, per. com., 1997), in reaches 7 - 10 the surface area for:

- pools remained the same, but there were more large pools with large woody debris.
- riffles decreased by 21 percent.
- runs increased by 63 percent.
- side channels increased by 80 percent.

Table 19. Summary of the impacts to the geomorphic and riparian conditions from the 1996 and 1997 floods (Tucannon MWP 1997).

Tucannon River Feature	February Flood 1996	New Years Flood 1997	Impact
Flow (provisional) Bankfull discharge at Starbuck is 975 cfs.	5580 cfs	3500 cfs	Structures and agricultural fields sustained significant damages.
Streambank Erosion and Stability	Substantial damages. Many banks are eroded and exposed Occasional dike failures caused additional damages.	Additional streambank erosion since February flood.	Negative, loss of property and/or structures.
Lateral Migration	Increased	Increased	Negative or positive, depending on land uses and meander length.
Bedload Aggradation	Increased Bedload. Aggradation increased substantially after early 60s and 70s dike projects. The potential negative impacts on bridges increased yearly.	Accelerated, due to constructed alluvium berms washing out and less bank stability following 1996 February flood. Aggradation above some bridges will cause severe flow restrictions at flood stage.	Negative, damages to bridges and structures. More bedload introduced than system is capable of moving. Dikes built with High W:D accelerate problem.
Width-to-Depth Ratio (A measure of channel width vs. depth at bankfull stage.)	Increased in areas where channels were diked or braided.	Increased in many areas, especially where river channels were diked, braided or multi-center bars existed.	Negative, affects temperature and river has less capability to move bedload
Sinuosity	Increased	Increased	Positive, for geomorphic stability but potentially negative to improved property.
River Braiding	Increased, especially in areas where river was previously braided	Increased	Negative, adversely affects temperature, salmon habitat and streambank stability.
Pools	Increased due to LWD and lateral movement.	Increase due to LWD and continued lateral movement.	Positive, river system is severely lacking pool habitat
Canopy Cover	Significantly reduced.	Reduced.	Reduced shade and increased water temperature.

According to a report by WDFW (Viola 1997), the number of pools in reaches 11 and 12 decreased by 62 percent and the surface pool area by 66 percent. Viola stated, however, that the remaining pools are larger and have much more large woody debris than pre-flood. He also noted that the mean depth of pools increased by 93 percent. He reported that this part of the stream had lost 25 percent of its shade and 47 percent of the overhanging vegetative cover. The TAC re-inventory noted that the number of large pools in reach 8 improved from 6 in 1994 to 9 in 1996. In reach 9, the number of pools decreased from 12 to 5 and had the least amount of large woody debris per pool. The number of pools decreased from 26 to 12 in reaches 10; reach 11 contained the same number of pools (25).

Short-term Fish Impacts

Short-term impacts to fish likely occurred as a result of the floods (Table 20). The April flood may have had the most impact to steelhead and the least impact to chinook. This flood occurred during the peak of spawning and the streambed was still very unstable from the February flood. The fall chinook were likely affected most because most of the eggs and pre-emergent fry that weren't washed out of the gravel were probably buried by bedload deposition and sediment that eroded from upland and upriver areas.

Table 20. Short-term impacts to chinook and steelhead from the 1996-1997 floods in the Tucannon subbasin, Washington (Tucannon MWP 1997).

Species life stage	February - 96	April - 96	January – 97
Spring chinook adults	no impact, none present	no impact, none present	no impact, none present
Spring chinook juveniles	serious loss of pre- and emergent fry heavy loss of fingerlings light to moderate loss of smolts	Moderate loss of fry light loss of fingerlings and smolts	same as Feb –96
Fall chinook adults	no impact, none present	no impact, none present	no impact, none present
Fall chinook juveniles	serious loss of pre- and emergent fry; no impact to fingerlings/smolts	light to moderate loss of fry fingerlings/smolts	Serious loss of pre- and emergent fry; no impact To Fingerlings/smolts
Steelhead Adults	light loss	light to moderate loss	light loss
Steelhead Juveniles	light to moderate loss of eggs; moderate loss of fingerlings; light to moderate loss of smolts	heavy loss of eggs and pre-emergent fry; light loss of smolts	Light to moderate loss of eggs; moderate loss of Fingerlings; light to moderate loss of smolts

Long-term Fish Impacts

The long-term fisheries impacts from flooding may be that fewer adult chinook salmon return from either of the two spawning seasons affected by floods. Poor returns of adult steelhead may also result. On state and federal lands (reaches 9 - 12), there may be better spawning and rearing areas available for future runs, but temperature problems will likely increase due to increased width-to-depth ratio and reduced shade. On private lands (reaches 1 - 8), large woody debris has increased, which will provide pool building materials and instream cover for many years provided that it is not removed. Early intervention by the Columbia Conservation District (CCD) to encourage landowners to maintain and secure large woody debris will be beneficial and will increase the number of large pools. The river has gained sinuosity and some portion of its former floodplain. This will increase geomorphic stability and large, high quality pools as long as new meander patterns are maintained and the river is not restored to its former entrenched and channelized condition.

Some of the instream habitat structures such as boulder clusters, rock weirs, and log weirs were either washed downstream or buried. Most of these habitat improvements were completed by WDFW during the mid-1980's when low flows were most common but they could not sustain a big flood. CCD facilitated habitat and streambank stability structures installed summer 1996, after the 1996 floods, sustained minor damage, mainly cosmetic not functional, in the 1997 flood. Similar habitat enhancement structures installed between 1997 and 1999 are functioning as designed requiring minor maintenance only to enhance fish habitat value and potential use.

Floodplain

There has been a significant alteration of the Tucannon River and its floodplain over the past 65 years. In a report of habitat conditions in 1935, MacIntosh (1989) reports that the Tucannon floodplain above Marengo was densely wooded, principally with conifers. Numerous groves of cottonwood and alder were present in the lower stretches of this area. Further, he reports that there was some scattered alfalfa fields above Marengo but those were not abundant Below Marengo, a fringe of cottonwood, alder, willow, and brush bound the river.

Currently, from the mouth to Cummings Creek (RM 34.5) floodplain connectivity and function is restricted by some means of diking or levees along an estimated 34% of the rivers' length (J. Bruegman, S. Martin, WDFW, per. com., 2001). This area is primarily in private land ownership with approximately 1 % in public ownership. In this 34.5 mile reach, the river has been significantly straightened, losing about 30% of it's pre-1960's flood length which has resulted in higher water velocities and less pool habitat. To maximize land use, agriculture, development and transportation, the floodplain has been isolated from the river by the construction of these dikes and levees. Protecting these capital investments has resulted in a poor and narrow riparian zone and lack of shade. Water temperatures are in excess of 75°F in lower areas of this reach and get as high as 80°F or more at the mouth (Schuck *et al*. 1999). Kelley *et al.* (1982) believes that elevated water temperature is an unnatural condition and that it began with the reduction of shade from riparian vegetation during the flood of 1964-1965. They also believe subsequent floods and channelization have made the problem worse. After correlating measures of the quantity and quality of salmonid rearing habitat in different reaches of the stream, Kelley *et al.* (1982) estimated that a program of restoring shade to the Tucannon River from Bridge 14 (RM 32) to Pataha Creek (RM 11.2) would nearly double the number of young

salmon and steelhead that could be reared. A program of creating pools in the upper area would increase the juvenile salmonid populations by 50 fish per pool created.

Above RM 34.5 on public land owned by WDFW and USFS and a small piece of privately owned land floodplain connectivity and function is restricted by some means of dike or levees along approximately 13% of the river (T. Bruegman, CCD and S. Martin, WDFW, per. com., 2001). The floodplain has been isolated from the river by these dikes and levees to protect capitol investments including Camp Wooten Environmental Learning Center (Washington State Parks), man made impoundments for a recreational put-take fisheries, fish hatchery and salmonid acclamation facility, transportation system and recreational use facilities and campgrounds. The riparian zone and floodplain in this upper reach is currently impacted by camping activities (WDFW 1997). Although the river may access the floodplain throughout the majority of this 40-mile reach, the riparian condition is less than ideal. Aerial photographs show substantial open areas and only 2 to 3 layers of vegetation. Streambank stability, and associated instream habitat is in poor condition in this reach. Martin *et al.* (1992) concluded that in 1991, bull trout harvest and habitat impacts by human activities significantly impact this species. Specifically, of four Blue Mountain streams studied, the Tucannon River had the greatest land use and stream disturbance. Impacts include a maintained road, horseback trails, camping sites, and cattle grazing. Stream disturbances included cattle grazing, removal of riparian vegetation by campers, and human disturbance.

Forest Service has not grazed cattle in the Tucannon River watershed since 1996. Also during this period of time, both the WDFW and USFS made concerted efforts to move campsites away from the streambank in concert with PACFISH standards (Appendix I).

Sediment Delivery

Conservation agriculture Best Management Practices (BMPs) have been and are continuing to be implemented on cropland, however sediment continues to enter the streams within the subbasin. Over 177,600 tons of sediment, resulting from erosion, was delivered to the mouth of Pataha Creek at its confluence with the Tucannon River.

Average erosion rates in the watershed range from just over 9 tons per acre per year with continuous cropping systems in the >18" precipitation zone to 25 tons per acre on wheat/summer-fallow cropping systems in the <12" precipitation zone to. The highest erosion rates occur with traditional cropping systems in the >18" precipitation zone where the erosion rates on class IVe, VIe and VIIe soils may exceed 35 tons per acre.

Cropland runoff can significantly affect the rangeland. In most instances, the cropland is located on the ridgetops, above the rangeland. In these areas, much of the water and soil that runs off the cropland runs onto and across the rangeland. In areas where the rangeland is in good and excellent condition, the rangeland is able to accept the runoff, and effectively filter the sediment from the water. However, much of the rangeland is in poor or fair condition and does not have adequate protection to receive the runoff waters resulting in additional erosion to the rangeland. Runoff waters concentrate in the drainages causing serious gully erosion.

Erosion on rangeland occurs as sheet, rill, and gully erosion. Generally, sheet and rill erosion on properly managed, good and excellent condition rangeland is one ton per acre or less. However, sheet and rill erosion is as much as 7.5 tons per acre on poor and fair condition grazed rangeland. Most rangeland soils in the Tucannon subbasin have a soil loss tolerance value "T" of one to two tons per acre

per year. It is estimated that sheet and rill erosion averages 1/2 ton per acre on the 31 percent of the rangeland in good and excellent condition (Tucannon MWP 1997). On 69 percent of the rangeland in poor and fair condition, it is estimated that sheet and rill erosion averages 3 tons per acre per year. Total sheet and rill erosion for rangeland is estimated to be 135,300 tons annually.

Gully erosion occurs on stock trails and in the bottoms of draws and drainage ways where livestock travel. Livestock overuse the plants in the riparian areas because the additional moisture makes the forage more desirable. Stock trails leading into the drainages often have heavy erosion rates due to yearlong use and lack of cover. The rates of gully erosion have not been quantified.

A detailed inventory of the Tucannon subbasin and their associated seasonal streams has not been completed for fisheries impacts related to livestock grazing of

riparian habitat and rangeland. Many studies describing the negative effects of the lack of range management on fish and wildlife habitat in the Tucannon River have been conducted. The general impact of sediment from rangeland on water quality has been documented (Engle 1972, Grant 1975). An estimated 28 percent of the sediment production within EPA Region 10, excluding Alaska, was from rangeland, second only to cropland in total production of sediment (Moore 1976).

Forest management on private lands, including conversion from forested areas to dryland crops, has changed the erosion and sediment patterns in the forested area. The average erosion rate for all sources in the forested area is 0.4 tons per acre per year and the average sediment delivery rate is 0.03 tons per acre per year (USDA 1986). The current annual sediment yield is 540 tons. On Federal Lands, in the past, the practice of clearcutting and tractor yarding of steep slopes created areas suspect to excessive amounts of sediment movement. Today, silvicultural practices incorporate more state of the art, low ground pressure equipment and mechanical harvesters to reduce soil disturbance and road usage, and focus on uneven age management to maintain adequate cover and ground vegetation.

The extensive transportation system in the subbasin has multiple avenue of sediment delivery to the streams. The steep road grades can result in moderate to sever erosion of the roadways surface and the ditch profile so that sediment may be delivered directly to the streams. Sediment from adjacent lands can be concentrated and directed to the streams. Roads that are too close to the streams that may require excessive maintenance can cause increased degradation to water quality and fish habitat. Steep, unprotected cut and embankment slopes have a moderate to sever tendency for mass wasting and other erosion. Inadequate size, length, placement and number of drainage culverts contribute to erosion and sediment transport problems.

Recreation activities are concentrated in the riparian area. People damage streambanks, particularly at campground sites, take down and remove trees and vegetation, and dam up the river when playing. All these human activities contribute to streambank instability and erosion, thus increasing sediment impact to fish habitat. Loss of riparian vegetation has been identified as a major contributor to increased sediment and water temperature in the Tucannon River watershed (SCS 1991, Kelley *et al.* 1982).

Instream Habitat

Instream habitat use by bull trout and steelhead trout is well documented in the Tucannon River (Schuck 1997; Martin 1992; Bumgarner 1999; Viola 1991). In 1991, Martin *et al.* (1992) found that juvenile bull trout growth, abundance, and condition were lower in the Tucannon River than in Mill Creek, which is an adjacent protected watershed. Habitat conditions were also found to be less desirable in the Tucannon River. Scour, pool, and cascade habitat were less available in the Tucannon River than in Mill

Creek. Further, sub-adult bull trout were more often found in sites containing undercut banks and sites with woody debris. These habitat types were more frequently encountered in Mill Creek than in the Tucannon River. Martin *et al.* (1992) report a strong relationship between sub-adult bull trout and sites containing boulders, overhead cover less than 1 meter above the water, woody debris in the water, undercut banks, and surface turbulence.

Kelley *et al.* (1982) reported that in 1981 only four percent of the Tucannon River's length was comprised of pool habitat. Seidel *et al.* (1985) found that 11 percent was pool habitat, while Martin *et al.* (1992) found pool habitat to comprise 10 percent of the total area above the Tucannon Hatchery. Kelley *et al.* (1982) reported that the common cause for a pool was the redirection of current against erosion resistant substrate or logjams. They report that in the reach between Bridge 14 and Marengo, the banks were nearly entirely rip-rapped, preventing pool formation. Of 18 reaches studied between Sheep Creek and Powers Bridge, 12 had significant portions of the banks altered and rip-rapped.

In general, all elements of fish habitat are in poor condition in the Tucannon River from Bridge 14 downstream. Levees have resulted in few off-channel rearing habitats, restriction of the river to access the floodplain, an increase in the magnitude and periodicity of floods, poor riparian zones, the inability of large woody debris to enter the channel, and a decrease in the number of pools. Land use impacts have resulted in increased sediment which impacts egg survival, water infiltration and subsequent runoff, and a reduction of properly functioning riparian areas. Above bridge 14 to Panjab Creek, pool habitat, large woody debris, riparian vegetation and off channel habitat are considered poor while above Panjab Creek, juvenile salmonid rearing habitat conditions were considered by Kelley *et al.* (1982) to be fair to good.

Wildlife

Wildlife habitats in the Tucannon subbasin consist of three types: riparian/floodplain, shrub steppe/agricultural, and timbered uplands. The riparian/floodplain habitat lies along the Tucannon River and its tributaries. The shrub steppe/agricultural habitat type encompasses much of the subbasin and consists primarily of agricultural croplands, rangeland, CRP lands, and some shrub steppe habitat. Timbered uplands include western ponderosa, Douglas fir - grand fir, and western spruce - fir. Timber stands occur on north slopes and ridges, with shrub/grass communities on the south and west slopes (Kuchler 1964). Portions of the uplands lie within the W.T. Wooten Wildlife Area, Wenaha Tucannon Wilderness Area, and Upper Tucannon Roadless Area. Daubenmire and Daubenmire (1968), Daubenmire (1970), and Franklyn and Dryness (1973) describe vegetative associations. Native habitats within the subbasin have been altered by human development such as agriculture, invasion of noxious weeds, silvicultural management, logging, road building, and fire suppression.

Riparian/Floodplain

Riparian/floodplain habitat is limited and highly vulnerable to degradation from various human activities and development. Riparian/floodplain habitat within the subbasin contains cottonwoods, willows, and various shrub species. Since the arrival of settlers in the early 1800's, from 50 to 90 percent of riparian habitat in Washington has been lost or modified. Riparian zones along the Tucannon River have been lost and fragmented by agricultural development. Habitat improvement projects are ongoing within the floodplain. Due to fire suppression and the lack of timber harvesting along the WDFW riparian area,

native tree species such as cottonwood and brush such as willows have been replaced by conifer species. Riparian habitat supports beaver, muskrat, otter, amphibians, reptiles, passerines, waterfowl, whitetail and mule deer, and many other species.

Shrub Steppe/Agricultural

As elevation decreases, the shrub steppe habitat type becomes more prominent and south slopes are more open, with bunch grasses and low shrubs comprising the dominant vegetation. Shrub steppe habitat consisting of sagebrush, *Artemisia* spp., rabbitbrush, *Chrysothamnus spp.*, and various bunch grasses, *Agropyron* spp., covered nearly all non-forested lands east of the Cascade range in Washington, of which only 40 percent remains (Daubenmire 1988). The lowland shrub steppe habitat component within the subbasin has suffered the same fate with vast amounts lost to development, due to agriculture. Agricultural development results in rapid and extensive loss of vegetation, while livestock grazing results in a slower impact to the composition and structure of native vegetative communities (Dobler and Eby 1990). The edge habitat around agricultural zones is inhabited by fewer species because it is less diverse, but is important to mule deer, upland birds, and raptors. Species dependent on shrub steppe habitat have been extirpated or populations are severely depressed. In recent years, 106,500 acres have been removed from agricultural production in Columbia and Garfield Counties (T. Johnson, WDFW, per. com., 2000) and placed in CRP, which has benefited numerous species of wildlife within the subbasin by re-establishing grassland habitat.

Timbered Uplands

Timbered uplands are important habitat for many species, particularly elk, mule deer, bighorn sheep, forest grouse, and various smaller mammals and birds. Heavy conifer forests on the north slopes and in the canyons characterize the higher elevations, whereas south slopes are open with scattered conifers and patches of brush. The vegetative communities of the Blue Mountains are a mixture of forests and bunchgrasses on the ridges. The Blue Mountains in Washington consist of the following forest types as described by Kuchler (1964): western spruce - fir, western ponderosa, and grand Fir - Douglas-fir. Agriculture, logging, road building, fire suppression, invasion of noxious weeds, and silvicultural practices, have altered forested upland habitats. Seral species diversity within the vegetative community has suffered from management practices such as fire suppression (Appendix J), which reduces the diversity within those communities. Over 90 years of fire suppression has allowed timbered stands to revegetate shade tolerant climax species (grand fir) and stimulate the spread of root and insect diseases. Portions of the Wenaha-Tucannon Wilderness and Upper Tucannon Roadless Areas are also located within the subbasin and contain vegetative communities not affected by logging and road building. However, fire suppression has resulted in changes in the vegetative community, which has a negative effect on wildlife species and the health and vigor of existing stands. (Appendix J)

The southern portion of the Tucannon subbasin is comprised of 48,149 acres of forestland. All land that supports a predominance of trees is defined as forest, even if it is intermixed with areas of brush, forbs, and grass.

The USFS manages the Umatilla National Forest, which comprises 48,611 acres (89 percent), of the forestland in the subbasin and includes 12,000 acres of wilderness. Washington State Department of Natural Resources (WDNR) manages approximately 4,948 acres, which includes 9 percent of the

forestland. Non-industrial private forestland owners and corporate forestland owners control approximately 1,108 acres, or 2 percent of the forest. The 16,728 acres managed by WDFW is mostly forested, but is not included in the forest category because it is managed primarily for wildlife habitat. Most of the forested area for the entire subbasin is in the higher elevations and ranges from the riparian areas with low gradients to high ridge tops with steep connecting canyon walls. The forest begins at the 24-inch annual precipitation zone and extends to Oregon Butte, which receives 70 inches of annual precipitation.

The forest ecosystem needs a combination of adequate moisture and soil that has an effective rooting depth and necessary fertility. South-facing slopes and ridge tops with shallow, drier soils produce grass cover with dispersed trees. Tree species in these areas were usually pure stands of ponderosa pine, *Pinus ponderosa*. Today they are mixed stands of ponderosa pine and Douglas fir, *Pseudotsuga menziesii*. North-facing slopes usually support densely forested stands of Douglas fir, ponderosa pine, western larch, *Larix occidentalis*, grand fir, *Abies Grandis*, Englemann spruce, *Picea Engelmanni*, and lodgepole pine, *Pinus contorta latifolia*. This same stand composition is found at all aspects in the higher elevations. Subalpine fir, *Abies lasiocarpa*, will also be found in stands at elevations of 3,500 feet or higher.

Forest products include sawlogs, pulp logs, posts, poles, fuel wood, shake bolts, and chip material. Sawlogs are delivered to area mills located in Walla Walla, Clarkston, and Lewiston. Logs are also transported to La Grande and Yakima and to western Washington for export. Pulp logs are delivered to buyers in Clarkston and Lewiston. Revenue from timber harvest is a significant part of the economy of southeastern Washington counties. Other high-value forest resources include water, recreation, forage, fish and wildlife.

The forested area of the Pataha Creek watershed is situated in the southern portion of the watershed and includes a total of 13,960 acres. The USFS manages 8,236 acres of public forest in the Umatilla National Forest, or 59 percent of the forestland. Non-industrial private forestland owners and corporate forestland owners control approximately 5,724 acres, or 41 percent of the forestland. Most of the forest is used for livestock grazing in summer.

Watershed Assessment

Many watershed assessments are available for the Tucannon subbasin:

Instream Habitat Improvement in Southeast Washington (1979-1991). This work includes instream habitat projects designed for resident trout that were installed and described by various authors throughout the late 1970s and early 1980s. The two main documents are *An Evaluation of Instream Habitat Alterations in Southeast Washington, 1983-1989* (Viola *et al.* 1991) and *Instream Habitat Improvement in Southeast Washington--A Summary with Guidelines for Construction* (Mendel and Ross 1988).

Sediment Transport, Water Quality and Changing Bed Conditions, Tucannon River, Washington (Hecht *et al.* 1982). This plan identifies and discusses the effects of land use and other watershed influences on the water quality and fish habitat of the river. It also discusses the effects of reduced water

quality on the aquatic populations within the stream. It was used, in conjunction with Kelley and Associates (1982), as the baseline for the SCS (1984) report listed below.

Ecological Investigations on the Tucannon River, Washington (Kelley and Associates 1982). This study includes the related biological investigations that were combined with the physical conditions from Hecht *et al.* (1982) and used as the baseline for the SCS (1984) report listed below.

Field Assessment and Design of Instream Habitat Improvement Projects on Asotin Creek and the Tucannon River (Orsborn and Bumstead 1983). Site evaluation, hydrologic analysis and design recommendations for the Tucannon River and Asotin Creek.

Southeast Washington Cooperative River Basin Study (SCS 1984). The objective of this study is to provide a basin-wide evaluation of existing land management and stream habitat conditions related to erosion and sediment problems.

Tucannon River Watershed Plan and Environmental Assessment (SCS 1991). This plan was prepared under authority of the Watershed Protection and Flood Act, Public Law 83-566, and recommends conservation practices that would lower water temperatures and reduce the amount of sediment delivered to the stream. This plan provides federal cost-share funds to private landowners to help establish the recommended practices. Instream habitat improvement, however, was not included as part of the planning or funding for this project. The joint SCS/TAC developed alternatives to address limiting factors and an alternative effects analysis was conducted (Appendix F).

Tucannon River Hatchery Evaluation Program Annual and Progress Reports (Bugert *et al.* 1991; Bumgarner *et al.* 1994; Schuck *et al.* 2000). These reports summarize the yearly activities of the WDFW as they relate to the Lower Snake River Compensation Program. They include recommendations for hatchery and wild production of Tucannon River Spring Chinook salmon, steelhead and hatchery rainbow trout.

Lyons Ferry Fall Chinook Salmon Hatchery Evaluation Program, Progress Report: (Mendel *et al.* 1992; Wargo *et al.* 1999). These reports summarize the yearly activities of the WDFW as they relate to the production of Snake River hatchery fall chinook. They also include investigations related to Tucannon River fall chinook under the Lower Snake River Compensation Plan.

Tucannon Basin Final Report - Assessment of Ongoing Management Activities (USFS 1993). This report analyzes the potential impacts of forest activities, within the Umatilla National Forest, on chinook salmon in the Tucannon River.

Initial Watershed Assessment – Tucannon River Watershed (WDOE 1995). This report assessed the availability of ground and surface water within the Tucannon River Watershed.

Wooten Wildlife Area Management Plan (WDFW 1995). This draft report details the management of all WDFW lands in the Tucannon Watershed.

Tucannon River Flows, Using the Instream Flow Incremental Method (WDOE 1995). This report was done by the Washington State Department of Ecology and includes flow data and recommendations for setting low-flow requirements.

Columbia River Inter-Tribal Fish Commission (1996). Wy-Kan-Ush-Mi Wa-Kish-Wit: Spirit of the Salmon. Vol. I. Emphasizes cultural, legal, biological, and institutional contexts and provides recommendations.

Columbia River Inter-Tribal Fish Commission (1996). Wy-Kan-Ush-Mi Wa-Kish-Wit: Spirit of the Salmon. Vol. II. Specific Subbasin breakdown for fish population status/goals, problems impacting fish, ongoing actions, and recommended actions) including law enforcement, instream flow and passage, watershed management for water quality, riparian restoration, range management, forest management, mining impact reduction, and artificial production).

The *Tucannon River Model Watershed Plan* (1997) was not meant to duplicate any of the previous efforts, rather to coordinate the application of the previously recommended activities. It is an extension of the original document, the *Tucannon River Watershed Plan - Environmental Assessment* and contains additional recommendations related to anadromous fish needs and resource problems. Full implementation of both plans will be necessary to reach project goals. The major publications central to the *Tucannon River Model Watershed Plan* include:

The *Pataha Creek Model Watershed Plan* (1998). This plan was submitted as part of the *Strategy for Salmon* (NPPC 1992). In 1993, the NPPC and BPA designated the Pataha Creek watershed as a model watershed. The primary emphasis of the plan is on the improvement of chinook salmon critical habitat as well as steelhead and bull trout habitat.

Supplementation Effects (Waples 1998). The effects on wild salmonid populations of hatchery supplementation using hatchery steelhead and chinook stocks are assessed. Populations throughout the Columbia River basin have been sampled since 1989. Samples from wild and hatchery populations have been collected, and electrophoretic data are used to determine whether significant genetic introgression has occurred. The Tucannon steelhead population was sampled.

SE Washington Steelhead Genetic Assessment (Shaklee and Young 1999). A comparison of the genetic structure of steelhead populations from several Snake River tributaries. One year of data from MSAT DNA samples is discussed.

Tucannon River Spring Chinook Genetics Assessment Study (Busack 1999 Draft). This draft summarized the genetic structure of Tucannon spring chinook from allozyme samples collected between 1985 and 1994. The assessment looks at the effects of hatchery supplementation on a population, supplemented using native broodstock (domestication effects).

CEEd, Center for Environmental Education (1999). Draft Pataha Creek Watershed Assessment. Prepared for the Pomeroy Conservation District. Includes a watershed overview, terrestrial ecosystems, sediment sources, channel characteristics, hydrology, water quality, and aquatic ecosystem elements.

Limiting Factors

The primary limiting factors that have contributed to the current depressed status of fish, wildlife and their associated habitats in the Tucannon subbasin are broadly classified into habitat degradation and non-native species competition. Habitat degradation can be described as the loss of quality, quantity, diversity and connectivity of habitat components and function. Many environmental and managed factors contribute to and influence these limiting factors and their resulting impacts on fish, wildlife and habitat resources in the Tucannon subbasin. From a subbasin restoration team viewpoint, we believe that all limiting factors must be addressed in an appropriate fashion to provide short and long term benefits for recovery efforts to be successful. Combined immediate and accumulative efforts addressing various limiting factors are critical to attaining management objectives.

Key limiting factors affecting fish are summarized below. Detailed discussion and documentation has been presented in earlier sections of this summary. These factors are water quality, geomorphic instability, riparian function, sediment, instream habitat, hatchery effects, out-of-basin effects, minimum viable populations, passage, data gaps, illegal harvest, exotic species, ecological productivity, and flow.

Water Quality

Water temperature is the main water quality limiting factor for the Tucannon subbasin. Historic and current temperature data indicate that the lower reaches of the Tucannon River and Pataha Creek have temperatures up to 75.2°F (24.0°C) during the summer months. The Tucannon River is on the current 1998 303(d) list of impaired water bodies for temperature for the segment that extends from the mouth at the Snake River to Tumalum Creek at river mile (RM) 32.7. WDOE is proposing to establish a temperature TMDL for this segment for the 2001 watershed cycle.

High fecal coliform concentration is the primary concern for Pataha Creek. Pataha Creek is on the 1998 and 1996 303(d) list of impaired waters for fecal coliform bacteria. WDOE is proposing a bacteria TMDL on the segment of Pataha Creek from the mouth at the Tucannon River (RM 11.2) to the headwaters for the 2001 watershed cycle.

Geomorphic Instability

Most reaches on the Tucannon River have a fraction of the pools a stream of this type should, one pool for every 5 to 7 bankfull discharge widths. The ratio of riffle/runs to pools has increased. Levees constructed for flood control have diminished the river's ability to create adequate complex pool habitat, off-channel-rearing areas, and to adequately access the floodplain. The amount of unvegetated stream banks has increased exposing raw banks to erosion resulting in sediment and gravel filling of the streambed and increasing sediment impacts to fish during the egg and pre-emergent fry stages.

Riparian Function

The River's ability to dissipate flood energy across a floodplain has diminished due to diked channels; land use practices, and decreased riparian woodlands. Percent of canopy cover tends to increase with increased elevation. Recreational impacts also increase with increased elevation and the put & take fisheries developed and maintained on public lands. These impacts have decreased vegetative cover resulting in diminished riparian filtration and stabilization functions, increased surface exposure to radiant heat, and increased bank instability.

Sediment

Land use practices have increased sediment delivery rates to the drainages and reduced floodplain and riparian function to filter and stabilize streambanks. The degraded condition of the riparian area and rangeland along with infestations of non-native grasses and weeds have inhibited the ecosystems ability to recover from natural or climatic events and continue to reduce the riparian biofunction ability.

Pataha Creek delivers large amounts of sediment to the lower Tucannon River. Fragile soil types and land use practices have also contributed to gravel that has become cemented with fine sediment impacting fall chinook using the lower Tucannon River.

Instream Habitat

Significant human actions throughout the basin have destabilized the Tucannon River. Road construction, river straightening and diking and effects from upland management such as forest and farm management practices have lead to a loss of instream habitat for fish. Catastrophic floods in 1964 and 1996 and human actions afterward also have eliminated high quality habitat for fish.

Hatchery Effects

Hatchery augmentation/supplementation within the Tucannon has been substantial since the 1950s. Out-of-basin stocks of trout, salmon and steelhead and hatchery production practices have been identified as contributing to the jeopardy opinion rendered by NMFS for hatchery actions in the Snake River basin. While managers have begun to address this issue in the Tucannon, significant hatchery fish releases occur annually.

Out-of-Basin Effects

Managers within the Tucannon have identified that fishery resources within the Tucannon are affected by outside actions such as migration corridor survival, fisheries, ocean productivity and pollution. Further, managers agree that actions within the Tucannon to recover listed salmonid populations cannot succeed without coordinated Columbia River basinwide efforts.

Minimum Viable Population Size (MPV)

Habitat degradation, hydropower development, overfishing, other fishery management problems, and ocean and in-basin productivity problems have all contributed to the decline of salmonid populations in the Tucannon. Spawning populations of spring chinook salmon and summer steelhead have both

recently been estimated to be below 100 individuals for some recent years. Such low escapements could seriously affect the ability of the populations to persist.

Exotic Species

The introduction and proliferation of non-native (exotic) species of fish, wildlife, plants and insects (e.g. – knapweed, yellow-star thistle, smallmouth bass, brook trout), pose a significant threat to the ecological health of the basin.

Fish Passage

Restrictive / impassable culverts and improperly or unscreened irrigation diversions affect fish populations within the basin. New NMFS screening criteria and lack of compliance by some irrigators potentially take juvenile salmonid during their rearing/migration periods. Some potential upstream migration barriers have been identified in Pataha Creek and elsewhere, but additional inventory is necessary to identify all passage problems.

Data Gaps

Lack of extensive fish population and habitat characterization and assessments limit the ability of managers to establish reliable spawning escapements, assess carrying capacities of habitats, and direct in-basin actions in the most cost effective and efficient manner.

Legal Harvest

Populations of fish and wildlife that may be at or below MVP, and are subject to illegal harvest, may be unable to recover from this activity because of a significant loss of spawners/breeders. Single stochastic events of this kind may result in the loss of long-term genetic health. WDFW enforcement personnel have documented frequent illegal harvest of bull trout adults and subadults.

Ecological Productivity

Recent research in the Northwest has established a strong link between marine nutrient loading (from salmonid carcasses) and the ecological health of fish, wildlife and forest resources, and primary productivity of the subbasin. The documented or suspected declines of salmon populations within the basin and the resultant decreases of salmon carcass deposition suggest nutrient privation may be limiting basin productivity.

Flows

In 1993, WDFW recommended instream flows for the Tucannon River based upon IFIM methodology. The seven-day low flows of the Tucannon River have exceeded the IFIM recommended flows in almost every year since 1959. Linear regression analysis at the USGS Tucannon Gage No. 13344500 show the number of days where the IFIM recommended flow is not met has increased from approximately 30 days in 1960 to 60 days in 1990. Exceedance curves for the Tucannon River based on historical flow data show the flow recommended by the IFIM analysis is not met more than 50% of the time during late July, through al of August, and into early September. (Covert, *et al*. 1995)

Wildlife

Wildlife populations in the Tucannon subbasin have been impacted by habitat loss due to agricultural development, silvicultural management, logging, livestock grazing, and invasion of noxious weeds. Fire suppression has modified the structure and composition of the forest community, which has a negative impact on wildlife species dependent on early-seral stage communities.

Habitat Loss

Agricultural development has altered or destroyed vast amounts of native shrub steppe habitat in the lowlands, and fragmented the riparian/floodplain habitat along the Tucannon River and Pataha Creek. Agricultural operations have increased sediment loads and introduced herbicides and pesticides into streams. The loss of shrub steppe habitat has resulted in the decline of wildlife populations that are dependent on this habitat type. Landowner intolerance of elk and agricultural damage can have a negative influence on elk management objectives.

Logging, road construction, silvicultural management, and invasion of noxious weeds in the Blue Mountains threaten existing populations of elk and mule deer by reducing the forage and habitat base. Noxious weeds threaten winter range. Open roads reduce elk utilization of important habitat. Conflicts between elk and agriculture are influenced by several factors and fluctuate in intensity from year to year. Landowner tolerance is the main factor that determines the level of elk damage complaints, but weather, crop rotations, crop prices, and elk densities also influence the level of complaints.

Timbered uplands provide habitat for large ungulates and other wildlife species dependent on this habitat. Historically, wildfire has been an integral component of the forest ecosystem by maintaining vegetative diversity and extensive early seral stage forests. Wildfires kept shade-tolerant species from encroaching on established forest communities (Zack 1995). Fire suppression results in the loss of diversity by allowing the invasion of shade tolerant species such as Douglas fir and grand fir. Fuel loads have also increased due to fire suppression, increasing the risk of devastating wildfire. The lack of fire within the ecosystem has resulted in significant changes to the forest community and has negatively impacted wildlife. Changes in forest habitat components have reduced habitat availability, quality, and utilization for wildlife species dependent on timbered upland habitats.

Ferruginous Hawk

The ferruginous hawk is listed as a state threatened species, and is dependent on large areas of shrub steppe habitat. Approximately 60 percent of the shrub steppe habitat in Washington has been modified or lost (Daubenmire 1988). This loss has impacted the availability of habitat for prey species on which the ferruginous hawk is dependent. Rabbits and hares, ground squirrels, pocket gophers, and kangaroo rats made up 94.6 percent of the prey base for ferruginous hawks (Olendorff 1993). These prey species are highly dependent on shrub steppe habitat. Only 4-5 nesting pairs were documented within the subbasin in 1997 (WDFW 1997). Ferruginous hawk nests in the subbasin are located on basalt cliffs.

Sharptail Grouse

Sharptail grouse were plentiful in southeastern Washington at the turn of the century. Hunting, livestock grazing, and loss of shrub steppe and riparian habitat resulted in extirpation of the sharptail grouse by the 1960's (Hudson and Yocum 1954, Shroeder *et al*. 2000).

Whitetail Jackrabbit

The whitetail jackrabbit is listed as a PHS and state candidate species. The loss of shrub steppe habitat has contributed to the dramatic decline in jackrabbit populations. Agricultural development and livestock grazing have modified and destroyed much of the shrub steppe habitat on which the whitetail jackrabbit was dependent.

Washington Ground Squirrel

The Washington ground squirrel is a PHS and state candidate species. The loss of shrub steppe and grassland habitats to agricultural development and livestock grazing has resulted in the loss of Washington ground squirrel colonies. Historical colonies were surveyed in 1997, but no ground squirrels were observed.

Ringneck Pheasant

The ringneck pheasant is the primary upland game bird species in southeast Washington. The annual pheasant harvest peaked in Columbia and Garfield Counties during the late 1970's and early 1980's at nearly 25,000 birds. By 1999, the pheasant harvest had declined 44 percent to 14,000 birds (WDFW 1999). The abundance of the pheasant population, hunter participation, and weather during the hunting season are factors that can impact the pheasant harvest. The dramatic decline in the pheasant harvest is a direct reflection of pheasant abundance. Hunter effort increases and hunter numbers decline as pheasant population decline. The loss of both riparian and shrub steppe/grassland habitat has resulted in a tremendous decline in the pheasant population within the subbasin.

Bighorn Sheep

Bighorn sheep were re-established on the W.T. Wooten Wildlife Area in 1960. The population has fluctuated between 20 – 75 animals over the last 40 years. The herd increased to approximately 60 head during the mid-1990's, but declined dramatically over the last two years due to scabies, *Psoroptes ovis*, and predation by mountain lion. Mortality of adults and young has been high, and the herd may be in jeopardy of declining to the point of no return. Free ranging domestic goats approximately three miles north of the Wildlife Area are a potential disease threat to the bighorn sheep population.

Rocky Mountain Mule Deer

Rocky mountain mule deer are a PHS and primary big game species within the Tucannon subbasin. Game management units (GMUs) 163, 166, and portions of units 149 and 178 lie within the subbasin. Mule deer populations in the lowland habitat increased significantly over the last 15 years, while mule deer numbers in the upland habitat have declined. The percentage of mule deer bucks in the harvest declined from 65 percent in 1985 to 53 percent in 1999, while the percentage of white-tailed bucks

increased. This is an indication that white-tailed deer populations and inter-specific competition have increased in the subbasin over the last 15 years, but not as much as in other subbasins in southeast Washington. White-tailed deer in the lowland areas (GMU-149) are susceptible to Epizootic Hemorrhagic Disease, and outbreaks occur with varying severity every 4-5 years. An outbreak in the lowlands in 1998 was severe, resulting in a significant decline in white-tailed deer numbers from the Snake River to Highway 12 near the Tucannon River.

Over the last 10 years, 106,500 acres of agricultural croplands were placed into the CRP program in the lowland areas of Columbia and Garfield Counties, improving habitat conditions for mule deer. The mule deer population in the timbered uplands has declined. The lack of fire to stimulate browse species on the winter range, noxious weed invasion, and inter-specific competition with white-tailed deer and elk are all potential limiting factors for mule deer (Hamlin *et al*. 1984; Unsworth *et al*. 1999; Whitaker and Lindzey 1999). Predation by cougar, black bear, and coyote also may be a significant factor in population declines in the upland area.

Rocky Mountain Elk

Elk populations in the Tucannon subbasin are below management objectives. The subbasin contains one elk management unit: 166-Tucannon. The population management objective for the Tucannon sub-herd is 700 elk (WDFW 2000). Subbasin surveys in March 2000 produced a count of 420 elk. However, there is a significant difference between herd levels east and west of the Tucannon River. The sub-herd west of the river is at management objective and has increased over the last five years. The sub-herd east of the river has declined significantly. Calf production is optimal with a summer calf ratio of 50+ calves/100 cows, but mortality over time is significant with spring calf ratios declining to 16 calves/100 cows. Calf mortality factors were identified between 1992-98 (Myers *et al*. 1999). The study showed that calves suffered an annual minimum mortality rate of 58 percent, with predation accounting for a minimum of 78 percent of the mortality. Cougar and bear were the primary predators involved. Habitat conditions are deteriorating for elk within the subbasin due to land subdivision, silvicultural management, logging, road building, livestock grazing, noxious weeds, and fire suppression. Off-road vehicle trails routed through historical calving areas and prime summer habitat are a continuing problem. In recent years, the USFS has implemented road closures, controlled burns, and weed control projects in an effort to improve wildlife habitat. The deteriorating condition of native habitats may be one of the major reasons agricultural damage conflicts are increasing (Myers *et al.* 1999). Elk may be forced to spend more time in agricultural areas causing increasing conflicts with landowners.

Artificial Production

The Tucannon Hatchery was constructed in 1949 by the Washington Department of Game (WDG, which is now WDFW) to produce rainbow trout to support a popular sport fishery (Figure 24). In 1984, under terms of the LSRCP, this hatchery was purchased and refurbished by the U.S. Army corps of Engineers (USCOE) to act as a satellite station to the Lyons Ferry Hatchery, which was built on the Snake River and became operational in 1983. Both of these hatcheries are used in combination to mitigate for fish and fishing losses caused by the four lower Snake River dams. A goal of wild fish restoration was added to this hatchery mitigation program because of federal ESA listings and declining populations of wild salmonids in the Snake River basin.

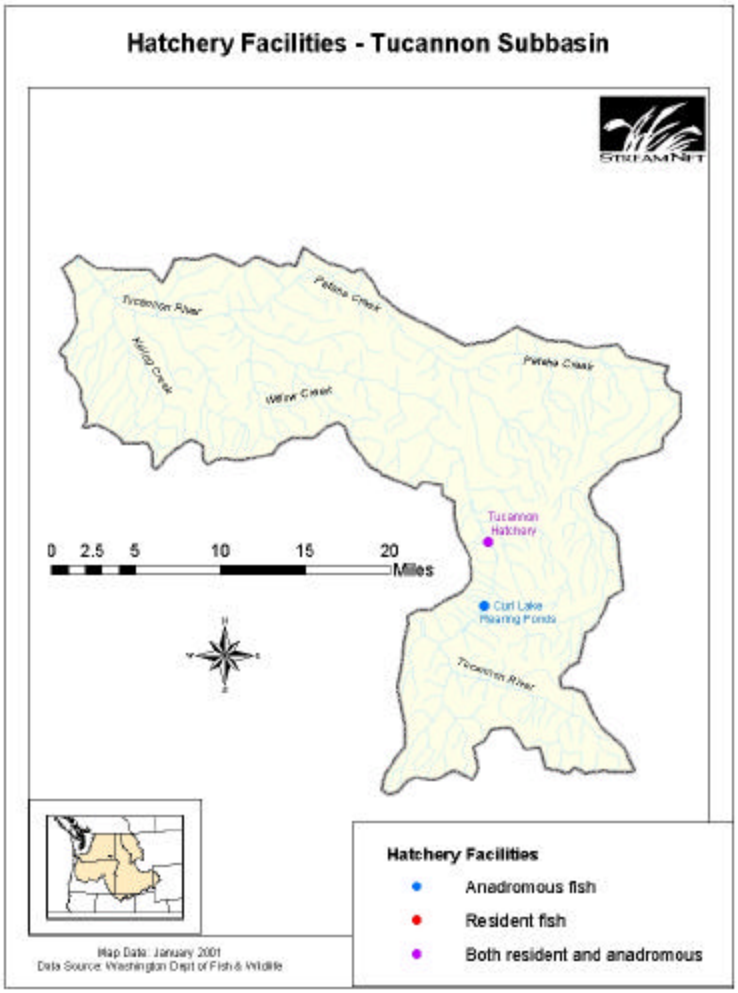

Figure 24. Hatchery Facilities within the Tucannon subbasin.

Supplementation of natural populations is an experimental approach being used to rebuild fish runs in the Columbia Basin. Several potential negative effects of supplementation have been identified, including decreased reproductive potential, decreased survival at various life stages, increased harvest or injury associated with fisheries targeting hatchery fish, loss of genetic variation, and others. Nevertheless, the co-managers have agreed in fisheries management forums to utilize supplementation strategies in some locations because of the potential it offers in returning a larger number of spawners than result from natural production alone. Bugert (1989) initiated a long-term sampling protocol for Tucannon spring chinook. The sampling documented some of the potential effects and determined the degree to which the effects affected spring chinook in the river. Washington Department of Wildlife (WDW) (1993) identified problems with the hatchery steelhead stock used in the LSRCP for Tucannon River releases and recommended development of a new stock for the program. Phelps (WDFW, per. com., 1994) concluded that wild steelhead remained genetically distinct from Lyons Ferry Hatchery stock steelhead. Phelps also concluded that the natural declining population was likely being suppressed

through interbreeding with hatchery stock steelhead. The WDFW believes that the data supported this conclusion and it appeared to show that little or no introgression of the hatchery stock had occurred into the natural population, as would be expected if there were successful interbreeding. The WDFW believes that the continued use of hatchery fish could damage the population. However, the tribal co-managers have offered other interpretations of the data, most recently in the spring of 2000 on the issue of allowing hatchery steelhead to pass upstream of the weir. Although there is no evidence of similar problems for spring chinook, smolt to adult returns (SAR) for hatchery reared fish are significantly less than for their wild counterparts (Bumgarner *et al.* 1998). This survival difference suggests a negative effect associated with the hatchery. Despite these concerns, the WDFW has initiated intensive fish culture by mean of a captive broodstock project, in which smolts are produced and released from fish kept in cultivation for their entire lifecycle. This is an effort to quickly rebuild population numbers and stave off loss of the genetic resource present in wild spring chinook. The captive broodstock effort is in addition to a conventional hatchery spring chinook supplementation program that releases yearling smolts into the river from adults returning to the river annually.

Chinook Salmon

In 1962, two spring-fed rearing ponds were excavated at Russell Springs, two miles downstream of Cummings Creek, and planted with non-native spring chinook fry. The first release of 16,000 Klickitat River stock occurred in August 1962. In June 1964, 10,500 Willamette River stock were outplanted. The large flood of 1964-65 destroyed these ponds and the program was discontinued (Phinney and Kral 1965). These were the only introduced non-native chinook that have been documented in the Tucannon River.

The LSRCP goals for the hatchery program are to increase the annual escapement of Tucannon spring chinook salmon to 1,152 hatchery spring chinook adults, and 18,300 hatchery fall chinook to the Snake River basin, while preserving the genetic integrity of these native stocks of salmon (WDFW 2000c). WDFW will not be producing an HGMP for most hatchery actions funded by the LSRCP for approximately 2-3 years, because they are currently covered in the NMFS Biological Opinion for the LRSCP.

The LSRCP hatchery program began by collecting native spring chinook adults, trapped near the Tucannon Hatchery in 1985, on their way to upriver spawning areas. Each year since then the returning hatchery and wild adults have been trapped near the Tucannon Hatchery for hatchery broodstock collection (egg take) or they have been enumerated and released upstream to spawn naturally. In recent years both hatchery and wild (unmarked) spring chinook have been collected for hatchery broodstock. The fish are taken to the Lyons Ferry Hatchery to remain in cold well water until they are ready to spawn in the fall. They are spawned and reared at Lyons Ferry Hatchery until they are marked and transferred to the Tucannon Hatchery in October. All hatchery smolts are tagged with coded-wires and fin-clips so they can be recognized as hatchery progeny when they return as adults. They remain at the Tucannon Hatchery until they are transferred in late winter to the Curl Lake acclimation pond about 5 miles upstream of the hatchery. They remain at the pond until March or April when they are volitionally released into the Tucannon River at about 15 fish per pound. The targeted release number is 132,000 smolts per year (WDFW 2000c) but releases have often been well below that level (Table 21). Yearling smolt releases have increased to an average of 127,000 each year,

resulting in annual hatchery returns of 300-400 adults each year until 1993 (Figure 25) (Bumgarner *et al.* 1997). Recently, a captive brood program (where juvenile spring chinook are raised at the hatchery through their entire life cycle until spawning) was added to the Tucannon spring chinook supplementation program. This is an effort to increase the number of spring chinook released into the Tucannon to try and increase the critically low numbers of adult spring chinook returning to the Tucannon River (WDFW 2000d-Master Plan to NPPC).

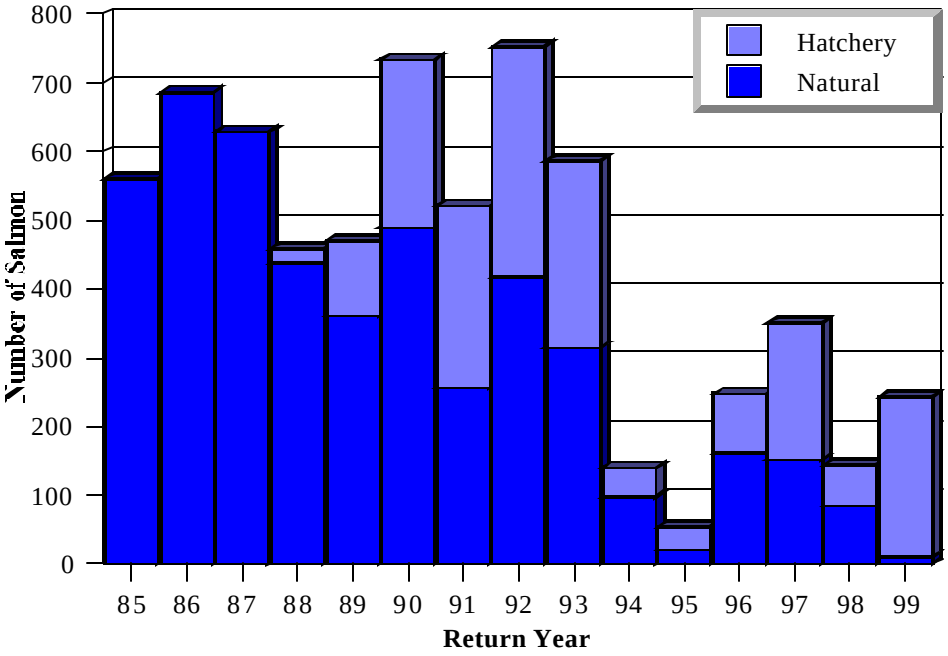

Figure 25. Tucannon River Spring Chinook escapement (Bumgarner *et al.* 1997).

The Lyons Ferry hatchery fall chinook stock was developed from native Snake River fall chinook. From 1976-1984 unmarked fall chinook were trapped at Snake River dams to develop an eggbank program. These fish were transported and held, gametes were taken, and progeny were reared and marked at various hatcheries in the Columbia Basin. Smolts were released back into the mainstem Snake River or the Kalama River (Bugert and Hopley 1989) in an effort to save this stock from extinction while Lyons Ferry Hatchery was being planned and constructed. Returns from this broodstock became the founding population for the Lyons Ferry Hatchery fall chinook program. Since 1984, broodstock has been collected at the hatchery or at Snake River dams (Mendel 1998). Currently, hatchery fall chinook salmon are released into the Snake River at Lyons Ferry Hatchery and at several sites upstream of Lower Granite Dam. There have been no known releases of hatchery fall chinook into the Tucannon River, but carcasses of stray hatchery fall chinook from the Lyons Ferry and the Umatilla hatcheries have been found in the Tucannon River on several occasions since 1990 (Mendel *et al.* 1992; Wargo *et al.* 1999).

Table 21. LSRCP releases of hatchery reared spring chinook and steelhead into the Tucannon River from Lyons Ferry or Tucannon hatcheries (WDFW data from M. Schuck, per. com., 2001).

	Summer Steelhead		Spring Chinook	
Year	**# fish**	**Lbs fish**	**# fish**	**Lbs. Fish**
1983	148,275	21,600		
1984	195,315	32,352		
1985	151,609	26,598		
1986	141,068	25,281		
1987	141,959	24,905	12,922	2,172
1988	161,293	28,297	152,725	15,173
1989	160,131	36,393	152,165	16,907
1990	119,264	23,060	145,146	13,195
1991	200,761	50,682	99,057	11,007
1992	130,040	31,037	85,737	7,798
1993	113,539	23,597	131,380	6,422
1994	145,538	33,365	83,409	5,957
1995	146,070	27,561	138,648	9,569
1996	139,242	28,417	130,069	8,120
1997	139,971	22,703	62,144	3,541
1998	160,068	33,259	75,419	4,820
1999	179,089	40,482	24,168	1,550
2000	145,768	34,054	127,939	10,276

Steelhead

Between 120,000 and 160,000 steelhead smolts were released annually from the Curl Lake acclimation pond from 1985 to 1997 primarily for adult steelhead harvest augmentation in the Snake and Tucannon rivers. The adult hatchery return goal for the Tucannon River is approximately 875 fish for harvest. Lyons Ferry and several hatchery stocks have been released into the Tucannon River in the past. Problems with the returning hatchery fish have been identified. Straying to distant reaches of the Snake River has considerably decreased adult returns to the Tucannon River. Some of the problem is suspected to be stock related (Schuck *et al.* 1993). For this reason, trapping and spawning of wild origin Tucannon River fish began in 1991 to develop a new broodstock. Poor survival success of the resulting smolts caused WDFW to discontinue stock development after three years. The program was restarted in 1999-2000 by trapping wild origin adult fish in the lower Tucannon River for development of a local broodstock (Appendix - K, HGMP). Wild origin steelhead are considered distinct based on their spawning distribution and genetic information; (R. Waples, NMFS. Per. com., 1993; T. Shaklee, WDFW, per. com., 1999). These fish will be used in the LSRCP program as the preferred stock for release into the Tucannon River and this stock should address ESA stock concerns over the use of Lyons Ferry and other out-of-basin hatchery stocks.

A study in 1991 showed that up to 17 percent of the hatchery stock smolt releases did not migrate from the river, and some were shown to become predatory on juvenile salmonids (Schuck *et al.*

1994). By using a different outplanting procedure at Curl Lake the percentage of residuals was reduced to 3.1 percent in 1993. Further changes were implemented in 1998 when all hatchery stock smolt releases occurred at or below RM 24.8 to minimize their potential interaction with wild adult steelhead and spring chinook. Hatchery stock return rates from Tucannon River smolt releases continue to be less than for any of the other Washington LSRCP sites (Martin *et al.* 2000).

Coho

In 1963, the WDF released 15,170 coho salmon fry into a 1-acre excavated pond at Russell Springs. After reaching smolt-size, they were released to the river in June 1964. Although the pre-smolts were sampled and found to be in good condition and had good survival, no follow-up sampling was completed, so the adult return rate is unknown (BPA 1984). The 1964-65 floods washed out these ponds and ended the coho program. A few hatchery coho from outside the basin have entered the Tucannon River to spawn each of the past 3-4 years.

Rainbow Trout

Hatchery rainbow trout (primarily Spokane stock) have been released into the Tucannon River as part of the LSRCP program for over 15 years (Table 22). These fish were intended to mitigate for lost fisheries in the mainstem Snake River caused by construction and operation of the four lower Snake River dams. Initially, the fish were released primarily within state owned lands with public access near the Tucannon Hatchery. However, during the last several years the fish were released in the lower portion of the Tucannon River to minimize adverse effects on listed steelhead and spring chinook. In 2000, these releases into the Tucannon River were terminated. The fish stocking has been shifted to area lakes and ponds to continue to provide fishery mitigation and to minimize potential adverse effects on listed salmonids in the Tucannon River.

Table 22. Rainbow trout stocked into the Tucannon River, Washington, 1983 - 1999 (WDFW data from M. Schuck, per. com., 2001).

Year	# fish	Year	# fish
1983	42,201	1992	10,212
1984	30,450	1993	8,400
1985	34,411	1994	6,652
1986	25,134	1995	4,056
1987	22,978	1996	4,050
1988	22,269	1997	4,000
1989	23,346	1998	3,016
1990	18,549	1999	2,976
1991	21,113	2000	0

Existing and Past Efforts

Summary of Past Efforts

Various state and federal agencies, tribes and local watershed groups have developed planning documents, policies and management guidelines for fish and wildlife habitat protection and enhancement for the Tucannon subbasin. Currently, the most effective plans and efforts are those that have been collaboratively developed and implemented, adequately funded, and produce short and long term on the ground results.

The Tucannon and Pataha model watershed plans were developed as part of the Nap's "Strategy for Salmon" and emphasizes section 7 of that strategy and specifically addresses the involvement of locally-based model watershed plans for developing and implementing fish and wildlife habitat protection and restoration measures.

The Tucannon subbasin restoration efforts have been expanded with planning, management, and funding being supported by programs outside of NPPC/BPA. While effectiveness in implementing these plans, policies and regulations varies, efforts to increase inter-agency coordination and cooperation are being made in the subbasin.

Fish

Efforts Funded by BPA through the Columbia Basin Fish and Wildlife Program

Tucannon River Model Watershed Project

The Northwest Power Planning Council and the Bonneville Power Administration designated the Tucannon River Watershed as a "model watershed" in 1993. During years 1993 through 1995 a locally based effort, lead by the Columbia Conservation District, brought together technical agencies, the tribes, and local citizenry to develop the Tucannon River Model Watershed Plan. The plan effort encompassed existing studies and assessments, conducted reach-by-reach current condition surveys, and population assessments to develop a management based implementation plan to protect, enhance, and restore salmonid habitat. 1996 to present has highlighted implementation of habitat restoration projects. Projects are designed and implemented to address identified limiting factors. Monitoring and Evaluation of these efforts indicate positive short term impacts to habitat, however long term impacts of riparian function restoration will need time to develop and thus to be evaluated.

Pataha Creek Model Watershed Project

All projects and administration of programs inside the Pataha Creek watershed have been funded by BPA. The remainder of Garfield County and lands lying inside the boundaries of the PCD receive funding from the Washington State Conservation Commission, state funding from HB2496, and the Salmon Recovery Funding Board.

Up until 1996, demonstration sites using riparian fencing, off-site watering facilities, tree and shrub plantings, and upland conservation practices were used to inform and educate landowners. These demonstration sites were the primary focus of the implementation phase of the *Pataha Creek Model Watershed Plan*. Efforts began in 1997 to stabilize the banks, reduce sedimentation, and create fish habitat in Pataha Creek. Root wads and woody debris were incorporated into the rock barbs and

vanes to create fish habitat that was either destroyed or was not present before the project was built. All the sites were planted with trees and shrubs to add further protection to the site and add the shade and vegetation needed for reducing sediment and lowering water temperature.

A showcase project for the Pataha Creek Model Watershed Project includes implementation of an off-site watering facility as part of a cost share program. It is anticipated that water quality will be improved by removing livestock from the stream. Other project activities include improvements to a corral system and a highway drainage system, tree planting, and implementation of habitat enhancements such as rock vanes and rock vortex weirs.

Several projects have been implemented to reduce erosion from croplands. Three-year continuous no-till projects are on schedule and monitoring is ongoing. Other practices such as terrace, waterway, sediment basin construction, and strip cropping systems are also taking place.

Nez Perce Tribe Conservation Enforcement Program

The Nez Perce Tribe (NPT) Conservation Enforcement Program enforces NPT hunting and fishing regulations within the Tucannon subbasin. Conservation enforcement officers conduct checks in the Tucannon subbasin seasonally as regulations, including season opening and closings, are issued by the NPT. According to Captain Adam Villavicencio (D. Johnson, Nez Perce Tribe, per. com., 2000), approximately 70 – 80 hours are expended on patrols for fishing violations during the spring chinook fishing season, and greater than 200 hours are expended on patrols during hunting season. Fishing for spring chinook has been closed during the last several years. Enforcement activities focus on preventing unlawful harvest including hunting or fishing without a tribal enrollment, hunting or fishing with non-tribal member partners and wastage. The NPT Conservation Enforcement program is partially funded by Bonneville Power Administration.

WDFW Bull Trout Species Interaction Study

BPA funded studies in the early 1990s that determined bull trout population densities in the Tucannon watershed and several other watersheds in southeast Washington, and the overlap of bull trout and steelhead or spring chinook salmon by habitat type. These studies examined the potential impacts of interspecific competition and anadromous fish. (Martin *et al*. 1992, Underwood *et al*. 1995).

Efforts Funded Outside of the Columbia Basin Fish and Wildlife Program

WDFW/LSRCP

The WDFW is funded by the LSRCP for operation of the Lyons Ferry Hatchery Complex and production of steelhead, spring chinook and rainbow trout for the Tucannon subbasin. The LSRCP also funds the hatchery evaluation program that monitors the wild anadromous fish populations in the Tucannon River and the effectiveness of the hatchery program. These WDFW programs have operated since about 1982. Evaluation activities include spawning surveys, adult trapping, juvenile population estimates and smolt trapping. WDFW produces several reports annually for different aspects of the programs.

Washington State Salmon Recovery Funding Board

Columbia Conservation District installed instream, riparian, and upland habitat enhancement projects in 1999 and 2000 (CCD).

USDA

CCD/Washington Conservation Commission (WCC)/USDA Farm Security Agency (FSA) work cooperatively to implement the Conservation Reserve Enhancement Program (CREP) for riparian buffer enhancement along salmonid bearing streams.

USDA FSA & NRCS Conservation Reserve Programs are multi-year and continuous programs to remove critical areas from active production and create, restore and enhance wildlife and fish habitat.

COE Instream/Fishery Enhancement

COE/WDG Instream habitat Improvement Project (Vail 1979, Ransom 1980, Mendel 1984, etc). This program was funded by the USACE and established as partial mitigation for fish losses caused by construction and operation of dams on the Snake River and was part of the LSRCP. Instream habitat was improved in southeast Washington streams to enhance natural production of salmonids and improve fishing success by anglers. This program operated from about 1979 through 1986. Numerous instream structures were constructed and evaluated for the amount of habitat they provided and the response by salmonids.

COE/WDG Fishery Enhancement Project (Mendel 1981, Mendel and Taylor 1981). WDG was funded in two phases by the USACE to examine the fishery enhancement potential of streams in southeast Washington. The project was terminated after only one year. Streams were examined and a brief assessment of their habitat conditions and limiting factors was compiled in a phase one report. In phase two, several higher quality areas were sampled to determine fish abundance and habitat conditions and the information was compiled into a report.

WDOE Instream Flow Restoration

The WDOE and the Washington Water Trust are working together to obtain water rights through lease and/or purchase for instream trust water rights. Negotiations are currently ongoing with two landowners on the Tucannon River, which, if successful, will result in a conversion of 2 to 5 cfs from out-of-stream consumptive use to instream flow trust water rights.

Metering of surface water diversions is required by statute (RCW 90.03.360). The WDOE is currently developing implementation plans that call for measurement devices on 80 percent of the water diversions within Water Resource Inventory Area 35.

Recreation Management

The WDFW relocated camping sites away from the river, and placed control fences to discourage use on the streambank at sites where relocation is not an option.

The USFS restricted camping within 75 feet of the stream rehabilitated degraded streambanks. These campgrounds and campsites will be rehabilitated and restored to native condition. Both agencies have initiated public information efforts protect natural resources.

Wildlife

Efforts Funded by BPA through the Columbia Basin Fish and Wildlife Program

None

Efforts Funded Outside of the Columbia Basin Fish and Wildlife Program

W. T. Wooten Wildlife Management Area

In 1997, the WDFW prepared the *W. T. Wooten Wildlife Management Plan* that identified impacts to fish and wildlife habitat (WDFW 1997). Also included in the plan was a description of the desired conditions and restoration activities needed to reach the desired condition. Specific activities accomplished on the W.T. Wildlife Area through 2000 include establishment of a 75-foot barrier between camping activities and the river, and development and deployment of educational signs about the sensitivity of the riparian zone. Riparian revegetation efforts have been completed on more than 30 acres, and 5 campgrounds have been completely removed from the riparian area. A complex 300-foot instream habitat structure was installed to increase pool habitat and stream length in a reach in which spring chinook salmon and steelhead trout spawn in cooperation with CCD and funding from BPA and SRFB.

Elk Mortality Study – WDFW 1999.

WDFW - Upland Restoration Program

The Upland Restoration Program (URP) is designed to assist private landowners to improve habitat conditions for wildlife on their property. Upland Restoration Program wildlife biologists implement habitat restoration projects on privately owned riparian, shrubsteppe, and upland forest habitats and agricultural lands enrolled in the Conservation Reserve Program (CRP). The URP has enrolled 252 cooperators with 400,253 acres into the program. A list of existing and past projects is included in Table 23.

Table 23. SE Washington District upland restoration project history.

Year	COOP[1]	Acres	Trees/ Shrubs	Habitat Ac. Seed	Water Develop
1990-91	105	186,136	6,633	55	31
1991-92	132	248,676	7,999	79	12
1992-93	159	282,447	6,601	666	4
1993-94	162	293,325	5,307	376	6
1994-95	165	331,512	11,585	115	5
1995-96	162	302,591	13,252	905	4
1996-97	171	303,591	14,100	1,057	7
1997-98	193	334,683	14,340	1,076	4
1998-99	225	375,271	35,975	375	68

1999-00	252	400,273	50,182	665	75

[1] Number of cooperators

Noxious Weed Control

The Columbia County Weed Board (Weed Board) has implemented a cost share program for yellow starthistle since 1976. In the spray year 2000, approximately 28 landowners sprayed an estimated 5,000 acres. The Weed Board also assisted landowners release yellow starthistle biologicals since 1989. In 2000, landowners released 21,700 Yellow Starthistle airy Weevil, *Eustenopus villosus* and others, including Yellow Starthistle Bud Weevil, *Bangasternus orientalis*, Yellow Starthistle Peacock Fly, *Chaetorellia australis*, Yellow Starthistle Flower Weevil, *Larinus curtis*, and the Yellow Starthistle Gall Fly, *Urophora sirunaseva.*

In 1989, the Weed Board released biologicals for knapweed. In 1992, the Weed Board coordinated a hand pulling crew to pull the knapweed in the Tucannon River riparian area. Biologicals were released in 1995, 1996 and in 2000 and included Bronze Knapweed Root-borer, *Sphenoptera jugslavica*, Spotted Knapweed Seed Head Moth, *Metzneria paucipunctella*, and Lesser Knapweed Flower Weevil, *Larinus minutus*.

The Weed Board is monitoring the Tucannon watershed for leafy spurge every year. If detected, a cost share program is available to control and/or eradicate leafy spurge.
The Weed Board has released 3 biologicals for rush skeletonweed, including Skeletonweed Mite, *Eriophyes chondrillae*, Skeletonweed Rust, *Puccinia* and Skeletonweed Midge, *Cystiphora schmidti*.

Conservation Reserve Program (CRP) an USDA FSA & NRCS program.

The Conservation Reserve Program (CRP) protects fragile farmland by assisting owners and operators in conserving and improving soil, water, and wildlife resources. Conservation is achieved by converting highly erodible and other environmentally sensitive acreage normally devoted to the production of agricultural commodities to a long-term approved cover crop. The CRP benefits wildlife and salmonid restoration efforts by enhancing habitats, forage, and sediment delivery reduction. Landowner participants sign contracts for 10 to 15 years.

A summary of CRP acreage in the Tucannon River watershed illustrates when contracts end and potentially return land to agricultural production. Currently, 31 percent of the cropland acres in the Tucannon River watershed are enrolled in CRP (Table 24).

A large amount of cropland has been converted into CRP since 1986. Contracts that were signed from 1986 to 1990 have expired and a portion of these resigned under newer contracts.

Table 25 illustrates the current acreages and practice types for CRP in the Pataha Creek watershed. Due to agricultural economic conditions over the last several years, the enrollment into government programs such as CRP continues to increase.

The CRP acreage in the Pataha Creek watershed encompasses 11 percent of the Tucannon subbasin. The CRP acreage allotment in Garfield County (25%) will undoubtedly be reached with another CRP signup period, which will set the limit on this type of upland conservation. However, the continuation of the continuous CRP and other programs will increase the number of acres along perennial salmon bearing and seasonal streams within the Pataha Creek watershed.

Table 24. Conservation Reserve Program acreage in the Tucannon River watershed, Washington.

Date coming out of CRP	Acres coming out of CRP	Acres remaining	% CRP acres of cropland
Spring 2001	0.0	21691.5	31%
9/30/01	645.0	21046.5	30%
9/30/02	73.0	20973.5	30%
9/30/03	None	20973.5	30%
9/30/04	None	20973.5	30%
9/30/05	None	20973.5	30%
9/30/06	1361.4	19612.1	28%
9/30/07	4220.5	15391.6	22%
9/30/08	6581.5	8810.1	12%
9/30/09	6181.0	2629.1	4%
9/30/10	2629.1	0.0	0%
Total Acres	21691.5	0.0	

Table 25. Conservation Reserve Program acreage and practice types in the Pataha Creek watershed, Washington.

Practice No.	Conservation Reserve Program Practice	Acres
CP1	Establishment of permanent grass and legumes	351
CP2	Establishment of native grasses	2,095
CP4	Wildlife habitat	7,579
CP4d	Permanent wildlife habitat	1,053
CP10	Grass already established	1,719
CP21	Filter strips	286
CP22	Riparian buffers	122
	Total CRP acreage	13,205

USDA/WCC CREP Riparian Buffer Program

The Conservation Reserve Enhancement Program (CREP) is part of USDA FSA's Conservation Reserve Program (CRP). The Washington CREP provides incentives to restore and improve salmon and steelhead habitat on private land. It is a Federal-State partnership, based on an Agreement signed by Secretary of Agriculture Dan Glickman and Washington Governor Gary Locke on October 19,1998. The CREP program is coordinated at a local level by conservation district.

CREP is a voluntary program to establish forested buffers along streams where riparian habitat is a significant limiting factor fro salmonids. In addition to providing habitat, the buffers improve water

quality and increase stream stability. The CREP program is coordinated at a local level by conservation district. Key elements of the program are riparian area rental, livestock exclusion, fencing and re-vegetation with native species

Accomplishments by Year

1956: Construction of the Tucannon Hatchery

1978: Construction initiated on instream habitat structures in the Tucannon River to assess their usefulness in creating durable pool habitat for salmonids (Vail 1979). The work was undertaken with USCOE funds as part of the LSRCP settlement.

1980: Assessment to begin instream habitat improvement project (Ransom 1980). The work was undertaken with USCOE FUNDS as part of the LSRCP settlement.

1981:

- Phase 1 and Phase 2 assessment of potential fisheries enhancement in SE WA. Work was funded by USCOE as part of the LSRCP (Mendel 1981, Mendel and Taylor 1982).

- Began construction of the Lyons Ferry Complex for production of spring and fall chinook, steelhead and rainbow trout for the Tucannon and Snake rivers.

1983-84: Construction of instream pool creating habitat structures in the Tucannon River and evaluation of benefits and costs. Log and rock weirs and boulder clusters were determined to have the greatest potential for creation of durable pools for salmonid usage (Mendel 1984, Hallock 1985, Fuller 1986, Mendel and Ross 1988, Viola 1990).

1983-99: Ongoing evaluation of hatchery production mitigation, as funded by the LSRCP of the USFWS.

1985: Renovation of Tucannon Hatchery and Curl Lake for the production and acclimation of spring chinook salmon, summer steelhead, and rainbow trout. The COE and WDFW complete construction for inclusion in the LSRCP.

1988: The USFS, in conjunction with several other grant sources, provided funding for a wastewater treatment facility for the town of Starbuck.

1990: NPPC funded development of first inclusive review of anadromous fish population status and development of the first subbasin plan.

1991: In 1991, the CCD, under the auspices of the Watershed Protection and Prevention Act, sponsored a plan to improve the Tucannon River watershed. The results are summarized in Table 26.

Table 26. Tucannon River Watershed Plan Environmental Assessment.

	Tucannon watershed (acres)	Planned to Accomplish (acres)	Actual Accomplished (acres)	Actual Accomplished (%)
Dry Cropland	67930	45000	4167	9
Rangeland	82244	62000	9651	16
Forest	54667	7	0	0
Stream (miles)	50	12	2	17

1992: Tucannon Spring Chinook salmon listed by NMFS as threatened under the ESA.

1992-96: The WDFW conducts studies under the LSRCP to reduce the potential effects of hatchery steelhead releases on wild juvenile salmonids. Study eventually recommends abandonment of the use of Curl Lake acclimation facility for the release of hatchery steelhead smolts. Releases are moved downstream to reduce their effects while maintaining a viable sport fishery. Study further reinforces the need to develop a locally adapted steelhead broodstock for use in the LSRCP program.

1993: The *Tucannon River Model Watershed Plan* was initiated. The CCD lead a multi-agency CSC/TAC in a basin-wide assessment to describe actions needed to recover populations of recently ESA listed salmon. Plan scope was later expanded to emphasize the recovery of habitat critical for all anadromous and resident salmonids.

1994: PCD initiated collaboration with citizens and agency representatives on salmon issues in the Pataha Creek watershed.

1995: The PCD received funding from BPA to construct 1,780 feet of fencing on lower Pataha Creek at a cost of $1,000.

1996:

- Tucannon River Model Watershed accomplishments
  - Installed 20 instream habitat projects by combining BPA funding with 4 other funding sources
    - 11 large plunge pools
    - 4460 ft. of habitat complexity and large woody debris
    - 1 off-channel rearing area developed
    - 125 small to medium pools created
    - 1 irrigation modification
    - 3100 ft. riparian fencing
    - 5000 trees and shrubs planted
- Pataha Creek Model Watershed accomplishments
- The following practices were implemented during 1996 using BPA cost share:

- Placed fish aquarium at the grade school and hatched rainbow trout for educational purposes.
- Restored 1,200 ft. of stream channel
- Cost shared 949 acres of deep fall subsoiling, 1782 acres of no-till seeding, 2.4 acres of critical area seeding, 40 acres of divided slope, 4.1 acres of riparian and upland buffers, and 39 acres of strip cropping. These practices saved over 25,000 tons of soil from entering Pataha Creek.
- Over 600 feet of fish stream was improved.
- Over 20 miles of terraces and waterways were installed saving 11,000 tones of soil from also entering Pataha Creek.
- Over 1800 trees were planted along the Pataha Creek.
- Involved local schools in tree planting and invertebrate education.

1997:

- The WDFW instituted development of Tucannon Spring Chinook Captive Broodstock Program. The program collected juvenile fish from the hatchery, which originated from wild parent stock. The WDFW began development of a master plan for submission to the NPPC to request funds to continue captive broodstock development. Master plan was completed and accepted by NPPC in 1999, and BPA funded facility development.
- Tucannon River Model Watershed accomplishments
  - Completed dormant stock plantings on 1996 project sites.
  - Installed 12 instream habitat projects combining BPA funding with 4other funding sources.
  - Performed Operations and Maintenance activities on 5 projects
    - 8 large plunge pools
    - 6828 feet of habitat complexity and large woody debris
    - 3 off-channel rearing areas developed
    - 98 small to medium pools created
    - 5762 ft. of riparian fencing
    - 7000 trees and shrubs planted
  - Fish aquarium salmonid lifecycle education project with Dayton Elementary School
  - Tucannon River steelhead listed as threatened under the ESA.
  - Blue Lake was deepened and a sub-surface outlet was installed to return cold water to the Tucannon River as a WDFW project.
- Pataha Creek Model Watershed accomplishments
  - ISCO samplers and temperature monitoring devices deployed in lower and upper Pataha Creek.
  - The following practices were implemented during 1997 using BPA costshare:
    - Cost shared 1,724 acres of deep fall subsoiling, 1614 acres of no-till seeding, 15.4 acres of critical area seeding, 28 acres of riparian and upland buffers, 88 acres of grass in rotation, and 844 acres of strip cropping. These practices saved over 19,000 tons of soil from entering Pataha Creek.
    - Over 400 feet of fish stream was improved.

- Over 17 miles of terraces and waterways were installed saving 8,260 tons of soil from also entering Pataha Creek.
- 7,000 ft. of pipeline was installed to remove and distribute cattle away from the creek and riparian areas.
- 3 off site livestock watering facilities were developed to remove cattle from the riparian area.
- Over 5,500 trees were planted along the Pataha Creek.

1998:

- Tucannon River Model Watershed accomplishments
  - Completed dormant stock plantings on 1997 projects.
  - Expanded dormant stock planting to 6 sites other than instream projects
  - Installed 12 instream habitat projects.
  - Performed O&M activities on 2 projects
    - 15 large plunge pools
    - 5540 ft. of habitat complexity and large woody debris
    - 1 off-channel rearing area developed
    - 146 small to medium pools created
    - 1 irrigation modification
    - 11,891 ft. of riparian fencing
    - 10,000 trees and shrubs planted
  - Initiated WDFW evaluations on instream habitat projects.
  - Expand water temperature data collection with WDFW.
  - Initiated a 2-year water quality study with WSU CEEd.
  - Continued Salmon In The Classroom project in cooperation with NRCS

Instream structures built in 1998 increased pool number, pool quality, and large woody debris, though these changes were relatively small. Based on snorkeling results, added habitat structures provided suitable habitat for juvenile salmonids, and will likely provide habitat for ESA listed adult salmon, steelhead, and bull trout (Bumgarner *et el*. 2000).

- Pataha Creek Model Watershed accomplishments
  - Initiated database construction from ISCO sampling with testing for total suspended solids.
  - The following practices were implemented during 1998 using BPA costshare:
  - Operated fish aquarium at grade school and hatched rainbow trout for educational purposes
  - Cost shared 1,136 acres of deep fall subsoiling, 1,453 acres of no-till seeding, 795 acres of two-pass seeding, 4.2 acres of critical area seeding, 123 acres of divided slope, 51 acres of riparian and upland buffers, and 79 acres of grass in rotation. These practices saved over 14,000 tons of soil from entering Pataha Creek.
  - 24,716 ft of pipeline was installed to remove and distribute cattle away from the creek and riparian areas.

- Over 600 ft. of fish stream was improved.
- Over 7 miles of terraces and waterways were installed saving 2,900 tons of soil from also entering Pataha Creek.
- Over 15,600 trees were planted along the Pataha Creek.
- Contracted with WSU for additional monitoring of water quality, invertebrates, and upland erosion control practices.

1999:

- The WDFW and tribal co-managers agreed to begin development of a new steelhead broodstock for use in the Tucannon River and the eventually phase out of the use of Lyons Ferry stock steelhead in the Tucannon.
- Tucannon River Model Watershed accomplishments
  - Completed dormant stock plantings on 1998 Projects.
  - Continued dormant stock plantings at 6 sites other than instream projects.
  - Installed 9 instream habitat projects combining BPA funding with 4 other funding sources.
    - 22 large plunge pools
    - 6146 ft. of habitat complexity and large woody debris
    - 1 off-channel rearing area developed
    - 98 small to medium pools created
    - 23,395 trees and shrubs planted
  - Initiated a continuous direct seed program on 600 acres saving 3,670 tons of soil.
  - Initialized 3 ISCO sediment samplers for data collection.
  - Initiated site snorkeling for fish utilization with WDFW.
  - Continued habitat improvement monitoring and evaluation with WDFW.
  - Continued water temperature data collection with WDFW and WSU CEEd.
  - Continued new water quality monitoring/evaluation with WSU CEEd.
  - Continued Salmon In the Classroom program with NRCS.

The 1998 and 1999 habitat alteration projects, and other measures identified in the *Tucannon River Model Watershed Plan* may play a key role in stabilizing, restoring, or rebuilding healthy populations of salmonids in the Tucannon subbasin. Long-term monitoring and evaluation of these habitat alteration projects into the future will be critical in determining the value of such actions (Bumgarner *et el.* 2000).

- Pataha Creek Model Watershed accomplishments
- The following practices were implemented during 1999 using BPA costshare:
  - Operated fish aquarium at grade school and hatched rainbow trout for educational purposes.
  - Cost shared 1,933 acres of deep fall subsoiling, 2,427 acres of no-till seeding, 1,974 acres of two-pass seeding, 4.6 acres of upland buffers, and 128 acres of grass in rotation. These practices saved over 15,897 tons of soil from entering Pataha Creek.
  - Over 4 miles of terraces and waterways were installed saving 2,900 tons of soil from also entering Pataha Creek.

- Over 12,000 trees were planted along the Pataha Creek.

2000:

- The WDFW completed the *Steelhead Hatchery and Genetic Management Plan* (HGMP) to guide the development of the stock. Completion of the HGMP initiated the NMFS public comment and review process.
- The WDFW drafted *the Snake River Fishery Management and Evaluation Plan* (FMEP) as required by NMFS for continuing fisheries in the Snake River and its tributaries in Washington.
- Tucannon River Model Watershed accomplishments
  - Completed dormant stock plantings on 1999 projects.
  - Completed dormant stock plantings on 20 additional sites
  - Installed 8.5 instream habitat projects (extreme fire danger level stopped project implementation, projects not completed will be finished in 2001).
    - 17 large plunge pools
    - 4900 ft. of habitat complexity and large woody debris
    - 1 off-channel rearing area developed
    - 59 small to medium pools created
    - 69,276 trees and shrubs planted
  - Four additional landowners entered the continuous direct seed program adding 800 areas to the program.
  - Continued ISCO sediment sampler data collection.
  - Continued habitat, water temperature, and water quality data collection and monitoring and evaluation activities with WDFW and WSU CEEd.
  - Initiated CREP with 5 landowners and enrolled a total of 168.5 acres.
- Pataha Creek Model Watershed accomplishments
- The following practices were implemented during 2000 using BPA costshare:
  - Operated fish aquarium at grade school and hatched rainbow trout for educational purposes
  - Cost shared 1,600 acres of no-till seeding, 1,192 acres of two-pass seeding, 413 acres of direct seeding, 9,000 ft. of riparian fencing, and 42 acres of grass in rotation. These practices saved over 14,000 tons of soil from entering Pataha Creek.
  - Over 15,000 trees were planted along the Pataha Creek.

The Pataha Model Watershed has received BPA funding since 1995 to reduce sedimentation in Pataha Creek and the Tucannon River and to restore habitat within the Pataha Creek riparian zone. Projects have saved over 167,000 tons of soil from being eroded from the land and kept over 28,000 tons from being transported to and entering the Pataha Creek and Tucannon River. The actual cost per ton saved was $3.67 per ton. To put this savings in perspective, the soil saved is enough to cover a football field 267 feet deep. Five years of project implementation has illustrated that (1) crops can be grown on the same ground year after year even in areas of marginal to low rainfall. (2) Soil does not need to be cultivated in order to prepare a seed bed for crop production. (3) Tree planting with livestock management can lead to improved riparian health. (4) These practices can be implemented at an economical benefit to the landowners and operators.

Present Subbasin Management

Existing Management

Various state and federal agencies, tribes and local watershed groups have developed planning documents, policies and management guidelines for fish and wildlife habitat protection and enhancement for the Tucannon subbasin. Currently, the most effective plans and efforts are those that have been collaboratively developed and implemented, adequately funded, and produce short and long term on the ground results.

The Tucannon and Pataha model watershed plans were developed as part of the NPPC's "Strategy for Salmon" and emphasizes section 7 of that strategy and specifically addresses the involvement of locally-based model watershed plans for developing and implementing fish and wildlife habitat protection and restoration measures.

The Tucannon subbasin restoration efforts have been expanded with planning, management, and funding being supported by programs outside of NPPC/BPA. While effectiveness in implementing these plans, policies and regulations varies progress towards increasing inter-agency coordination and cooperation are being made in the subbasin.

Federal Government

U.S. Forest Service

The Pomeroy Ranger District of the Umatilla National Forest is located within the Tucannon subbasin. The district has been increasing efforts to improve fish and wildlife habitat on National Forest lands.

The USFS manages the Umatilla National Forest according to the Forest Plan, which is prepared and reviewed with the public every 10 years. However, due to the presence of the threatened chinook salmon, they are operating under the *Assessment of Ongoing Management Activities* (USFS 1993) as approved by the NMFS.

A USFS team of fish biologists developed guidelines, Pacific Fisheries (PACFISH)(Appendix I), to protect and enhance anadromous fish habitat on USFS lands. These guidelines will be used as the interim policy until the *Umatilla National Forest Plan* is approved by NMFS.

A 1993 Presidential team of scientists, the Forest Ecosystem Management Assessment Team (FEMAT), developed various alternatives for management of USFS and U.S. Bureau of Land Management (BLM) lands for protection of spotted owls, marbled murrelets, and anadromous fish. None of the FEMAT alternatives have been adopted, but PACFISH recommendations are being followed.

The *Land and Resource Management Plan* (1994) for the Umatilla National Forest divides the Tucannon subbasin into 15 different land management strategies (Table 27).

Table 27. USFS management strategies for USFS lands in the Tucannon subbasin, Washington.

Management Strategies	Acres
A1 Nonmotorized Dispersed Recreation	4,839
A2 OHV Recreation	4
A3 Viewshed 1	959
A4 Viewshed 2	2,251
A6 Developed Recreation	330
A9 Special Interest Area	559
A10 Wenaha-Tucannon Special Management Area	3,293
B1 Wilderness	13,062
C1 Dedicated Old Growth	2,020
C2 Managed Old Growth	69
C3 Big Game Winter Range	10,581
C4 Wildlife Habitat	13,138
C5 Riparian (Fish and Wildlife)	2,273
C8 Grass-Tree Mosaic	4,951
D2 Research Natural Area	67
P Private and Other Ownership	969
E2 Timber and Big Game	18,714

Management Strategy definitions – Appendix H

Currently the Pomeroy Ranger District is beginning the planning process for an ecosystems approach site-specific project in the lower Tucannon area. A project area of 11,500 areas in two subwatersheds that run east and west on both sides of the Tucannon River has been selected to analyze opportunities to reduce down fuel loadings, increase forage diversity and health through prescribed fire, convert stands of decedent mixed conifer species to historical seral species revitalizing stand health, reducing insect and disease populations and creating a mosaic of cover and forage for wildlife species.

During this planning process, they will also investigate partnership opportunities with the WDFW and private landowners in the bottomlands to enhance vegetation diversity, reduce potential catastrophic fire situations by reducing down fuel loadings, partnership fish habitat projects both on and

off federal lands, discuss options for reducing effects of past management activities, develop plans to return natural flow patterns in tributary streams, propose wildlife projects to enhance habitat or supplement needed resources (i.e. grouse/turkey guzzlers) and look at long term needs for the watersheds to sustain TE&S fish species, wildlife, clean cold water and healthy vegetation.

A project of this size and scope will require an Environmental Impact Statement, which will analyze all proposed effects and highlight opportunities. Close coordination and input from the public, county, state, federal and interested groups will drive the alternatives and proposed action. This document may serve as an important vehicle towards that end. A comprehensive look at the watershed displaying existing conditions, goals, objectives and opportunities will serve well as a watershed assessment for both the state and federal agencies.

The Umatilla National forest Plan describes specific goals for the Forest, which was established in the planning process to develop the Plan and guide Forest management in the future. They were expressed in broad terms and are timeless, meaning there is not specific date to reach or complete them. Based on these broad goals a desired future condition is described, which is our best guess at what the Forest will look like at the end of 10 years and at the end of 50 years, given full implementation of Forest Plan direction. Each desired future condition describes objectives, which is the level of goods, services and effects that we anticipated to be produced as the Plan is fully implemented. The objectives are supplemented with narrative summaries of resource outputs and schedules. In a broad context, Forest wide Standards and guidelines identify Forest-wide requirements and conditions to be met while achieving the Plan's goals and objectives. All of these are tied to an acre of land through management areas. These area descriptions of each selected management strategy (practices and prescriptions) for specific areas. The management areas list goals, descriptions, desired future conditions, standards and guidelines, and management practices by resource element for each area. Within each management area section, there are additional specific standards and guidelines, which guide management strategies and activities for each resource area (i.e. recreation, visuals, cultural resources, wildlife, fish, range, timber, water and soil, minerals and energy, lands, transportation, fire, fuels, and pests).

For acres in the uplands of the Tucannon subbasin, it is recommended that the Umatilla National Forest Plan be utilized to determine short and long term management strategies for each management area allocation within the National Forest Lands. This document may be acquired through CD-ROM.

Natural Resources Conservation Service

NRCS has a Memorandum of Understanding to provide assistance to Conservation Districts in the implementation of the District's short and long-term goals and objectives. The Natural Resources Conservation Service provides technical assistance to the CCD in the form of engineering, social and economic studies; watershed assessment and individual farm plans. The CCD also is receiving approximately $100,000 of donated plant materials by the NRCS to enhance riparian areas on the Tucannon River. NRCS works with the CCD in development of a yearly Biological Assessment for projects that impact T&E species. All practices implemented in the PCD meet NRCS standards and specifications.

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service budgets for and administers the operation, maintenance, and evaluation of the LSRCP spring and fall chinook, steelhead, and rainbow trout programs in the Tucannon River. The Water Resources Development Act of 1976, Public Law 94-587, authorized the LSRCP to offset losses caused by the four Lower Snake River dam and navigation lock projects (Corps 1975). The WDFW operates the LSRCP facilities (Tucannon Hatchery and Curl Lake Acclimation Pond) in the Tucannon River Basin and they are co-managers along with the Confederated Tribes of the Umatilla Indian Reservation and the Nez Perce Tribe within the basin.

The U.S. Fish and Wildlife Service also has permitting and oversight responsibilities to protect and enhance bull trout and other listed or sensitive fish or wildlife species within the subbasin under the Endangered Species Act (ESA).

Columbia Basin Fish and Wildlife Authority (CBFWA)

The CBFWA developed the Columbia River Fish Management Plan (CRFMP) an agreement among the tribal, state and federal parties with jurisdiction over Pacific salmon originating in the Columbia Basin that provides procedures whereby the parties co-manage anadromous fish harvest, production and habitat (Columbia River Inter-Tribal Fish Commission, (CRITFC) 1995). The CRFMP stems from the treaty fishing rights lawsuit, U.S. v Oregon. Although the CRFMP expired in 1999, the co-managers are working on developing another plan. The interim, short-term agreements on managing the fisheries have been entered into prior to execution of the specific fishery (spring or fall). The CRFMP, and further agreement, have all emphasized the importance of artificial propagation actions to accomplish the goals of rebuilding natural runs. Agreements struck in the U.S. v Oregon forum often determine the number, purpose and location of fish released from various hatcheries. Management actions for the Tucannon artificial propagation program are often included in U.S. v Oregon agreements.

Tribes

The Wy-Kan-Ush-Mi Wa-Kish Wit: Spirit of the Salmon (CRITFC 1995) makes institutional and technical recommendations for the Columbia Basin and presents a Tucannon subbasin plan calling for a number of administrative, instream flow and passage, watershed management and artificial production actions for the subbasin.

Nez Perce Tribe (NPT)

The Tucannon River is mentioned as a border of Nez Perce lands ceded to the United States in the Treaty of 1855. The NPT reserved certain treaty fishing rights on these ceded lands as well as other usual and accustomed areas. The NPT also retained the right to hunt and gather roots and berries on open and unclaimed land. Commensurate with the rights to hunt, fish and gather roots and berries, the NPT is responsible for protecting and enhancing these treaty resources and habitats for present and future generations. The NPT co-manages fish and wildlife with WDFW, specifically participating on review and implementation of the hatchery production activities in the subbasin.

Confederated Tribes of the Umatilla Indian Reservation (CTUIR)

The CTUIR is responsible for protecting and enhancing treaty fish and wildlife resources and habitats for present and future generations. Members of the CTUIR have federal reserved treaty fishing and hunting rights pursuant to the 1855 Treaty with the United States government. CTUIR co-manages fish and wildlife resources with state fish and wildlife managers and individually and/or jointly implements restoration and mitigation activities throughout areas of interest and influence in northeast Oregon and southeast Washington. These lands include but are not limited to the areas of the Tucannon Subbasin in which CTUIR held aboriginal title. CTUIR fish and wildlife activities relate to all aspects of management (habitat, fish passage, hatchery actions, harvest, research, etc.). CTUIR policies and plans applicable to subbasin management include the CTUIR *Columbia Basin Salmon Policy* (1996), *Wy-Kan-Ush-Mi Wa-Kish-Wit: Spirit of the Salmon* (Columbia River Inter-tribal Fish Commission 1996a, 1996b), and the CTUIR *Wildlife Mitigation Plan for the John Day and McNary Dams* (Childs 1997).

State

Washington Department of Fish & Wildlife

The WDFW is a major landowner in the Tucannon subbasin and is responsible for preserving, protecting, and perpetuating populations of fish and wildlife. Washington State laws, policies or guidance that WDFW uses to carry out its responsibilities include:

Hydraulic Code (RCW 75.20.100-160): This law requires that any person, organization, or government agency that conducts any construction activity in or near state waters must comply with the terms of a Hydraulic Project Approval permit issued by WDFW. State waters include all marine waters and fresh waters. The law's purpose is to ensure that needed construction is done in a manner that prevents damage to the state's fish, shellfish, and their associated habitat(s).

Strategy to Recover Salmon (part of *Extinction is not an Option*): The strategy is intended to be a guide, and it articulates the mission, goals, and objectives for salmon recovery. The goal is to restore salmon, steelhead, and trout populations to healthy harvestable levels and improve those habitats on which the fish rely. The early action plan identifies specific activities related to salmon recovery that state agencies will undertake in the 1999-2001 biennium and forms the first chapter in a long-term implementation plan currently under development. The early actions are driven by the goals and objectives of the Strategy. Many of the expected outcomes from the early actions will directly benefit regional and local recovery efforts.

The *Bull Trout and Dolly Varden Management Plan*: Describes the goal, objectives and strategies to restore and maintain the health and diversity of self-sustaining bull trout and Dolly Varden stock and their habitats.

The *Wild Salmonid Policy for Washington:* Describes the direction the WDFW will take to protect and enhance native salmonid fish. The document includes proposed changes in hatchery management, general fish management, habitat management and regulation/enforcement.

The *Draft Steelhead Management Plan*: Describes the goals, objectives, policies and guidelines to be used to manage the steelhead resource.

Washington Priority Habitats and Species (PHS): A guide to management of fish and wildlife "critical areas" habitat on all State and private lands as they relate to the Growth Management Act of 1990. The recommendations address upland as well as riparian habitat and place emphasis on managing for the most critical species and its habitat.

Specific wildlife species management or recovery plans, (eg Blue Mt. Elk Herd Management Plan 2000, Statewide Elk Management Plan, Bighorn Sheep Herd and Statewide Management Plan, Bleack Bear, State Ferruginous Hawk Recovery Plan, State Management Plans, Sharptail Grouse, Bald Eagle Recovery Plan).

The *W.T. Wooten Wildlife Area Management Plan:* Describes prioritized species management goals and objectives for management of state owned lands which constitute the wildlife area. The WDFW has established three mandates for the management of the Wooten Wildlife Area (Bruegman 1995):

- The Department shall preserve, protect and perpetuate wildlife, and wildlife habitats and shall maximize the recreational and aesthetic benefits of wildlife for all citizens, maximizing public recreational opportunities without impairing the supply of wildlife.
- The Department shall pursue the protection, restoration, or enhancement of wildlife habitat as its primary approach to maintaining healthy wildlife populations and maximizing wildlife-associated recreation.
- Department controlled lands will be managed primarily for the benefit of fish and wildlife and related recreation. Land use decisions will be based on long-term benefits to habitat.

The *Draft Snake River Wild Steelhead Recovery Plan:* This plan is an assessment of problems associated with the continuing decline in natural steelhead populations within the Snake River basin and includes recommendations to reverse the decline. The WDFW manages fisheries and fish populations to provide diverse recreational opportunity and conserve or enhance indigenous populations.

The *Lower Snake River Compensation Plan*: This program is funded by BPA and the USFWS through the LSRCP office, and the WDFW administers and implements the Washington portion of the program. The program mitigates for the loss of fish populations and recreational opportunities resulting from construction of the four lower Snake River dams. Specific mitigation goals include “in-place” and “in-kind” replacement of adult salmon and steelhead. The WDFW developed implementation plans as part of the LSRCP program and include:

The *Tucannon Spring Chinook Captive Broodstock Master Plan:* (WDFW 2000d) A BPA-funded plan for the construction, operation, and implementation of the Tucannon captive brood program. The plan was required by the Northwest Power Planning Council as part of the 3-step process for new artificial production initiatives within the Columbia Basin. The plan relates captive brood actions to resident and anadromous fish management within the basin.

The *Tucannon Wild Steelhead Hatchery and Genetics Management Plan*: (WDFW 2000e) plan describes the goals, objectives, and effects of local steelhead broodstock development on ESA listed salmon and trout in the Tucannon subbasin. This HGMP (Appendix J) met requirements established by NMFS under the ESA section 4(d) rule adopted in 2000.

The WDFW Snake River *Fishery Management and Evaluation Plan* (FMEP): A plan required by NMFS for all fisheries in the Snake River and its tributaries in Washington. The plan is an assessment of fisheries effects on listed anadromous salmonids.

The WDFW enforcement Program enforces state laws concerning illegal harvest, fish passage, water surface screening requirements and stream hydraulics permitting. These state laws are normally in direct support of the protection provisions of the Endangered Species Act for listed species. In the Tucannon subbasin, officers patrol streams for closed season harvest or taking of protected species listed under both state law and the federal ESA, such as spring chinook salmon, fall chinook, summer steelhead, and bull trout. Officers also monitor for illegal habitat modification, alteration and destruction activities on area streams and ensure work occuring within the ordinary high water area of streams is conducted under authority of and in accordance with appropriate state hydraulic project approval (HPA) permits.

Washington State Department of Natural Resources

The WDNR manages 2394 acres of state land throughout the subbasin. These lands are generally located in sections 16 and 36 within each township. The main goal of the WDNR is to maximize monetary returns from state lands in order to fund school construction. This type of management often reduces the habitat value for wildlife on WDNR lands. The WDNR also enforces and monitors logging practice regulations on private lands.

Washington Department of Ecology

The WDOE is charged with managing water resources to ensure that the waters of the state are protected and used for the greatest benefit. The WDOE allocates and regulates water use within the Tucannon subbasin. Permits are required to divert surface water and ground water withdrawals in excess of 5,000 gallons per day. The WDOE also acts as trustee for instream trust water rights issued to the State of Washington and held in trust.

The WDOE regulates surface and ground water quality within the Tucannon subbasin. The 1972 Federal Clean Water Act authorizes and requires states to establish water quality standards for specific pollutants. Every two years, the WDOE is required to list in Section 303(d) of the Clean Water Act those water bodies that do not meet surface water quality standards. The WDOE utilizes data collected by agency staff as well as data from tribal, state, local governments, and industries to determine whether or not a waterbody is listed on the 303(d) list. Total Maximum Daily Loads must be completed for every parameter that exceeds state water quality standards on listed water bodies.

The WDOE proposes several changes to surface water quality standards and the classification system. The revised standards must be applied so that they support the same uses covered under the

current classification structure. Changes to the surface water quality standards will affect many programs, including monitoring, permits, TMDLs and the 303(d) list.

Local Government

Garfield County Commission

The Garfield County Board of Commissioners has no known management program pertaining to fish and wildlife in Garfield County. The County works with the PCD, WDFW, and NRCS in meeting existing policies and guidelines.

The City of Pomeroy

The City of Pomeroy currently has no known management program. The City cut down overgrowth inside the Pataha Creek stream channel to maintain a free flowing channel through Pomeroy. However, this practice has not been implemented in 20 years because the USFWS set strict guidelines pertaining to the removal of habitat from the stream and riparian areas.

The City of Pomeroy received a grant for a new treatment plant and construction will begin in 2001. This will alleviate this point source of pollution and will aid in the improvement of the water quality in the lower portions of Pataha Creek.

Columbia County

Columbia County Commissioners have adopted a county comprehensive management plan developed through the Growth Management Act (GMA) process. For this plan/process they established land use policies, zoning ordinances and maps defining urban growth boundaries, forest, agricultural, and industrial lands according to statewide goals. Columbia County ordinance #93-07 as amended and adopted January 18, 1994 and the Columbia County Shoreline Master Program, June 1975 and have a "draft" Comprehensive Flood Hazard Management Plan, December 2000. Columbia County Commissioners have also designated Columbia Conservation District as the lead entity for watershed planning and implementation through ESHB 2496, Salmon Recovery Program (1998).

The Columbia Conservation District

The CCD is Columbia County's designated lead agency for watershed planning and implementation. The CCD is responsible for the implementation and management of the *Tucannon River Model Watershed Plan* and the Washington State Salmon Recovery Act within Columbia County.

The Columbia County Weed Board

The weed board conducts a cost share program with public and private landowners to control infestations of Washington State Class-A weeds. The program includes biological, chemical, and mechanical/hand control strategies. The weed board would like to expand cost share programs for more landowner involvement in rangeland and riparian protection and enhancement, as well as, restoration demonstration projects.

Existing Goals, Objectives, and Strategies

Fish

The Tucannon subbasin has diverse populations of fish and wildlife that are of economic and ecological significance to the people of Washington State and the northwest. These natural resources have special cultural significance to the Confederated Tribes of the Umatilla Indian Reservation and the Nez Perce Tribe.

The general goal is to restore the health and function of the Tucannon subbasin to ensure viable habitats for self-sustaining fish and wildlife populations while maintaining economical self-sustaining agriculture.

Goals, objectives, strategies and actions listed reflect a common general theme and overlap between various resource management entities. During the subbasin summary process they have been identified by their respective contributors with the understanding that the subbasin management plan process that follows will identify and clarify mutually respected goals, objectives, strategies and actions to facilitate fish, wildlife and associated habitat restoration.

Entity A. - The Tucannon River Model Watershed Council provided the following goal and objectives (Appendix G):

Goal: Improve habitat conditions in the watershed to support viable anadromous and resident fish populations while maintaining the economic sustainability of the local agriculture economy.

Objective 1 Increase natural stream stability and instream pool quality and quantity.

Intent:

- Create large, high quality pools for adult holding areas and rearing habitat for juveniles.
- Improve gravel sorting and stability for improved spawning, insect production, and survival of overwintering fish.
- Improve cover (i.e. logs, roots, undercuts, overhanging vegetation, turbulence and boulders).
- Reduce loss of fish habitat and cropland.
- Reduce damage to structures (i.e. bridges, roads, houses, etc.) caused by floods and flood repairs.

Strategy 1. The number of pools will be increased to one, high-quality pool per every 5-7 bankful widths (Rosgen 1994; Leopold 1994).

Strategy 2. The pool will be at least one meter deep, with a total surface area of 20 square meters (MacIntosh 1994).

Strategy 3. Each pool will have at least one element of cover (Hankin and Reeves 1988).

Strategy 4. Bankful discharge channel will be reduced to a width-to-depth ratio of 25 feet or less

Recommended Actions:

- Construct instream habitat improvement projects using bioengineering techniques. Restore riparian buffer area though tree and shrub plantings
- Coordinate the WCC/USDA Conservation Reserve Enhancement Program (CREP) to restore riparian buffer function.

Objective 2 Reduce the weekly average of the daily maximum water temperature to 70EF during summer months downstream to the confluence of Pataha Creek.

Intent:

- Reduce the weekly average of the daily maximum water temperature for each month in the summer to 70EF to make it habitable for salmonids downstream to the confluence with Pataha Creek.

Strategy 1. Reduce the weekly average of the daily maximum water temperature to 70EF at the confluence with Pataha Creek.

Strategy 2. Prioritize the upper reaches of the stream for treatment towards the lower reaches.

Strategy 3. Reduce width-to-depth ratio by 20 percent on public land and at least 5 percent on private land.

Strategy 4. Improve irrigation efficiency to at least 70 percent.

Recommended Actions:

- Continue temperature data collection and monitoring to identify thermal barrier limiting factors.
- Design and implement site-specific actions to narrow channel flow during low flow months.
- Work with landowners to identify water withdrawal efficiency needs.
- Develop and implement water withdrawal modification and management plans.
- Revegetate riparian area
- Implement current management programs in partnership with USDA NRCS
- Work with landowners to identify and secure instream flow enhancements

Objective 3 Reduce erosion and sedimentation rates to meet Class A water quality standards for turbidity, and lower the percent fines in spawning gravel to less than 15 percent.

Intent:

- Improve or maintain spawning success and juvenile salmonid overwintering.
- Improve insect production.
- Improve water clarity for feeding.
- Improve respiration.
- Reduce gill abrasion.

Strategy 1. Reduce turbidity to the state standard (not to exceed 5 NTUs over background levels).

Strategy 2. Reduce fines in the gravel to less than 15 percent of the substrate.
Strive for 8 mg/L DO in the spawning gravel.

Strategy 3. Reduce streambank erosion to 15 percent of the streambank length.

Strategy 4. Reduce sediment delivery rates to 10 percent.

Strategy 5. Improve and stabilize water diversions to eliminate the need to rebuild loose-rock diversions or diversion ditches every year.

Recommended Actions:

- Implement USDA CREP program to restore riparian habitats and function.
- Encourage maintaining CRP acreage through continuous program signups.
- Work with landowners to continue increasing agricultural acreages under direct seed systems.
- Work with landowners to continue implementation of upland BMP's.

- Work with the Weed Board to control noxious weed infestations to reduce soil erosion impacts to instream habitat.
- Work with agencies and landowners to restore native range vegetation and forest ecosystem cultures.
- The *Tucannon River Watershed Plan-Environmental Assessment* recommended conservation practices to reduce erosion and sedimentation (Table 28).

Table 28. Recommendations to reduce erosion and sedimentation in the Tucannon River, Washington.

Land use	Practice	Unit
Crop	Crop residue use	21,181 ac.
	Conservation tillage (No-till)	3,240 ac.
	Strip cropping	8,421 ac.
	Divided slope	8,745 ac.
	CRP	10,390 ac.
	Terraces	6,307 ac.
	Conservation cropping	1,852 ac.
	Permanent vegetation establishment	1,488 ac.
	Grassed waterways	279 ac.
	Water control basins	375 ac.
	Sediment basins	6
Grazed Range	Fencing	20 mi.
	Water development	20 ac.
	Seeding	300 ac.
	Brush management	150 ac.
	Proper grazing use	61,603 ac.
	Planned grazing system	61,603 ac.
	Deferred grazing	20,000 ac.
Forest	Critical area treatment	410 ac.
Riparian	Vegetation planting & protection	12 mi.
	Streambank erosion control	6,000 ft.

Objective 4 Utilize cost-effective and efficient ways to treat identified resource problems.

Intent:

- Work on the highest priority resource problems first.
- Favor the use of low-cost alternatives to treat those resource problems that are long term in nature.
- Use treatments that will contribute toward stream channel stability and increased fish habitat.

Strategy 1. The CSC/TAC will develop a protocol for prioritizing proposed projects and annually review the protocol and proposed projects.

Strategy 2. These committees will develop a procedure for evaluating completed projects and make changes as necessary to insure habitat quality as part of the adaptive management strategy.

Recommended Actions:

- Utilize the Watershed Council to prioritize projects.
- Continue using the Interdisciplinary team to design and engineer identified projects.

Objective 5 Promote cooperation and agreement between landowners and resource agencies for decision-making regarding resource use and fish habitat improvement.

Intent:

- Continue to maintain and improve the good working relationship between the landowners and natural resource agencies.

Strategy 1. Clarify, define, and continue the role of the CSC/TAC in project direction and prioritization.

Recommended Actions:

- Maintain interaction with the Watershed Council, watershed landowners with CCD coordination.
- Promote WCC/USDA CREP program.

Objective 6 Improve and re-establish riparian vegetation to reduce water temperature, increase stream channel stability and improve fish habitat.

Intent:

- Improve the canopy cover over the stream.
- Reduce streambank erosion and sedimentation.
- Increase filtration of potential pollutants.
- Increase overhanging cover.
- Increase large woody debris recruitment for improved complexity, quantity and quality of instream fish habitat.

Strategy 1. Increase canopy cover to 75 percent.

Strategy 2. Decrease length of eroding streambank to 15 percent of the total streambank length.

Strategy 3. Reduce maximum water temperature to 70EF at the confluence of Pataha Creek.

Strategy 4. Reduce fecal bacteria counts to meet the state standard for Class A waters (100 colonies/100ml).

Strategy 5. Increase species and age class diversity of riparian vegetation.

Recommended Actions:

- Finish current two-year water quality monitoring project.
- Implement WCC/USDA CREP program.
- Revegetate riparian areas at instream project sites.
- Revegetate other identified riparian areas.
- Continue the native stock nursery started on the Tucannon River, WDFW lands.
- Work with landowners to develop alternative livestock water systems, riparian grazing management plans, and fencing programs.

- Identify floodplain connectivity potential with landowners.

Objective 7 Improve and maintain rangeland condition to reduce negative impacts to fish.

Intent:

- Improve rangeland condition and minimize the negative impacts of rangeland use on fish.

Strategy 1. Reach the implementation goals for rangeland as described in the *Tucannon River Model Watershed Plan* (SCS 1991).

Recommended Actions:

- Continue work with the Weed Board to control noxious weed infestations.
- Work with landowners to establish grazing management systems.
- Develop off-site livestock water systems.
- Work with landowners to reestablish grass and shrub communities.
- Work with weed board and landowners to reduce noxious weed impacts on rangeland and its effects to fish habitat and water quality.

Objective 8 Improve and maintain forest health to reduce negative impacts on fish.

Intent:

- Improve forestland condition and minimize the negative impacts to fish.

Strategy 1. Reach the implementation goals for forestland as described in the *Tucannon River Model Watershed Plan* (SCS 1991).

Strategy 2. Implement PAC-FISH standards on USFS lands.

Recommended Actions:

- Work with landowners to develop and implement forest management plans.
- Remove heavily used camping areas.
- Restore and revegetate areas impacted by human use.
- Design camping areas to withstand extreme use.
- Work with weed board and landowners to reduce noxious weed impacts on forestland and its effects to fish habitat and water quality.

Entity B. - Pataha Creek Model Watershed Program goals

- improve instream fish habitat quality and quantity, while maintaining and restoring natural stream stability;
- reduce water temperatures to meet the water quality standard for temperature, as set by the Washington State Department of Ecology (WDOE), for "Class A" streams;
- reduce erosion and sedimentation rates to meet the water quality standard for turbidity, as set by the WDOE, for "Class A" streams;
- reduce bacteria counts and improve DO levels to meet state Class A standards (100 organisms/100 ml) and (DO- 8 mg/l), respectively;
- improve and reestablish riparian vegetation;
- maintain perennial flow of Pataha Creek to its mouth;
- remove barriers to improve fish migration;
- utilize cost-effective ways to treat identified resource problems;

- promote cooperation and agreement between landowners and resource agencies in decision making for resource use and fish habitat improvement;
- improve and maintain rangeland condition;
- improve and maintain forest health.

Entity C. - The WDOE recommends the following water quantity/quality goals and objectives for the Tucannon subbasin:

Goal 1. Maintain, restore and enhance the quality and quantity of habitat necessary to sustain and restore indigenous fish.

Objective 1 Maintain or improve instream flows

Strategy 1. Evaluate the location and timing of flow limited stream reaches and prioritize them for instream flow restoration and enhancement activities.

Strategy 2. Complete the process for establishing and adopting into rule instream flow(s) needed for salmonids.

Strategy 3. Develop cooperative and coordinated approaches with co-managers and the public to restore and enhance instream flows.

Strategy 4. Increase monitoring/regulation of water use and instream flows to ensure compliance with existing water use authorizations. Meter existing water diversions consistent with the overall metering strategy for WRIA 35.

Strategy 5. Assist in improvement of efficiency of irrigation systems to reduce diverted quantities of water.

Strategy 6. Pursue targeted and appropriate water purchases and leases for trust instream water rights as a method to enhance/restore instream flows.

Objective 2 Meet Washington State Surface Water Quality Standards for Temperature in the Tucannon River.

Strategy 1. Complete a Total Maximum Daily Load for Temperature on the Tucannon River in accordance with the Clean Water Act.

Strategy 2. Determine Waste Load Allocations and Load Allocations for Temperature in the segment of the Tucannon River from the mouth, at the Snake River, to Tumalum Creek.

Strategy 3. Complete a Detailed Implementation Plan for the Tucannon River that will outline steps required to meet Temperature Waste Load Allocations and Load Allocations.

Strategy 4. Complete and implement a Monitoring Plan for Temperature on the Tucannon River that will serve to determine the success of the TMDL and Detailed Implementation Plan.

Objective 3 Meet Washington State Surface Water Quality Standards for Bacteria in Pataha Creek.

Strategy 1. Complete a Total Maximum Daily Load for Bacteria for Pataha Creek in accordance with the Clean Water Act.

Strategy 2. Complete Waste Load Allocations and Load Allocations for Bacteria in the segment of Pataha Creek from the mouth, at the Tucannon River, to the headwaters.

Strategy 3. Complete a Detailed Implementation Plan for Bacteria on Pataha Creek that will outline steps required to meet Bacteria Waste Load Allocations and Load Allocations.

Strategy 4. Complete and implement a Monitoring Plan that will serve to determine the success of the TMDL and Detailed Implementation Plan.

Entity D. - The WDFW recommends the following fish goals and objectives for the Tucannon subbasin:

Goals:

1. Protect, restore, and enhance the abundance and distribution of wild summer steelhead, spring chinook salmon, bull trout and other indigenous fish in the Tucannon subbasin to provide non-consumptive fish benefits including cultural or ecological values.
2. Maintain, enhance or restore sustainable fishery and harvest opportunities for anadromous and resident fish.
3. Maintain or enhance genetic and other biological characteristics of naturally and hatchery produced anadromous and resident fish.

Objective 1. Increase native spring chinook salmon to sustainable and harvestable levels. Determine the wild escapement goal to meet this objective and meet the LSRCP goal to return an average of 1,152 hatchery produced spring chinook annually to the Tucannon and Snake Rivers.

Objective 2. Increase native summer steelhead to sustainable and harvestable levels of at least 600 to 1,500 fish per year. Refine the wild fish escapement goal and needs. Meet the LSRCP mitigation goal to return an average of 875 adult steelhead to the Tucannon River annually for harvest.

Objective 3. Maintain and increase naturally produced fall chinook returning to the Tucannon River.

Objective 4. Restore and maintain the health and diversity of bull trout and other resident salmonids to sustainable and harvestable levels. Determine the spawning escapement goal and population needs of resident fish.

Objective 5. Maintain LSRCP trout mitigation for resident trout in Tucannon lakes and maintain or increase stream fishing opportunities for trout.

Strategy 1. Protect, enhance or restore the abundance and distribution of indigenous fish.

- Evaluate or refine methods to establish recovery goals, escapement goals and desired future conditions or other goals. Refine methods for determining carrying capacities for salmonids in streams within the basin to establish biologically sound restoration and target goals.
- Establish wild/natural fish goals for recovery, escapement, desired future condition and harvest implementation plans.

- Provide protection for federal and state threatened and sensitive fish species in resource management plans.
- Enforce federal, state, tribal and local land use regulations to protect fish habitats.
- Increase enforcement of laws and fishing regulations pertaining to illegal take of fish (all life stages).

Strategy 2. Protect, enhance or restore water quality to improve the survival, abundance and distribution of anadromous and resident fish

- Reduce stream temperatures by restoring or enhancing riparian vegetation, floodplain function and increasing hypothetic and instream flows.
- Increase water quality monitoring and enforcement of existing regulations to maintain or enhance water quality. Use the Clean Water Act, Section 401, and the Washington Fish and Forests regulations to protect and restore water quality and fish habitat.
- Complete the Total Maximum Daily Load (TMDL) process and implement measures to remove streams from 303d listings under the Clean Water Act and improve water quality.
- Support timely updates and resource inventories related to local land use plans to prevent further development and degradation of floodplains, wetlands, riparian buffers and other sensitive areas.
- Properly maintain, relocate or eliminate forest, public and private roads in riparian or other sensitive areas.
- Implement the Conservation Reserve Enhancement Program (CREP), Continuous Conservation Reserve Program (CCRP), Wetland Reserve Program and other pertinent federal, state, tribal and local programs along riparian and other sensitive areas.
- Monitor and evaluate efforts to improve water quality and use the data to assist in management decisions.
- Use existing programs to reduce sediment delivery to stream channels from roads, agriculture, logging, and other land use activities.

Strategy 3. Protect, enhance and restore instream and riparian habitat to improve the survival, abundance and distribution of anadromous and resident fish.

- Enforce federal, state, tribal and local land use regulations to protect fish habitats.
- In the short term, plant native vegetation, construct pools and place woody debris in streams to increase channel complexity and provide pools and cover for fish.
- Over the long term, modify land use to improve stream sinuosity, channel stability, width/depth ratio, pool frequency, size and quality, and large woody debris recruitment in the stream to provide benefits to fish habitat quantity and quality.

- Reduce sediment deposition in area streams by reducing erosion and sediment delivery to waterways.
- Improve watershed conditions to reduce high water events and reduce instream substrate scour, deposition or movement.
- Improve floodplain function to improve stream channel stability, hypothetic flows and instream habitat diversity.
- Improve or eliminate stream fords and other substrate disturbances.
- Monitor and evaluate the quantity and quality of fish habitat in the basin to provide baseline information and to assess the success of management strategies.
- Monitor and evaluate efforts to protect, enhance and restore instream and riparian habitats and utilize the data to assist in management decisions.
- Identify, prioritize and protect critical habitat to improve production and survival of indigenous fish.

Strategy 4. Protect, enhance and restore instream flows to improve passage conditions and increase rearing habitat for anadromous and resident fish.

- Evaluate the location and timing of dewatered or flow limited stream reaches and prioritize them for instream water flow restoration and enhancement activities.
- Refine and/or determine flows needed for salmonid migration and rearing.
- Increase stream flows by improving the efficiency of irrigation systems and conversion of conserved water to instream flows.
- Increase stream flows by lease and/or purchase of water rights.
- Increase monitoring of water use and instream flows. Use collaborative efforts or enforcement of existing regulations and water rights to increase available instream water.
- Modify state water laws to allow water users to transfer water for instream use and to provide adequate protection downstream.
- Evaluate efforts to protect, enhance and restore instream flows

Strategy 5. Restore or enhance upstream or downstream passage for resident and anadromous fish.

- Identify and evaluate passage or screening needs within the basin and prioritize implementation of restoration.
- Modify or remove culverts, bridges, grade controls and water diversion structures as necessary to improve passage.
- Implement screening of all diversions (pump and gravity) to meet State and NMFS criteria. Achieve compliance with state screening and passage laws.
- Operate and maintain all fish passage facilities to ensure proper function and efficient passage of fish.
- Monitor river conditions and operation of passage facilities to ensure adequate fish passage.

Strategy 6. Use artificial production, as necessary, to maintain, restore or enhance indigenous fish populations and harvest opportunities.

- Evaluate the need for further hatchery supplementation or augmentation for bull trout, steelhead, spring chinook, resident trout, etc. Complete the artificial production Master Plan or HGMP for the subbasin before increasing hatchery production. Implement artificial production plans (Master Plan or HGMP).
- Continue existing LSRCP hatchery production and releases for spring chinook and steelhead to restore endemic populations and provide harvest opportunities.
- Modify LSRCP production programs as needed to minimize their potential effects on wild salmonid populations and to address ESA concerns.
- Operate broodstock traps to collect endemic steelhead and spring chinook for holding and spawning at existing hatchery facilities.
- Evaluate acclimation benefits and costs for hatchery steelhead. Complete long-term planning for the use of acclimation.
- and implement a comprehensive study to assess the risks and benefits of steelhead supplementation activities in the subbasin to determine effectiveness of rebuilding natural steelhead while maintaining their genetic structure and long-term viability.
- Continue hatchery production and releases of rainbow trout in area ponds and lakes to provide harvest and recreational fishing opportunities.
- Continue efforts to develop and phase into use of a local steelhead stock for the hatchery program.

Strategy 7. Implement artificial production practices that minimize adverse effects on fish habitat and maintain the viability and stock characteristics of hatchery fish.

- Monitor hatchery facility discharges to ensure they are within NPDES permit requirements.
- Use IHOT genetics guidelines for broodstock selection, mating and rearing.
- Monitor the health and disease status of hatchery fish.

Strategy 8. Monitor and evaluate hatchery programs to ensure they are successful and minimize adverse effects on listed or other indigenous species.

- Continue to monitor and evaluate the performance of the LSRCP spring chinook supplementation program.
- Continue to monitor and evaluate the LSRCP captive brood program for spring chinook salmon.
- Continue to monitor and evaluate the performance of the LSRCP steelhead program.
- Continue to monitor and evaluate the recreational and tribal fisheries in the basin and the contribution by hatchery programs.
- Conduct baseline genetic monitoring and evaluation of hatchery populations in the subbasin.

Strategy 9. Maintain or enhance fishery and harvest opportunities for anadromous and resident salmonids.

Maintain the congressionally mandated Lower Snake River Compensation Plan (LSRCP) harvest mitigation for steelhead and resident trout in Washington.

- Continue hatchery production and releases of Lyons Ferry Hatchery (LFH) and local stock steelhead to provide harvest and recreational fishing opportunities and meet mitigation goals.
- Modify LSRCP production programs as needed to minimize their potential effects on wild salmonid populations. Continue to manage steelhead sport fisheries to maximize recreational opportunity within the basin through consumptive and non-consumptive fisheries, while protecting wild populations through regulations and sanctuary area closures.
- Continue hatchery production and releases of rainbow trout in area ponds and lakes to provide harvest and recreational fishing opportunities to provide mitigation for lost fishing opportunities.
- Continue efforts to develop and phase into use of a local steelhead stock in the Tucannon River that will allow harvest augmentation (mitigation) and supplementation, as well as minimize adverse effects on indigenous steelhead, chinook, bull trout and other resident fish.
- Monitor the hatchery program to ensure it is successful and that it has minimal effects on indigenous species.
- Monitor and assess the effects of fishing seasons on the survival of indigenous species.

Strategy 10. Maintain warmwater or other fisheries as appropriate without conflicting with indigenous fish needs.

- Assess distribution, abundance and biological characteristics of nonindigenous fish within the basin.
- Evaluate non-indigenous fisheries.
- Develop a fishery management plan for non-indigenous fish.
- Monitor the fishery and adjust the plan, regulations, etc. as necessary.

Strategy 11. Monitor and evaluate the productivity, abundance, distribution, and genetic and other biological characteristics of indigenous anadromous and resident fish to provide baseline data and to assess the success of management strategies.

- Conduct redd and carcass surveys to monitor adult and determine adult salmonid spawning escapements.
- Maintain, modify and operate traps or adult counting facilities to enumerate adult salmonid returns, monitor migration timing and conduct biological sampling.
- Evaluate the need for additional trapping or counting facilities.
- Evaluate juvenile anadromous fish production, migration timing and survival by operating a smolt trap in the lower river.
- Conduct biological surveys to monitor and evaluate juvenile anadromous and resident fish distribution, abundance, condition, habitat use, life history, etc.
- Continue baseline genetic and biological monitoring and evaluation of indigenous salmonid populations in the subbasin.

- Use radio telemetry to examine migration into, and within the Snake River, migration timing, passage efficiency at potential barriers, over-winter and other habitat use, and life history of bull trout.

Strategy 12. Improve out-of-basin survival of migratory fish.

- Support efforts to improve passage and survival of migrant fish downstream of the subbasin.
- Support research within the Columbia River basin to fully understand the role of native and introduced predators on indigenous fish.
- Conduct monitoring of migratory fish to determine survival rates, timing and distribution outside the basin.

Entity E. - The Tribal Recovery Plan (Wy-Kan-Ush-Mi Wa-Kish-Wit, CRITFC 1995) identifies goals and recommended actions for each Columbia River subbasin upstream of Bonneville Dam. The goals are numeric escapement values for adult fish, and for the Tucannon are as follows:

- Spring chinook: 3,000
- Steelhead: 2,200
- Fall chinook: 2,000
- Lamprey: None established.
- The recommended actions for the Tucannon River system are:
- Habitat Enhancement Actions for Tucannon

Administrative

- Law and Codes, Enforcement & Revision
- State of Oregon (OR)/Environmental Protection Agency complete Total Maximum Daily Load for stream temperatures, sediment, other pollutants (Clean Water Act)
- Enforce Oregon fish screening statutes
- Upgrade Oregon Forest Practices Act to be consistent with Grande Ronde (UGR) Anadromous Fish Habitat Plan
- Upgrade Forest Service Plan consistent with UGR Plan to be in compliance with National Forest Management
- Revised mining laws to be consistent with production of high quality water and fish habitat

Instream Flow & Passage

Instream Flow Enhancement

- Purchase, exchange, lease or seasonally rent water rights for selected fish habitat during critical low flow periods
- Implement more efficient irrigation methods and water conservation practices benefiting landowners and instream flows

Watershed Management

Water Quality Needs

- Increase shade cover to reduce stream temperatures (increased downstream extent of temperature <60°F)

- Reduce sediment from agricultural practices and unimproved roads
- Reduced nitrate, phosphates, bacteria and other contaminates related to agriculture practices
- Manage ponds and lakes that are located in close proximity to the mainstem Tucannon on a manner that will minimize contribution of elevated water temperatures

Priorities: Mainstem Tucannon River, Pataha Creek

Riparian Restoration Needs

- Implement UGR Plan on state, federal and tribal lands
- Implement Best Management Practices (BMPs), including stream buffers to benefit fish on private lands
- Acquire, lease or implement management agreement to restore natural flood-plain habitat and function
- De-emphasize recreational use along upper mainstem Tucannon River by relocating existing use

Priorities: Mainstem Tucannon River, Pataha Creek

Range Management

- Revise and implement BMPs to be consistent with UGR Plan Standards & Guidelines (S&Gs)
- Restrict/remove livestock in substandard areas
- Acquire, lease, and develop projects in priority areas (see above)

Forest Management

- Upgrade, monitor, and enforce Forest Practices Act consistent with UGR Plan S&Gs on private lands
- Implement UGR Plan Standards & Guidelines on state, federal, tribal lands
- Identify and implement active restoration projects
- Institute or continue protection of "good" habitat areas such as upper Tucannon drainage within wilderness area and upper mainstem Tucannon River below wilderness area

Mining Impacts Reduction Needs

- No current problems

Artificial Production

1. Maintain the Tucannon stock spring chinook program of 132,000 yearling smolts
   a. Use no more than 50% of the returning adults for program broodstock requirements. Release all other returning adults upstream into the primary natural production area.
   b. Change release location to a site upstream of the hatchery weir to encourage more escapements above the weir into the best spawning/rearing habitat area. Immediately develop acclimation facilities in the primary natural production area. In the interim, acclimate and release spring chinook from the Curl Lake acclimation pond.
2. Discontinue use of non-native stocks in existing summer steelhead program. Develop a new broodstock population from natural Tucannon returns.
   a. Reduce program to 120,000 yearling smolts.

b. Continue the existing steelhead release program from Curl Lake in a manner, which would not interfere with spring chinook acclimation.

3. Begin acclimation/release program of 500,000 subyearling fall chinook. Lyons Ferry stock should be use as the founder population for this program.
   a. Develop adult capture and juvenile acclimation/release facilities in the Starbuck Dam area to support future broodstock collection and smolt out-planting activities. Until final facilities are developed, direct stream releases should occur.
4. Evaluate historical status of coho populations and current production potential in the subbasin for reestablishment of species.
5. Discontinue all catchable trout programs in the areas where they may affect anadromous salmonid restoration activities.
6. A program to restore lamprey populations utilizing either transplantation or artificial propagation should be developed under the overall leadership of the affected tribes.
7. Monitor and evaluate all artificial production actions. Use adaptive management to determine whether program changes (i.e., release number, size, time, location, and/or

Wildlife

The primary wildlife goal is to protect, enhance, restore, maintain and/or increase PHS wildlife populations and associated habitats to viable or management objective levels for ecological, social, recreational, subsistence, and aesthetic purposes within the subbasin while maintaining the economic sustainability of the local agriculture economy. Numerous wildlife species occur in the three habitat types within the subbasin, including those identified by WDFW as threatened, species of concern, or PHS. Goals, objectives, strategies and actions identified in the Fish section addressing riparian, rangeland and forest health will apply to wildlife and associated habitats and are not duplicated here but provide a linking of efforts to address total watershed health for the benefit of resource restoration and recovery.

Ferruginous Hawk

Status: State threatened, Federal species of concern

Limiting Factors: Loss of shrub steppe habitat and prey species, mortality and competition for nesting sites (WDFW 1996; Olendorff 1993).

Goal: Establish and maintain a viable ferruginous hawk population.

Objective 1 Increase nesting pairs within the subbasin to 10-12, over five years**.**

Strategy 1. Establish cliff-nesting platforms.

Sharp-tail Grouse

Status: State threatened, Federal species of concern

Limiting Factors: Loss of shrub steppe habitat; sharp-tails extirpated; no viable population from which to build (Hudson and Yocum 1954; Schroeder *et al.* 2000).

Goal: Re-establish a viable sharptail grouse population within the subbasin.

Objective 1 Establish six viable leks (100-150 birds) within the subbasin over five years.

Strategy 1. Inventory suitable habitat conditions and sites for re-introductions with a six-month evaluation period.

Strategy 2. Re-introduce sharp-tail grouse.
Strategy 3. Improve habitat quality of CRP lands to make suitable for sharp-tails; establish abundant legumes within CRP.
Strategy 4. Use artificial leks to establish breeding sites.

Washington Ground Squirrel

Status: State and Federal species of concern.
Limiting Factors: Loss of habitat and mortalities to agricultural development and crop control.
Goal: Increase the population within the subbasin.
Objective 1 Establish six viable colonies: 15+ squirrels/colony over five years.
Strategy 1. Inventory existing populations in six-month period.
Strategy 2. Inventory suitable ground squirrel habitat in a six-month period.
Strategy 3. Purchase conservation easements to protect habitat.
Strategy 4. Trap and transplant Washington ground squirrels into historical or existing habitat.

Bighorn Sheep

Status: State game species.
Limiting Factors: Mortality due to predation and scabies (Foreyt *et al*. 1990).
Goal: Establish and maintain a viable bighorn sheep population within the Tucannon subbasin.
Objective 1 Increase the bighorn sheep population to 60+ animals within five years.
Strategy 1. Develop technique to control scabies mites (parasites) in free ranging bighorn sheep.
Strategy 2. Supplement the population if bighorn sheep numbers drop below 15 breeding ewes.
Strategy 3. Monitor adult mortality. If predation from mountain lion and coyotes is a limiting factor, initiate predator control until the bighorn population is at population objective level.
Strategy 4. Control noxious weeds on bighorn sheep range.

Mule Deer

Status: State Game species.
Limiting Factors: Mule deer populations in the uplands have declined. Factors contributing to the decline may be fire suppression, predation, and competition with white-tail deer (Hamlin *et al*. 1984; Unsworth *et al*. 1999; Whitaker and Lindzey 1999).
Goal: Maintain the mule deer population at current levels in the lowlands, and increase populations in the uplands.
Objective 1 Increase mule deer populations to 1980 level
Strategy 1. Improve range conditions in the lowland by controlling the spread of noxious weeds, with an emphasis on yellow-star thistle and knapweed.
Strategy 2. Improve habitat in the uplands through controlled burning.
Strategy 3. Determine productivity and adult mortality factors in mule deer.

Rocky Mountain Elk

Status: State Game species.

Limiting Factors: Conflicts with agriculture; noxious weed invasion; calf mortality (predation); mortality of adult cows east of the Tucannon River (Myers *et al*. 1998).

Goal: The elk population east of the Tucannon River is below management objective (Fowler 2000). Increase the wintering elk population east of the Tucannon River to management objective (WDFW 2000).

Objective 1 Increase the wintering elk population to 450 elk east of the Tucannon River and maintain at least 250 elk west of the Tucannon River within the next five years**.**

- Strategy 1. Improve habitat conditions through forage enhancement projects.
- Strategy 2. Improve habitat conditions through control of noxious weeds.
- Strategy 3. Improve habitat conditions through the use of controlled burns.
- Strategy 4. Reduce disturbance in key habitat through road-area closures.
- Strategy 5. Monitor and reduce adult elk mortality east of the Tucannon River.

W.T. Wooten Wildlife Area

The W.T. Wooten Wildlife Area is located in the upper Tucannon River drainage and borders the Umatilla National Forest and private lands. The wildlife area is home to a wide variety of wildlife species, from spotted frogs, to neotropical migrants, mountain lion, elk, and bighorn sheep.

Location: Upper Tucannon drainage, 25 east of Dayton and 14 miles south of Pomeroy.

Size: 14,000 acres.

Limiting Factors: Declining habitat values from fire suppression and noxious weeds.

Goal: Improve habitat conditions on the Wildlife Area for elk and other wildlife.

Objective 1 Enhance 1,000 acres of key habitat areas over the next five years.

- Strategy 1. Increase noxious weed treatment and monitoring.
- Strategy 2. Increase use of fire in conifer stands to improve habitat conditions.
- Strategy 3. Initiate forage enhancement projects on the wildlife area.

WDFW Upland Restoration Program

The Upland Restoration Program is the tool WDFW uses to promote recreational access and implement cooperative habitat protection and restoration projects on private lands within the subbasin. The program concentrates habitat improvement efforts on restoring native habitats for game species, PHS assemblages, and other wildlife species of concern. Specific URP goals, objectives, and strategies for this subbasin are described below.

Location: Columbia-Garfield counties.

Size: 90,105 project acres within Tucannon subbasin.

Limiting Factors: Declining habitat values on private land.

Goal: Enroll private landowners in WDFW habitat restoration programs.

Objective 1 Improve habitat conditions on private lands and increase recreational access.

- Strategy 1. Improve habitat conditions in riparian zones by planting shrubs, trees, and filter strips.
- Stategy 2. Improve habitat condition on native rangelands by controlling noxious weeds, installation of guzzlers, and seeding native grasses and forbs.

Strategy 3. Improve wildlife habitat conditions in CRP fields by planting a diverse mix of native vegetation.

Strategy 4. Improve upland habitats through water developments, weed control, and forage enhancement projects.

Strategy 5. Increase the diversity of wildlife, and increase populations on private land by improving habitat diversity.

Strategy 6. Increase public recreational access through WDFW access programs with private landowners.

Strategy 7. Control and enforce access programs for landowners.

U.S. Forest Service

Forest Service goals, objectives, strategies and recommended actions can be found under the Umatilla National Forest Plan Chapter 4 of the Land and Resource Management Plan, available from the U. S. Forest Service or Columbia Conservation District. Listed in the Plan are 26 ***goals*** (pages 1-3), desired future condition descriptions for each natural resource area, forest management ***objectives*** (pages 3-46), which are tied to outputs/effects, followed by a resource summary. Forest wide standards and guidelines serve as the ***strategies*** (pages 47-93) for management requirements by describing goal statements followed by general directions as emphasized by Forest Service manuals, handbooks, policy and appropriate laws at the local state and federal levels. ***Recommended actions*** (pages 48-195) can be tied to each management area discussion.

Research, Monitoring, and Evaluation Activities

Fisheries

A variety of research, monitoring and evaluation activities, past and current occur in the Tucannon subbasin. The most extensive and on going are the activities associated with WDFW and the LSRCP. Columbia Conservation District (CDD) and Pomeory Conservation District (PCD), the respective lead entities for the two model watershed programs that make up the Tucannon subbasin, work cooperatively with WDFW and local staffs (contracted services) to tie various assessments and monitoring activities with WDFW to maintain consistency and cost efficiency. CCD and PCD also utilize WSU CEEd, extension service and NRCS to maintain assessment validity and credibility for water quality, upland Best Management Practices (BMP) and project engineering monitoring.

BPA-funded Research, Monitoring and Evaluation Activities

WDFW continues to evaluate the spring chinook captive brood program to determine its effectiveness at increasing stock abundance by returning adults to the spawning grounds, and monitor survival rates and life history characteristics of captive brood fish in the hatchery. Survival rates, life history, and genetic characteristics of captive brood progeny that return and spawn in the river will also be evaluated. Survival rates of captive broodstock, and their resultant progeny will be tracked for each brood year. Individual family survivals, growth, and maturation rates will be tracked. Adverse effects may result from intensive artificial propagation, and may include inappropriate spawn timing, and changes in age structure, fecundity, fertility, or sex ratio of the propagated population. These variables will be assessed in the captive population. Survival from egg-to-fry and egg-to-smolt will be

documented for each brood year for comparison. In addition, a random sample of progeny from the captive brood will be sacrificed for comparison of meristic differences to the supplementation of fish and wild fish in the Tucannon River.

The Confederated Tribes of the Umatilla Indian Reservation (CTUIR) is assessing the abundance and distribution of lamprey in the Tucannon subbasin. Lamprey has been identified within the tribal salmon recovery plan as a species of cultural importance (Wy-Kan-Ush-Mi-Wa-Kish-Wit 1995). Electrofishing, streambed samples and data compilation from cooperating agencies will provide a basic assessment of their status.

Several separate evaluation or research activities are ongoing within the Tucannon subbasin. The LSRCP funded monitoring and evaluation activities associated with the Lyons Ferry complex studies include:

- Monitor and evaluate the quality and release of hatchery spring and fall chinook and summer steelhead produced from the Lyons Ferry complex.
- Evaluate hatchery release strategies from all release sites (downstream survival rates).
- Estimate the incidental take of wild origin juvenile steelhead in the Touchet River resulting from a sport fishery directed at LSRCP catchable rainbow trout.
- Determine natural production and estimate freshwater survival rates for spring chinook and summer steelhead in Southeast Washington streams. Compare natural survival rates to hatchery survival rates for spring chinook and steelhead.
- Assess and quantify the juvenile out-migration of natural and hatchery-origin spring and fall chinook, and summer steelhead from the Tucannon River.
- Monitor and evaluate adult trapping/collection of spring chinook and summer steelhead for broodstock.
- Estimate adult returns and return rates, collect life history and genetic characteristics, and document distribution of adult fall and spring chinook and summer steelhead to southeast Washington streams and facilities.
- Maintain phenotypic and genotypic characteristics of salmon and steelhead stocks.
- Continue with implementation of a captive brood program for Tucannon River spring chinook in 2000-2001.
- Where appropriate, cryogenically archive salmon and steelhead semen for future use.
- Assess LSRCP hatchery evaluation actions to determine potential effects on species listed under the Endangered Species Act.
- Represent WDFW during formal ESA consultation between NMFS and the USFWS.
- Analyze, update, modify, and submit new ESA Section 10 scientific and enhancement direct take permits as needed.
- Coordinate and integrate Washington's anadromous fish management and research with the Section 7 LSRCP Biological Assessment, subsequent Biological Opinions and Management Plans, and the NMFS Recovery Plan.

WDFW collects genetic samples from spring chinook juveniles and spawned adults. WDFW has shifted its genetic monitoring away from electrophoretic analysis to DNA analysis in the last few years. It is anticipated that as captive brood origin adults return, both DNA and electrophoretic analysis will be conducted for comparisons with samples collected in the mid-1980's.

NMFS will continue the collection of samples of wild origin steelhead, and hatchery supplementation steelhead from the Tucannon River. This study began in 1989, and is designed to identify the long- term genetic effects of supplementation on natural populations (Waples *et al.* 1998).

WDFW, CTUIR, NPT, and the Oregon Department of Fish and Wildlife (ODFW) are collecting steelhead DNA samples from Snake and Walla Walla River basins as part of a coordinated effort to describe the population and stock structure of wild steelhead populations in the region. The effort utilizes funds from a variety of sources to gather and analyze the DNA samples. The project is coordinated by the USFWS (Campton pers. comm.)

WDFW is collecting DNA samples from bull trout captured in adult traps and from electrofishing undertaken by LSRCP evaluation crews, and by WDFW District management personnel. Samples collected are presently archived until funds are available to complete DNA analysis.

WDFW and the USFS coordinate annual bull trout spawning surveys to assess bull trout spawning densities within the basin. Surveys have shown a steady increase in the spawning population in recent years and identified new spawning areas for survey (Martin *et al.* 1993; G. Mendel (WDFW), per. com. 2000).

- WDFW will assess the effectiveness of locally developed steelhead broodstock to return adults to the Tucannon Basin. This work will occur simultaneously with LSRCP evaluations but will include the following goals as described in the Tucannon HGMP (Appendix J).
- Estimate the contribution of the conservation/mitigation program-origin summer steelhead to the basin and compare performance to the natural population.
- Monitor and evaluate any changes in the genetic, phenotypic, or ecological characteristics of the populations potentially affected by the program.
- Assess the need and methods for improvement of conservation/mitigation activities in order to meet program objectives, or the need to discontinue the program because of failure to meet objectives.
- Collect and evaluate information on adult returns.

The Tucannon River Watershed Water Quality Monitoring Project 's specific objectives include providing baseline data for assessing the current water quality status of the Tucannon River and providing evidence for effectiveness evaluation of CCD efforts to address key water quality parameters through habitat restoration efforts. Grab samples taken every two weeks, at nine stations, are analyzed for the most critical water quality parameters, sediments, temperature, and fecal coliform. Other parameters sampled and analyzed include ammonia, nitrate, total Kjeldahl nitrogen, and total phosphorous. These samples conducted once every two months at all stations. Stream discharge is also measured monthly at four stations (4,6,9 and USGS station at Smith Hollow, approximately half way between stations 1 and 2).

The Bonneville Power Administration (BPA), through the Tucannon River Model Watershed Program, funds the Tucannon River Watershed Habitat Monitoring Project, conducted by WDFW Snake River Lab. Pre-construction and 1 year post-construction habitat measurements taken for comparative analyses include: 1) site length, 2) maximum and mean site depth, 3) mean wetted width, 4) mean thalweg depth, 5) quantitative and qualitative counts of wood debris, 6) number of pools, 7) pool quality, 8) pool area, 9) pool depth, and 10) a fluorescent dye rate. Snorkeling is done to determine fish utilization. Details of the methods and results are provided in WDFW (Bumgarner et.al. 2000).

Non BPA funded Research, Monitoring and Evaluation Activities

The Pataha Creek Water Quality Monitoring Project (Project), a collaborative effort between the PCD and WSU, was initiated in September 1998. The Project aims to assess the success of agricultural management practices for Pataha Creek. Project objectives include 1) providing evidence of the effectiveness of PCD efforts to address key water quality parameters, and (2) providing baseline data for assessing the creeks' water quality status.

The PCD is also collecting data from 2 ISCO samplers that are located in upper Pataha Creek and the lower Tucannon River. The PCD has operated these samplers for three years and samples twice daily for TSS. The samples have shown that the sediment delivered into Pataha Creek originates from runoff events caused by thunderstorms and/or rain on frozen ground conditions. The implementation of upland conservation practices along with riparian restoration projects will eventually reduce this problem.

Wildlife

BPA-funded Research, Monitoring and Evaluation Activities

No known activities identified.

Non BPA-funded Research, Monitoring and Evaluation Activities

The WDFW operates multiple wildlife projects within the subbasin. Annual surveys are conducted for deer and elk, and diversity species. The Upland Restoration Program works with private landowners to improve wildlife habitat on private lands.

- The WDFW manages the 14,000-acre Wooten Wildlife Area. Forage enhancement and weed control projects.
- Mentoring elk re-located from Hanford.
- Ferruginous hawk surveys.
- Washington ground squirrel surveys.
- Bighorn sheep surveys.
- Bighorn sheep disease monitoring and treatment.
- Deer/Elk surveys.
- Deer/Elk harvest surveys.
- Elk Reproductive Study.
- Elk Calf Mortality Study.
- Elk population and damage assessment study.
- Forage enhancement projects of elk.
- Hatchery Ridge Prescribed Burn.
- Wooten Forage enhancement.
- Wooten weed control.
- Wooten Wildlife Area field restoration
- Upland Restoration Projects: private land.
- WDOE flow monitoring project and report
- WDOE water quality ambient monitoring

- WDFW and WDOE IFIM Project
- Snake R. Lab monitoring and evaluation project
- Kelly and Associates and other NRCS funded assessment projects

U.S. Forest Service

The Pomeroy Ranger District (PRD) manages habitat on National Forest lands within the subbasin. The PRD has a very active controlled burning program and is in the process of updating its *Travel-Access Management Plan* for roads and trails.

- Tucannon #3 burn and reseed.
- Pasture winter range burn.
- Abels Ridge winter range burn.
- Water Pond Development west Tucannon.
- Upper Tucannon burn.
- Middle Tucannon Yellow-star Thistle.
- Meadow Prescribed Fire Vegetation.
- Tallow Tail Burn.

Statement of Fish and Wildlife Needs

The following Tucannon subbasin near-term fish and wildlife needs are based on the findings and recommendations in the Tucannon River and Pataha Model Watershed Plans, the Tucannon River Watershed Plan-Environmental Assessment and information collected and recommended by WDFW, WDOE, USFS, CTUIR, and the NPT. Projects that address the following needs are directed at satisfying subbasin limiting factors and fish and wildlife management goals, objectives, and strategies.

Fish

Habitat

- Improve or re-establish well developed, mature riparian buffers, increased channel stability and sinuosity, and floodplain connectivity throughout the subbasin.
- Decreased water temperatures and sediment delivery to the Tucannon River.
- Identify, protect, or purchase critical watershed areas, as identified in *Washington's Priority Habitats and Species*, or water rights for the protection of native species and their habitats.
- Improve instream fish habitat quality and quantity.
- Improve fluvial geomorphic conditions for attainment of self-sustainable fish populations and reduction of sediment delivery due to streambank erosion.
- Reduce water temperatures.
- Reduce upland erosion and sedimentation delivery rates to decrease the percentage of fines in spawning gravels.
- The Tucannon River Model Watershed Plan to restoration, maintenance, or enhancement activities for spawning and rearing habitat within the subbasin.
- Characterize the current productive capacity of the basin for salmonid production and recommend minimum and desired annual escapements by species.

Data Gaps / Assessment

- Assess the effect of exotic fish species on resident and migrant salmonid juveniles.
- Assess the level of residualism from hatchery reared endemic brood steelhead in the subbasin.
- Assess the response of fish populations to increased marine nutrient availability.
- A full assessment of the abundance, distribution, habitat use, life history, biological characteristics, and status of the following species:
    - mountain whitefish
    - bull trout
    - torrent sculpin
    - margined sculpin
    - Pacific and River lamprey
    - redband trout
    - westslope cutthroat trout
    - wild steelhead
- Assess factors limiting the production of spring and fall chinook salmon.
- Assess factors limiting the production of steelhead.
- Evaluate and implement the removal of exotic fish species such as brook trout.
- Re-assess the *Tucannon River Model Watershed Plan* in relationship to current ESA recovery plans
- Develop spawner / recruit data bases from information collected to determine what are full seeding levels of spring chinook and steelhead for the basin.
- Determine whether residual wild stock origin juvenile steelhead pose a significant threat to the natural population.
- Determine subbasin-specific hooking mortality rates for juvenile and adult steelhead, bull trout or chinook salmon released in sport fishing seasons.
- Evaluate the catch and effects of fisheries on whitefish, bull trout, chinook salmon and resident wild rainbow/redband trout.
- Conduct on-the-ground assessment of previous plan actions, current habitat conditions, water quality, and usage.
- Expand monitoring and assessment activities to improve our understanding of bull trout distribution, abundance, life histories and movements.

Artificial Production

- Determine the level of stray non-endemic salmon and steelhead that enter the Tucannon River and recommend actions to mitigate their effect.
- Determine whether captive brood Tucannon spring chinook can be used effectively to reestablish extirpated populations in Asotin Creek and potentially in the Walla Walla River.
- Increase native stock steelhead and spring chinook to sustainable levels

Natural Production

- Initiate a cooperative project to address juvenile and adult passage problems in the basin (screens, culverts, diversions).

- Assess the efficacy of habitat improvement projects within the basin to alleviate factors limiting the production of native salmonids.
- Increase wild steelhead and spring chinook to sustainable levels
- Monitor and evaluate the natural production of fall chinook in the lower Tucannon River.
- Determine escapement and harvest management goals for natural production.
- Increase deposition of salmonid carcasses and nutrient cycling (enhance ecological productivity)

Enforcement

- Ascertain the present level of compliance with screening and passage requirements for the basin.
- Increase efforts to control illegal harvest of ESA listed salmonids.

Wildlife

Habitat

- Enhance riparian vegetative diversity and abundance to increase habitat available for wildlife and promote natural stream channel development and stability.
- Enhance forage base for elk on W.T. Wooten Wildlife Area and National Forest lands.
- Control and reduce the spread of noxious weeds within the subbasin.
- Improve and diversify the vegetative composition of CRP in order to provide better habitat for existing wildlife populations.
- Improve road closure programs on National Forest.
- Reduce OHV use on National Forest lands.
- Use controlled burns to improve habitat in the timbered uplands.
- Improve native/natural grass and shrub stands.
- Improve fluvial geomorphic conditions for riparian stability.
- Improve water availability for wildlife.
- Reduce upland erosion through noxious weed control.

Population Management

- Re-introduce sharptail grouse into the subbasin.
- Re-introduce Washington ground squirrels into the subbasin if surveys determine populations are insufficient to re-establish viable colonies.
- Develop technique to control scabies in free ranging bighorn sheep.

Assessments/Data Gaps

- Monitor ferruginous hawk nesting populations and productivity on a more frequent basis.
- Inventory potential sharptail grouse habitat.
- Inventory Washington ground squirrel populations and habitat.
- Increase deer surveys.
- Maintain elk surveys.
- Increase bighorn sheep surveys.
- Determine mortality rate and factors for adult bighorn sheep.

The following projects are examples of implemented needs based on the goals, objectives, strategies and recommended actions of the Land and Resource Management Plan. This is not an all inclusive list for the next three to five years, but more a summary of projects that we have already begun the NEPA process to develop site specific alternatives from which to select a preferred course of action and implement. For example, the following prescribed fire projects were proposed to increase forage habitat for wildlife, decrease down fuel loadings, reduce potentials of catastrophic wildfire around infrastructure, reduce stand densities, reduce noxious weed populations, enhance diversity within the landscape, and in some cases attempt to restore historical vegetative characteristics:

- Tucannon #3 burn and reseed.
- Pasture winter range burn.
- Abels Ridge winter range burn.
- Upper Tucannon burn.
- Middle Tucannon yellow-star thistle burn.
- Meadow prescribed fire vegetation burn.
- Tallow tail burn.
- Fuel breaks around Camp Wooten and Tucannon fish hatchery.

Examples of some proposed projects that will meet the desired future condition for recreation, trails, fish habitat improvement, water quality improvement, and protection of wilderness values are:

- Sheep Creek culvert replacement.
- Sheep Creek bridge construction.
- Sheep Creek dispersed parking improvement.
- Sheep Creek trailer trailhead construction.
- Panjab Creek trailhead bridge construction.
- Tucannon campground improvements and possible additions.
- Tucannon handicapped trail construction.
- Tucannon guard station reconstruction.

Examples of projects that might create structural opportunities to enhance wildlife habitat are:

- Water pond development west Tucannon.
- Grouse guzzlers lower Tucannon.

Examples of projects that might achieve the objectives and desired future conditions of healthy, vigorous conifer stands through stewardship management (thinning from below, removal of dead, dying and diseased timber, commercial thinning, uneven aged management) that are being considered include:

- Lower Tucannon EIS.

Examples of projects that might increase fish rearing, establish pools, create spawning and overwintering habitat within the riparian are:

- Challenge cost share projects in conjunction with the Tucannon Model Watershed Group.
- Challenge cost share projects with private land owners.
- Individual projects that involve instream structures (rock barbs, planting streamside vegetation, installing woody debris, placement of rock weirs or individual boulders).
- Looking are opportunities to return Hixon Creek to its original channel.

All of these proposed projects are built around the goals, objectives, strategies and management area allocation direction located in the Umatilla Land and Resource Management Plan. Other projects will

be considered as more site-specific information is developed and opportunities (funding) are made available to accomplish the selected actions.

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Appendix A: Washington State water quality standards

	Class AA (Extraordinary)	Class A (Excellent)	Class B (Good)	Class C (Fair)
Fecal Coliform	Shall not exceed 50 colonies/100 ml and no more than 10% of samples can exceed 100 colonies/100 ml.	Shall not exceed 100 colonies/100 ml and no more than 10% of samples can exceed 200 colonies/100 ml.	Shall not exceed 200 colonies/ 100 ml and no more than 10% of samples can exceed 400 colonies/100 ml	No limits
Water Temperature	Shall not exceed 16 degrees C (68F) due to human activities. For temperatures Exceeding 16C, activities raising temperatures .3 C will not be allowed.	Should not exceed 18 degrees C (64 F) due to human activities. For temperatures exceeding 18 C, activities raising temperatures .3 C will not be allowed.	Should not exceed 21 degrees C (69F) due to human activities. For temperatures exceeding 21C, activities raising temperatures .3 C will not be allowed.	Temperatures shall not exceed 22 degrees C (71F)
Dissolved Oxygen	Dissolved oxygen shall exceed 9.5 mg/L.	Dissolved oxygen shall exceed 8.5 mg/L.	Dissolved oxygen shall exceed 6.5 mg/L.	Dissolved oxygen shall exceed 4 mg/L.
Total Dissolved Gas	Total dissolved gas shall not exceed 110% saturation	Total dissolved gas shall not exceed 110% saturation	Total dissolved gas shall not exceed 110% saturation	Total dissolved gas shall not exceed 110% saturation
PH	Shall be within a range of 6.5 to 8.5 with human-caused variation of less than .5 units.	Shall be within a range of 6.5 to 8.5 with human-caused variation of less than .5 units.	Shall be within a range of 6.5 to 8.5 with human-caused variation of less than .5 units.	Shall be within a range of 6.5 to 8.5 with human-caused variation of less than .5 units.
Turbidity	Shall not exceed 5 NTU over background turbidity, if background turbidity is 50 NTU or less. If background turbidity exceeds 50 NTU, there can not be an increase greater than 10%.	Shall not exceed 5 NTU over background turbidity, if background turbidity is 50 NTU or less. If background turbidity exceeds 50 NTU, there can not be an increase greater than 10%.	Shall not exceed 5 NTU over background turbidity, if background turbidity is 50 NTU or less. If background turbidity exceeds 50 NTU, there can not be an increase greater than 10%.	Shall not exceed 5 NTU over background turbidity, if background turbidity is 50 NTU or less. If background turbidity exceeds 50 NTU, there can not be an increase greater than 10%.
Toxic, Radioactive, or Other Harmful Material	Shall be below limits, which have potential, singularly or cumulatively, to affect common water uses or sensitive biota.	Shall be below limits which have potential, singularly or cumlatively, to affect common water uses or sensitive biota.	Shall be below limits which have potential, singularly or cumlatively, to affect common water uses or sensitive biota.	Shall be below limits which have potential, singularly or cumatively, to affect common water uses or sensitive biota.
Ammonia	No numerical standards exist, but calculations are made in reference to pH and water temperature	No numerical standards exist, but calculations are made in reference to pH and water temperature	No numerical standards exist, but calculations are made in reference to pH and water temperature	No numerical standards exist, but calculations are made in reference to pH and water temperature
Flow	No numerical standards, but water quality shall meet common water uses.	No numerical standards, but water quality shall meet common water uses.	No numerical standards, but water quality shall meet common water uses.	No numerical standards, but water quality shall meet common water uses.
Sediment	No numerical standards, but water quality shall meet common water uses.	No numerical standards, but water quality shall meet common water uses.	No numerical standards, but water quality shall meet common water uses.	No numerical standards, but water quality shall meet common water uses.
Habitat	No numerical standards, but	No numerical standards, but	No numerical standards, but	No numerical standards, but

Modifications	water quality shall meet common water uses.	water quality shall meet common water uses.	water quality shall meet common water uses.	water quality shall meet common water uses.

Appendix B: WDOE's Proposed Surface Water Quality Standards

The proposed changes to the surface water quality standards will effect many aspects of water quality including: monitoring programs, permits, Total Maximum Daily Loads (TMDLs) and WDOE's list of impaired waters [303(d) List]. An overview of the proposed changes are as follows:

1. The Classification System – The current classification system of AA, A, B, C and Lake Classes assigns characteristic uses to each class with lower classes supporting fewer uses. The proposed changes in standards will be coupled with the appropriate assignment of uses to waterbodies so that they support the same uses covered under the current Class structure, or a "Use-Based System.
2. Anti-degradation – The anti-degradation section of the standards is a set of procedures to ensure that beneficial uses are properly supported. It will allow the degradation of high quality waters only where it is necessary and in the overriding public interest and allow waters of unique quality to be set aside from future degradation.
3. Bacteria Standards – Revise Indicator Bacteria for human health protection.
4. Dissolved Oxygen Criteria – Revise Dissolved Oxygen Criteria for protection of aquatic life including salmonid spawning, salmonid rearing, and warm water fish spawning and rearing.
5. Temperature Criteria – Revise Temperature Criteria for protection of aquatic life including Bull Trout & Dolly Varden; Salmon, Steelhead and Cutthroat Spawning; Salmon, Steelhead, and Cutthroat Rearing; Non-anadromous Rainbow Trout; Warm Water fish spawning and rearing.
6. Ammonia Standard - Apply new EPA acute ammonia criteria values to all freshwater and apply the new EPA chronic values to non-salmonid waters, and continue to use existing chronic criteria in salmonid waters.

Appendix C: Plant species in the Tucannon subbasin

SCIENTIFIC NAME	COMMON NAME
Abies grandis	Grand Fir
Abies lasiocarpa	Subalpine Fir
Acer negundo	Box Elder
Agropyron spicatum	Bluebunch Wheatgrass
Alnus rhombifollia	White Elder
Betula occidentalis var. occidentalis	Water Birch
Bromus japonicus	Japanese Brome
Bromus tectorum	Cheatgrass
Centaurea solstitialis	Yellow Starthistle
Carduus nutans	Musk Thistle
Carex nebraskensis	Nebraska Sedge
Centaurea spp.	Knapweed
Chondrilla juncea	Rush Skeletonweed
Cicuta douglasii	Water Hemlock
Cirsium arvense var. horridum	Canada Thistle
Clematis ligusticifolia	Western Clematis
Cornus sericea var.occidentalis	Red-osier Dogwood
Crataegus douglasi var. douglasii	Hawthrone
Elaeagnus angustifolia	Russian Olive
Elaocharis panciflora	Few-flowered Spike Rush
Euphorbia esula	Leafy Spurge
Equisetum spp.	Horsetail
Festuca idahoensis	Idaho Fescue
Heraclleum lanatum	Cow Parsnip
Juglans nigra	Black Walnut
Juncus biglumis	Two-flowered Rush
Larix occidentalis	Western Larch
Leymus cinereus	Basin Wildrye
Lycium halimifolium	Matrimony Vine
Phalaris arundinacea	Reed Canary Grass
Picea engelmannii	Engelman Spruce
Pinus contorta latifolia	Lodgepole Pine
Pinus ponderosa	Ponderosa Pine
Populus balsamifera ssp. Tricocarpa	Black Cottonwood
Prunus virginiana var. melanocarpa	Chokecherry
Pseudotsuga menziesii var. glauca	Douglas Fir

SCIENTIFIC NAME	COMMON NAME
Rhus trilobata	Skunkbush Sumac
Ribes spp.	Sticky Current
Robinia psuedo-acacia	Black Locust
Rosa nutkana var. hispida	Rose
Salix alba var. calva	Golden Willow
Salix eriocephala	Crect Willow
Sambucus cerulea	Blue Elderberry
Scripus acutus	Hardstem Bullrush
Symphoricarpos albus	Snowberry
Taeniatherum caput-medusae	Medusa-head Ryegrass
Tanacetum vulgare	Common Tansy
Thuja plicata	Western Red Cedar
Tsuga heterophilla	Hemlock
Typa latifolia	Cattail
Uritca dioica var. gracilis	Stinging Nettle

Appendix D: Threatened and endangered wildlife, fish and plant species in Washington State

ANIMALS and FISH LISTINGS (31 SPECIES)

T=Threatened
E=Endangered

Status	Species
E	Albatross, short-tailed (*Phoebastria albatrus*)
T	Bear, grizzly lower 48 States, except where listed as an experimental population (*Ursus arctoshorribilis*)
T	Butterfly, Oregon silverspot (*Speyeria zerene hippolyta*)
E	Caribou, woodland (ID, WA, B.C.) (*Rangifer tarandus caribou*)
E	Deer, Columbian white-tailed (*Odocoileus virginianus leucurus*)
T	Eagle, bald (lower 48 States) (*Haliaeetus leucocephalus*)
T	Goose, Aleutian Canada (*Branta canadensis leucopareia*)
T	Lynx, Canada (lower 48 States) (*Lynx canadensis*)
T	Murrelet, marbled (CA, OR, WA) (*Brachyramphus marmoratus marmoratus*)
T	Owl, northern spotted (*Strix occidentalis caurina*)
E	Pelican, brown (except U.S. Atlantic coast, FL, AL) (*Pelecanus occidentalis*)

T	Plover, western snowy (Pacific coastal pop.) (*Charadrius alexandrinus nivosus*)
T	Salmon, chinook (spring/summer Snake R.) (*Oncorhynchus tshawytscha*)
T	Salmon, chinook (lower Columbia R.) (*Oncorhynchus tshawytscha*)
T	Salmon, chinook (spring upper Columbia R.) (*Oncorhynchus tshawytscha*)
T	Salmon, chinook (Puget Sound) (*Oncorhynchus tshawytscha*)
T	Salmon, chinook (fall Snake R.) (*Oncorhynchus tshawytscha*)
T	Salmon, chum (Columbia R.) (*Oncorhynchus keta*)
T	Salmon, chum (summer-run Hood Canal) (*Oncorhynchus keta*)
E	Salmon, sockeye (*Oncorhynchus nerka*)
T	Salmon, sockeye (*Oncorhynchus nerka*)
T	Sea turtle, green (except where endangered) (*Chelonia mydas*)
E	Sea turtle, leatherback (*Dermochelys coriacea*)
T	Sea-lion, Steller (eastern pop.) (*Eumetopias jubatus*)
E	Steelhead (upper Columbia R. Basin) (*Oncorhynchus mykiss*)
T	Steelhead (Snake R. Basin) (*Oncorhynchus mykiss*)
T	Steelhead (upper Willamette R.) (*Oncorhynchus mykiss*)
T	Steelhead (lower Columbia R.) (*Oncorhynchus mykiss*)
T	Trout, bull (U.S.A., coterminous, lower 48 states) (*Salvelinus confluentus*)
E	Whale, humpback (*Megaptera novaeangliae*)
E	Wolf, gray (lower 48 States, except MN and where XN; Mexico) (*Canis lupus*)

Plant Listings

Status	Species
E	Sandwort, Marsh (*Arenaria paludicola*)
T	Paintbrush, golden (*Castilleja levisecta*)
T	Howellia, water (*Howellia aquatilis*)
E	Lomatium, Bradshaw's (*Lomatium bradshawii*)
T	Lupine, Kincaid's (*Lupinus sulphureus kincaidii*)
T	Checker-mallow, Nelson's (*Sidalcea nelsoniana*)
E	Checkermallow, Wenatchee Mountains (*Sidalcea oregana calva*)
T	Ladies'-tresses, Ute (*Spiranthes diluvialis*)

Appendix E: Rare plants found in Columbia County

Scientific Name	Common Name	Status*	Record**
Allium campanulatum	Sierra onion	Sensitive	
Allium dictuon	Blue mountain onion	Threatened	SC
Bolandra oregana	Bolandra	Sensitive	
Cypripedium fasciculatum	Clustered lady's-slipper	Threatened	SC
Hackelia diffusa var *diffusa*	Diffuse stickseed	Sensitive	
Impatiens aurella	Orange balsam	Review	
Lomatium serpentinum	Snake canyon desert-parsley	Sensitive	H
Lupinus cusickii	Prairie lupine	Review	SC
Mimulus washingtonensis	Washington monkey-flower	Review	
Physaria didymocarpa var *didymocarpa*	Common twinpod	Sensitive	
Ranunculus populago	Mountain buttercup	Sensitive	
Spiraea densiflora var *splendens*	Subalpine spiraea	Review	

LE = Listed Endangered, LT = Listed Threatened, PE = Proposed Endangered, PT = Proposed Threatened, C = Candidate for listing, SC = Species of Concern (an unofficial status) ** H = Known only from historic record

Known high-quality plant communities and wetland ecosystems of Columbia County, Washington

Scientific Name	Common Name
POPULUS TREMULOIDES	QUAKING ASPEN
CRATAEGUS DOUGLASII	BLACK HAWTHORN
HERACLEUM MAXIMUM	SHRUBLAND PARSNIP
ABIES GRANDIS	GRAND FIR
VACCINIUM MEMBRANACEUM	BIG HUCKLEBERRY
LARIX OCCIDENTALIS	WESTERN LARCH FOREST
PINUS MONTICOLA	WESTERN WHITE PINE
CLINTONIA UNIFLORA	QUEEN'S CUP
POPULUS BALSAMIFERA SSP. TRICHOCARPA	BLACK COTTONWOOD
CICCUTA DOUGLASII	WESTERN WATER HEMLOCK
PSEUDOROEGNERIA SPICATA	BLUEBUNCH WHEATGRASS
POA SECUNDA	SANDBERG'S BLUEGRASS

WILDLIFE SPECIES IN THE TUCANNON SUBBASIN

Accipiter cooperii	Cooper's Hawk
Accipiter gentilis	Northern Goshawk
Accipiter striatus	Sharp-shinned Hawk
Actitis macularia	Spotted Sandpiper
Aegolius acadicus	Northern Saw-whet Owl
Aeronautes saxatalis	White-throated Swift
Agelaius phoeniceus	Red-winged Blackbird
Aix sponsa	Wood Duck
Alectoris chukar	Chukar
Ambystoma macrodactylum	Long-toed Salamander
Ammodramus savannarum	Grasshopper 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 platyrhynchos	Mallard
Anas strepera	Gadwall
Antrozous pallidus	Pallid Bat
Aquila chrysaetos	Golden Eagle
Archilochus alexandri	Black-chinned Hummingbird
Ardea herodias	Great Blue Heron
Ascaphus truei	Tailed Frog
Asio flammeus	Short-eared Owl
Asio otus	Long-eared Owl
Asyndesmus lewis	Lewis's Woodpecker
Aythya americana	Redhead
Aythya marla	Greater Scaup
Bombycilla cedrorum	Cedar Waxwing
Bombycilla garrulus	Bohemian Waxwing
Bonasa umbellus	Ruffed Grouse
Branta canadensis	Canada Goose
Branta canadensis minima	Cackling Canada Goose
Branta canadensis paruipes	Lesser Canada Goose
Bubo virginianus	Great Horned Owl
Bucephala albeola	Bufflehead
Bucephala clangula	Common Goldeneye
Bucephala islandica	Barrow's Goldeneye
Bufo boreus	Western Toad
Bufo woodhousii	Woodhouse's Toad

WILDLIFE SPECIES IN THE TUCANNON SUBBASIN

Buteo jamaicensis	Red-tailed Hawk
Buteo lagopus	Rough-legged Hawk
Buteo regalis	Ferruginous Hawk
Buteo swainsoni	Swainson's Hawk
Calcarius lapponicus	Lapland Longspur
Calidris bairdii	Baird's Sandpiper
Calidris himantopus	Stilt Sandpiper
Calidris mauri	Western Sandpiper
Calidris melanotos	Pectoral Sandpiper
Calidris minutilla	Least Sandpiper
Calidris pusilla	Semipalmated Sandpiper
Callipepla californica	California Quail
Canis latrans	Coyote
Carduelis pinus	Pine Siskin
Carduelis tristis	American Goldfinch
Carpodacus cassinii	Cassin's Finch
Carpodacus mexicanus	House Finch
Castor canadensis	Beaver
Catharus fuscescens	Veery
Catharus guttatus	Hermit Thrush
Catharus ustulatus	Swainson's Thrush
Catherpes mexicanus	Canyon Wren
Certhia americana	Brown Creeper
Cervus elaphus nelsonii	Rocky Mountain Elk
Ceryle alcyon	Belted Kingfisher
Chaetura vauxi	Vaux's Swift
Charadrius vociferus	Killdeer
Charina bottae	Rubber Boa
Chondestes grammacus	Lark Sparrow
Chordeiles minor	Common Nighthawk
Chrysemys picta	Painted Turtle
Cinclus mexicanus	American Dipper
Circus cyaneus	Northern Harrier
Cistothorus palustris	Marsh Wren
Clethrionomys gapperi	Southern Red-backed Vole
Coccothraustes vespertinus	Evening Grosbeak
Colaptes auratus	Northern Flicker
Coluber constrictor	Racer
Columba livia	Rock Dove
Contopus borealis	Olive-sided Flycatcher
Contopus sordidulus	Western Wood-pewee
Corvus caurinus	Northwestern Crow
Corvus brachyrhynchos	American Crow
Corvus corax	Common Raven
Crotalus viridis	Western Rattlesnake
Cyanocitta stelleri	Steller's Jay
Cygnus columbianus	Tundra Swan
Dendragapus obscurus	Blue Grouse

WILDLIFE SPECIES IN THE TUCANNON SUBBASIN

Dendroica coronata	Yellow-rumped Warbler
Dendroica petechia	Yellow Warbler
Dendroica townsendi	Townsend's Warbler
Diadophis punctatus	Ringneck Snake
Dryocopus pileatus	Pileated Woodpecker
Dumetella carolinensis	Gray Catbird
Empidonax hammondii	Hammond's Flycatcher
Empidonax oberholseri	Dusky Flycatcher
Empidonax occidentalis	Cordilleran Flycatcher
Empidonax difficilis	Pacific-scope Flycatcher
Empidonax traillii	Willow Flycatcher
Eptesicus fuscus	Big Brown Bat
Eremophila alpestris	Horned Lark
Erethizon dorsatum	Common Porcupine
Eumeces skiltonianus	Western Skink
Euphagus cyanocephalus	Brewer's Blackbird
Falco mexicanus	Prairie Falcon
Falco sparverius	American Kestrel
Felis concolor	Mountain Lion
Fulica americana	American Coot
Gallinago gallinago	Common Snipe
Glaucidium gnoma	Northern Pygmy-owl
Glaucomys sabrinus	Northern Flying Squirrel
Haliaeetus leucocephalus	Bald Eagle
Hirundo pyrrhonota	Cliff Swallow
Hirundo rustica	Barn Swallow
Hyla regilla	Pacific Tree Frog
Hypsiglena torquata	Night Snake
Icteria Bullockii	Bulllock's Oriole
Icteria virens	Yellow-breasted Chat
Ixoreus naevius	Varied Thrush
Junco hyemalis	Dark-eyed Junco
Lanius excubitor	Northern Shrike
Larus argentatus	Herring Gull
Larus californicus	California Gull
Larus delawarensis	Ring-billed Gull
Larus hyperboreus	Glaucous Gull
Larus thayeri	Thayer's Gull
Lasionycteris noctivagans	Silver-haired Bat
Lasiurus cinereus	Hoary Bat
Lepus americanus	Snowshoe Hare
Lepus californicus	Black-tailed Jackrabbit
Lepus townsendii	White-tailed Jackrabbit
Limnodromus scolopaceus	Long-billed Dowitcher
Lophodytes cucullatus	Hooded Merganser
Loxia curvirostra	Red Crossbill
Lutra canadensis	Northern River Otter
Lynx rufus	Bobcat

WILDLIFE SPECIES IN THE TUCANNON SUBBASIN

Marmota flaviventris	Yellow-bellied Marmot
Martes americana	American Marten
Meleagris gallopavo	Wild Turkey
Melospiza lincolnii	Lincoln's Sparrow
Melospiza melodia	Song Sparrow
Mephitis mephitis	Striped Skunk
Mergus merganser	Common Merganser
Microtus longicaudus	Long-tailed Vole
Microtus montanus	Montane Vole
Microtus richardsoni	Water Vole
Molothrus ater	Brown-headed Cowbird
Muf musculus	House Mouse
Mustela erminea	Ermine
Mustela frenata	Long-tailed Weasel
Mustela vison	Mink
Myadestes townsendi	Townsend's Solitaire
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
Neotoma cinerea	Bushy-tailed Woodrat
Nucifraga columbiana	Clark's Nutcracker
Numenius americanus	Long-billed Curlew
Nycticorax nycticorax	Black-crowned Night Heron
Odocoileus hemionus	Mule Deer
Odocoileus virginianus	White-tailed Deer
Ondatra zibethicus	Common Muskrat
Onychomys leucogaster	Northern Grasshopper Mouse
Oporornis tolmiei	Macgillivray's Warbler
Oreortyx pictus	Mountain Quail
Otus flammeolus	Flammulated Owl
Otus kennicottii	Western Screech Owl
Ovis canadensis	California Bighorn Sheep
Ovis canadensis canadensis	Rocky Mountain Bighorn Sheep
Pandion haliaetus	Osprey
Parus atricapillus	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
Perdix perdix	Gray Partridge
Perisoreus canadensis	Gray Jay
Perognathus parvus	Great Basin Pocket Mouse

WILDLIFE SPECIES IN THE TUCANNON SUBBASIN

Peromyscus maniculatus	Deer Mouse
Phalacrocorax auritus	Double-crested Cormorant
Phalaenoptilus nuttallii	Common Poorwill
Phalaropus lobatus	Red-necked Phalarope
Phalaropus tricolor	Wilson'S Phalarope
Phasianus colchicus	Ring-necked Pheasant
Phenacomys intermedius	Heather Vole
Pheucticus melanocephalus	Black-headed Grosbeak
Phrynosoma douglassii	Short-horned Lizard
Pica pica	Black-billed Magpie
Picoides arcticus	Black-backed Woodpecker
Picoides pubescens	Downy Woodpecker
Picoides tridactylus	Three-toed Woodpecker
Picoides villosus	Hairy Woodpecker
Pipilo chlorurus	Green-tailed Towhee
Pipilo maculatus	Spotted Towhee
Pipistrellus hesperus	Western Pipistrelle
Piranga ludoviciana	Western Tanager
Pituophis catenifer	Gopher Snake
Plecotus townsendii	Townsend's Big Eared Bat
Podilymbus podiceps	Pied-billed Grebe
Pooecetes gramineus	Vesper Sparrow
Procyon lotor	Common Raccoon
Rallus limicola	Virginia Rail
Rana catesbeiana	Bullfrog
Rana pretiosa	Columbia Spotted Frog
Rattus norvegicus	Norway Rat
Recurvirostra americana	American Avocet
Regulus calendula	Ruby-crowned Kinglet
Regulus satrapa	Golden-crowned Kinglet
Reithrodontomys megalotis	Western Harvest Mouse
Salpinctes obsoletus	Rock Wren
Sayornis saya	Say's Phoebe
Scapanus orarius	Coast Mole
Sceloporus graciosus	Sagebrush Lizard
Sceloporus occidentalis	Western Fence Lizard
Sciurus niger	Eastern Fox Squirrel
Selasphorus rufus	Rufous Hummingbird
Sialia currucoides	Mountain Bluebird
Sialia mexicana	Western Bluebird
Sitta canadensis	Red-breasted Nuthatch
Sitta carolinensis	White-breasted Nuthatch
Sitta pygmaea	Pygmy Nuthatch
Sorex merriami	Merriam's Shrew
Sorex monticolus	Montane Shrew
Sorex palusturis	Water Shrew
Sorex preblei	Preble's Shrew
Sorex vagrans	Vagrant Shrew

WILDLIFE SPECIES IN THE TUCANNON SUBBASIN

Spea intermontana	Great Basin Spadefoot
Spermophilus columbianus	Columbian Ground Squirrel
Spermophilus lateralis	Golden-mantled Ground Squirrel
Spermophilus washingtoni	Washington Ground Squirrel
Sphyrapicus nuchalis	Red-naped Sapsucker
Sphyrapicus thyroideus	Williamson's Sapsucker
Spilogale gracilis	Western Spotted Skunk
Spizella arborea	American Tree Sparrow
Spizella passerina	Chipping Sparrow
Stelgidopteryx serripennis	Northern Rough-winged Swallow
Stellula calliope	Calliope Hummingbird
Sterna caspia	Caspian Tern
Sterna forsteri	Forster's Tern
Strix varia	Barred Owl
Sturnella neglecta	Western Meadowlark
Sturnus vulgaris	European Starling
Sylvilagus floridanus	Eastern Cottontail
Sylvilagus nuttallii	Mountain Cottontail
Tachycineta bicolor	Tree Swallow
Tachycineta thalassina	Violet-green Swallow
Tamias amoenus	Yellow-pine Chipmunk
Tamiasciurus hudsonicus	Red Squirrel
Taxidea taxus	American Badger
Thamnophis elegans	Western Terrestrial Garter Snake
Thamnophis sirtalis	Common Garter Snake
Thomomys talpoides	Northern Pocket Gopher
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
Ursus americanus	Black Bear
Vermivora celata	Orange-crowned Warbler
Vireo olivaceus	Red-eyed Vireo
Wilsonia pusilla	Wilson's Warbler
Xanthocephalus xanthocephalus	Yellow-headed Blackbird
Zapus princeps	Western Jumping Mouse
Zenaida macroura	Mourning Dove
Zonotrichia leucophrys	White-crowned Sparrow

Appendix G: The Tucannon River Model Watershed Plan

The Tucannon River Model Watershed Plan emphasizes a long-term and practical approach to aquatic habitat restoration. Applying these practices will assist the Tucannon River's natural ability to correct problems such as high width-to-depth ratio, low sinuosity, poor velocity distribution, and impaired bedload movement. Solving these problems will result in positive gains for aquatic habitat and riparian areas. The main differences between the Planned Alternative and the Optimal Alternative are the length of stream where total geomorphic restoration is recommended and the amount of recommended streambank plantings. Regardless of which alternative is applied, there will be more protection for the fish and wildlife resources in this watershed as a result of recently proposed changes in the management of state and federal lands. The changes primarily address protection of the riparian zones on all fish-bearing streams within these lands.

No-Action Alternative

This alternative attempts to outline a baseline of resource conditions that do not include measures specifically designed to maintain or improve fish habitat. Other alternatives can be compared with this alternative to estimate their relative effect.

Activities and management occurring on state and federal lands are expected to continue at their current rate as described in *the Wooten Wildlife Management Plan* and the PAC-FISH standards, respectively. As state and federal lands comprise nearly 25 percent of the watershed, this will likely contribute to improved habitat conditions in the upper reaches of the subbasin. For example, several campsites on state lands have been relocated to alleviate pressure on the riparian area. The USFS has also established a 75-foot buffer zone that includes no camping along streams within their campgrounds.

The primary source of erosion from the forestland has been identified as the road system (SCS 1991). The USFS is conducting a complete inventory of the transportation system on the Umatilla National Forest. The most critical areas will be treated by 1) obliterating the road and reclaiming the area; 2) re-shaping the road and stabilizing it with vegetation; 3) re-surfacing the road with non-eroding rock material; or 4) complete reconstruction of the road to restore the degrading base and provide surfacing to allow for both recreation and log-hauling traffic. New roads in the Umatilla National Forest will be designed and constructed according to standards appropriate to planned uses and activities, safety, economics and impacts on lands and resources using criteria in Forest Service Manual 7700-7720 (USFS 1985).

The PL-566 Watershed Project will continue to be implemented on the upland areas, but no instream structures will be developed for fish habitat. Up to 12 miles of streambank vegetation can be planted under this program. Individual efforts on private lands through various grants or special projects will continue, but some identified problems will not be treated. The level of treatment from these sources is limited by available funds and is not necessarily coordinated on a watershed basis. As a result, these programs are usually not as efficient and effective because actions are sometimes taken without any order of priority or importance and the goals of this plan will not be achieved. The stream will continue to be channelized and riparian vegetation lost due to ongoing land uses, floods, and flood control

actions. Fish habitat quality and quantity is expected to remain in its present condition or continue to decrease.

Planned Action Alternative

This alternative assumes the full implementation of the PL-566 Plan, including the 12.9 miles of stream corridor planting. Corridor width will be 30 feet where possible to get the full benefit of channel shading (Theurer *et al*. 1985). In addition to these practices, there are 514 structures recommended to create pools for fish habitat and stabilize eroding streambanks (Table 29). Off-channel rearing sites are identified for 9 sites and geomorphic restoration is recommended for approximately 5,500 feet of channel. All of the stream practices recommended for stream channel stabilization are a long-term approach to benefit fish habitat and existing land uses. Irrigation diversions will be converted to more permanent structures that protect and provide fish habitat and do not have to be reconstructed in the stream every year. Irrigation systems will be evaluated and remodeled or re-nozzled to improve efficiency.

The WDFW has relocated camping sites away from the river, and placed control fences to discourage use on the streambank at sites where relocation is not an option. The USFS has restricted camping within 75 feet of the stream and will also be rehabilitating streambanks that are degraded. These campgrounds and campsites will be rehabilitated and restored to native condition. Both agencies have initiated public information efforts protect natural resources. New campgrounds will be designed and landscaped to withstand heavy use similar to what occurs in municipal parks.

New or reconstructed roads will be designed to minimize erosion from cuts on embankments. These designs will improve the interception and storage of sediment. Centerbars that naturally form within 200 feet of bridges in bridge approaches will be removed periodically and will not be vegetated with trees or shrubs.

Road culverts will be designed and constructed to collect and convey water safely to stable outlets that do not headcut or deliver excessive sediment to the stream. Maintenance of existing roads will include methods to limit erosion and sediment transport and loss of riparian vegetation to minimize impacts to fish. In some cases, this will require the cooperation of state, county, and individual landowners to design waterways to adequately transport and store runoff.

Table 29. Pool habitat and streambank stability recommendations for the Tucannon River, Washington.

	Planned Action		Optimal Action	
Location	Practice	Units	Practice	Units
Reach 1				
	1. Rootwad Revetment		1. Rootwad Revetment	
	2. Vortex Rock Weir (Pool)		2. Vortex Rock Weir (Pool)	2
	3. Off-Channel Pond		3. Off-Channel Pond	
	4. Meander Bend Jam	3	4. Meander Bend Jam	
	5. Large Woody Debris		5. Large Woody Debris	
	6. Rock Barb	15	6. Rock Barb	1
	7. Geomorphic Channel Reconstruction		7. Geomorphic Channel Reconstruction	
Reach 2				
	1. Rootwad Revetment	37	1. Rootwad Revetment	

Location	Planned Action Practice	Units	Optimal Action Practice	Units
	2. Vortex Rock Weir (Pool)	4	2. Vortex Rock Weir (Pool)	7
	3. Off-Channel Pond		3. Off-Channel Pond	
	4. Meander Bend Jam		4. Meander Bend Jam	
	5. Large Woody Debris		5. Large Woody Debris	
	6. Rock Barb	12	6. Rock Barb	2
	7. Geomorphic Channel Reconstruction		7. Geomorphic Channel Reconstruction	
Reach 3				
	1. Rootwad Revetment	26	1. Rootwad Revetment	
	2. Vortex Rock Weir (Pool)	2	2. Vortex Rock Weir (Pool)	
	3. Off-Channel Pond		3. Off-Channel Pond	
	4. Meander Bend Jam	9	4. Meander Bend Jam	
	5. Large Woody Debris	2	5. Large Woody Debris	
	6. Rock Barb	13	6. Rock Barb	7
	7. Geomorphic Channel Reconstruction		7. Geomorphic Channel Reconstruction	
Reach 4				
	1. Rootwad Revetment	53	1. Rootwad Revetment	
	2. Vortex Rock Weir (Pool)	6	2. Vortex Rock Weir (Pool)	5
	3. Off-Channel Pond		3. Off-Channel Pond	
	4. Meander Bend Jam	20	4. Meander Bend Jam	
	5. Large Woody Debris	4	5. Large Woody Debris	
	6. Rock Barb	22	6. Rock Barb	6
	7. Geomorphic Channel Reconstruction	1200	7. Geomorphic Channel Reconstruction	900
Reach 5				
	1. Rootwad Revetment		1. Rootwad Revetment	
	2. Vortex Rock Weir (Pool)		2. Vortex Rock Weir (Pool)	
	3. Off-Channel Pond		3. Off-Channel Pond	
	4. Meander Bend Jam		4. Meander Bend Jam	1
	5. Large Woody Debris	5	5. Large Woody Debris	
	6. Rock Barb	18	6. Rock Barb	11
	7. Geomorphic Channel Reconstruction		7. Geomorphic Channel Reconstruction	
Reach 6				
	1. Rootwad Revetment	18	1. Rootwad Revetment	
	2. Vortex Rock Weir (Pool)	6	2. Vortex Rock Weir (Pool)	4
	3. Off-Channel Pond		3. Off-Channel Pond	
	4. Meander Bend Jam	10	4. Meander Bend Jam	
	5. Large Woody Debris		5. Large Woody Debris	
	6. Rock Barb	6	6. Rock Barb	3
	7. Geomorphic Channel Reconstruction	1500	7. Geomorphic Channel Reconstruction	3,400
Reach 7				
	1. Rootwad Revetment	18	1. Rootwad Revetment	
	2. Vortex Rock Weir (Pool)	5	2. Vortex Rock Weir (Pool)	
	3. Off-Channel Pond	1	3. Off-Channel Pond	
	4. Meander Bend Jam		4. Meander Bend Jam	
	5. Large Woody Debris		5. Large Woody Debris	
	6. Rock Barb	6	6. Rock Barb	
	7. Geomorphic Channel		7. Geomorphic Channel	

Location	Planned Action Practice	Units	Optimal Action Practice	Units
	Reconstruction		Reconstruction	
Reach 8				
	1. Rootwad Revetment		1. Rootwad Revetment	
	2. Vortex Rock Weir (Pool)	2	2. Vortex Rock Weir (Pool)	
	3. Off-Channel Pond	1	3. Off-Channel Pond	
	4. Meander Bend Jam		4. Meander Bend Jam	6
	5. Large Woody Debris		5. Large Woody Debris	
	6. Rock Barb	4	6. Rock Barb	
	7. Geomorphic Channel		7. Geomorphic Channel	550
	Reconstruction		Reconstruction	
Reach 9				
	1. Rootwad Revetment	30	1. Rootwad Revetment	
	2. Vortex Rock Weir (Pool)		2. Vortex Rock Weir (Pool)	
	3. Off-Channel Pond		3. Off-Channel Pond	
	4. Meander Bend Jam	11	4. Meander Bend Jam	
	5. Large Woody Debris		5. Large Woody Debris	
	6. Rock Barb	11	6. Rock Barb	
	7. Geomorphic Channel		7. Geomorphic Channel	
	Reconstruction		Reconstruction	
Reach 10				
	1. Rootwad Revetment	9	1. Rootwad Revetment	
	2. Vortex Rock Weir (Pool)	2	2. Vortex Rock Weir (Pool)	1
	3. Off-Channel Pond	1	3. Off-Channel Pond	
	4. Meander Bend Jam		4. Meander Bend Jam	
	5. Large Woody Debris	2	5. Large Woody Debris	
	6. Rock Barb	7	6. Rock Barb	
	7. Geomorphic Channel		7. Geomorphic Channel	
	Reconstruction		Reconstruction	
Reach 11				
	1. Rootwad Revetment		1. Rootwad Revetment	
	2. Vortex Rock Weir (Pool)		2. Vortex Rock Weir (Pool)	
	3. Off-Channel Pond	3	3. Off-Channel Pond	
	4. Meander Bend Jam		4. Meander Bend Jam	
	5. Large Woody Debris	21	5. Large Woody Debris	
	6. Rock Barb		6. Rock Barb	
	7. Geomorphic Channel	2,800	7. Geomorphic Channel	
	Reconstruction		Reconstruction	
Reach 12				
	1. Rootwad Revetment	52	1. Rootwad Revetment	
	2. Vortex Rock Weir (Pool)	8	2. Vortex Rock Weir (Pool)	
	3. Off-Channel Pond	3	3. Off-Channel Pond	
	4. Meander Bend Jam		4. Meander Bend Jam	
	5. Large Woody Debris	16	5. Large Woody Debris	
	6. Rock Barb	4	6. Rock Barb	
	7. Geomorphic Channel		7. Geomorphic Channel	
	Reconstruction		Reconstruction	
	Total Instream Structures	**514**	**Total Instream Structures**	**56**
	Meander Reconstruction	**5,500 ft**	**Meander Reconstruction**	**4,850 ft**

Optimal Action Alternative

This alternative also assumes the full implementation of the PL-566 Plan which concentrates on the treatment of the uplands. It also assumes all of the practices in the planned action alternative. In addition to these practices, tree planting is recommended for an additional 4.6 miles of the streambank (Table 30). The number of Class I pools will remain the same as the planned alternative. Geomorphic restoration is recommended for an additional 28,000 feet of stream channel. The result of this alternative would be to restore natural geomorphic stream function to a majority of the stream channel, which would provide the maximum benefit for fish habitat and existing land uses. All irrigation systems will be equipped with flow meters to be able to effectively monitor water use efficiency.

Table 30. Streambank planting recommendations.

Reach	Location	Distance (Miles)	Canopy Cover (%)	Dominant Plant Community	Potential Planting Sites (ft)[a]	Minimum Planting Recommended (ft)
1	Snake River Confluence to Starbuck bridge (2)	4.6	30	Alder	11,300	8,475
2	to Smith Hollow Road bridge (3)	3.25	60	Alder	7,350	5,550
3	to Pataha Confluence	3.7	56	Alder	15,750	9,750
4	to Enrich bridge (6) - also called Robertson of Brines Road bridge	5.9	32	Alder/ Cottonwood	5,100	3,825
5	to King Grade Road bridge (7)	4	35	Alder/ Cottonwood	7,475	5,600
6	to Marengo bridge (8)	3.75	66	Alder/ Cottonwood	4,650	3,500
7	to section bridge (11)	3.2	33	Alder/ Cottonwood	5,400	4,075
8	to bridge (13)	2.5	81	Cottonwood/ Alder	1,450	1,125
9	to confluence with Tumalum Creek	2.3	1	Alder	9,300	6,975
10	to confluence with Cummings Creek	2.05	13	Alder	2,100	1,575
11	to USFS boundary sections 35 & 2	3	31	Alder/ Cottonwood	6,750	5,025
12	to bridge at Tucannon Campground	4.4	15	Cottonwood/ Alder	7,950	5,950
13	Bridge at Tucannon Campground to Little Tucannon River	2	49	Alder/ Cottonwood	1,400	1,025
14	Little Tucannon River to Panjab Creek Confluence	2	17	Alder/ Cottonwood	5,900	4,425
30	Panjab, Confluence with the Tucannon to Meadow Creek	2.75	53	Grand fir/ Alder	1,300	975
					93,175	67,850

					17.6 Miles	12.9 Miles

* Estimated from Hankin and Reeves inventory [a] adjusted based on post-flood inventory

Alternative Effects

Alternatives have been developed for the three main limiting factors for fish production: high water temperature, excess sediment, and poor pool habitat for resting and rearing

The No Action, Planned Action, and Optimal Action alternatives represent three levels of treatment for each of these limiting factors. The level of response to each alternative action is listed in Table 29 and discussed below. Table 31 includes the estimated cost of each alternative. No measures for treatment of high levels of fecal coliforms have been developed because it is assumed that treating the other problems will also treat the fecal coliform problem.

Table 31. Alternative effects analysis.

Problem	Goal	No Action	Planned Action	Optimal Action
High Water Temperature	Reduce stream temperature to:			
	1) 61° F at USFS Boundary	Yes	Yes	Yes
	2) 70° F at Pataha Confluence	*Yes	Yes	Yes
	3) 70° F at Snake Confluence	No	No	Yes
Poor Pool Quality and Quantity	Increase number of large, high quality pools to geomorphic amount appropriate for stream type	No	Yes	Yes (with emphasis on geomorphic reconstruction)
Reduce Erosion and Sedimentation to Meet State Standards	A) Decrease turbidity to <5 NTU's over the background	*Yes	Yes	Yes
	B) Decrease sediment yield to:	39,000 tons	39,000 tons	39,000 tons
	1. Decrease fines in gravels to < 15%	*Yes	Yes	Yes
	2. Reduce streambank erosion to 15%	No	Yes	Yes
	3. Maintain at least 8mg/L DO in spawning gravel	*Yes	Yes	Yes

*Given full implementation of the PL-566 Plan

Limiting Factor: High Water Temperature

No Action Alternative - Since no changes are proposed in this alternative, the response will be essentially the existing condition. Temperature will continue to be a limiting factor for fish production. Average maximum daily water temperatures during the summer will be in the unsuitable range for fish downstream of the National Forest boundary (Theuer *et al.* 1985). Water temperatures may be reduced somewhat due to practices applied on National Forest and state lands. If the PL-566 plan is fully implemented, average maximum daily temperature will be suitable for fish down to the confluence of Pataha Creek. The effect of this alternative on temperature will be equivalent to the planned action alternative.

Planned Action Alternative - Following the planting of 12.9 miles of streambank with trees, the area of suitable average mean daily water temperatures during the summer months will extend down to the USGS gauge near Starbuck (Theuer *et al.* 1985). The area of suitable average daily maximum temperatures in summer will extend to the junction with Pataha Creek. This alternative is consistent with the recommended alternative in the PL-566 Plan (1991). An unknown level of improvement in water temperatures may result from increased flow in the Tucannon River. This will occur by improving the water-use efficiency of irrigation systems in the Tucannon watershed.

Optimal Action Alternative - This alternative recommends 4.2 miles of planting in addition to the 12.9 miles of planting recommended in the Planned Action Alternative. The vegetative condition in this alternative will closely approximate the climax vegetative condition. As a result, the area with suitable average mean daily water temperatures for fish will extend to the confluence with the Snake River (Theuer *et al.* 1985). Average maximum daily temperatures will be suitable for fish down to the confluence with Pataha Creek. As in the Planned Action Alternative, improving the efficiency of irrigation systems may reduce water temperatures further.

Limiting Factor: Excess Sediment

No Action Alternative - Sediment will continue to be a limiting factor for fish production unless full implementation of the PL-566 Plan is accomplished. Full implementation of the plan would reduce sediment supplied to the river by 80 percent, from 144,000 tons down to 39,000 tons, and should improve egg-to-smolt survival (SCS 1991).

All other alternatives for sediment reduction do not include additional recommendations beyond the recommendations in the PL-566 plan so the effects are equivalent to the No Action Alternative. The improvement in the irrigation diversions should provide localized benefits for sedimentation but should not significantly impact total sediment production.

Limiting Factor: Lack of Quality Pool Habitat and Stream Stability

No Action Alternative - Quality pool habitat for adult resting and juvenile rearing will continue to be lacking in most reaches. Existing pools generally lack cover and are undersized. There are long reaches that do not have large pools. The stream will still have excessive streambank erosion, braiding, and a lack of large woody debris.

Planned Action Alternative - In this alternative, 403 structures are recommended to create large pools for fish habitat. In many cases, this will also stabilize eroding streambanks. This alternative will increase the number of high quality pools to the amount that would be natural for the geomorphic stream classes present in the Tucannon River. Woody debris will be added to 115 existing pools to improve

instream cover. Some of the structures will function both for streambank stability and creation of pools for fish habitat.

Approximately 2,300 feet of stream channel will be restored to its original geomorphic condition, which will stabilize streambanks and help maintain pool habitat. This will also improve gravel sorting and conditions for spawning.

Optimal Action Alternative - In addition to the items identified in the Planned Action Alternative, an additional 29,000 feet of stream will be reconstructed to its original geomorphic condition. This will increase the long-term stability of the river system, including pool habitat, width-to-depth ratio, pool-to-riffle ratio, and streambank stability. The stream width-to-depth ratio will decrease as the stream returns to its meander wavelength and the stream becomes narrower and deeper. This alternative should improve the efficiency of the canopy cover produced by trees and improve shading, which will help reduce water temperature in summer and moderate ice in the winter.

Appendix H: U.S. Forest Service Management Strategy Definitions

Human-caused Physical Characteristics

The Land and Resource Management Plan for the Umatilla National Forest divides the Forest into 25 different land management strategies. Fifteen of these strategies apply to the Tucannon River subbasin. Table 32 lists these strategies by title. Map 2 in the Appendix displays the locations of each area. A brief description of each Management Strategy follows Table 32. For a more detailed description please refer to the Umatilla National Forest Land and Resource Management Plan Final Environmental Impact Statement.

Table 32. Management Strategy Acres in the Tucannon SubBasin

Management Strategies	Acres
A1 Nonmotorized Dispersed Recreation	4,839
A2 OHV Recreation	4
A3 Viewshed 1	959
A4 Viewshed 2	2,251
A6 Developed Recreation	330
A9 Special Interest Area	559
A10 Wenaha-Tucannon Special Management Area	3,293
B1 Wilderness	13,062
C1 Dedicated Old Growth	2,020
C2 Managed Old Growth	69
C3 Big Game Winter Range	10,581
C4 Wildlife Habitat	13,138
C5 Riparian (Fish and Wildlife)	2,273
C8 Grass-Tree Mosaic	4,951
D2 Research Natural Area	67
P Private and Other Ownership	969

E2 Timber and Big Game	18,714

Management Strategy A1, Nonmotorized Dispersed Recreation: provide nonmotorized recreation opportunities in an area characterized by a predominantly natural, or natural appearing, environment with minimum sights and sounds of human activity.
Management Strategy A2, OHV Recreation: Provide motorized recreation in a predominately natural or natural appearing environment with a moderate degree of isolation from sights and sounds of human activity.

Management Strategy A3, Viewshed 1: Manage the area seen from primary travel routes, use area, or water body where forest visitors have a major concern for the scenic qualities (sensitivity level 1) as a natural appearing landscape.

Management Strategy A4, Viewshed 2: Manage the area seen from a travel route, use area, or body of water where some forest visitors have a major concern for the scenic qualities (sensitivity level 2) as a natural appearing, to slightly altered landscape.

Management Strategy A6, Developed Recreation: Provide recreation opportunities that are dependent on the development of structural facilities for user conveniences where interaction between users and evidence of others is prevalent.

Management Strategy A9, Special Interest Areas: Manage, preserve, and interpret areas of significant cultural, historical, geological, botanical, or other special characteristics for educational, scientific, and public enjoyment purposes.

Management Strategy A10, Wenaha-Tucannon Special Management Area: Managed the Wenaha-Tucannon special management areas for multiple-use purposes as set forth in the Conference Report of the Endangered American Wilderness Act of 1978 (H.R. Report No. 95-861)(U.S. Laws, Statues, etc. 1978c). This report emphasized the traditional big game hunting use and the desire to maintain fish and wildlife populations and habitat.

Management Strategy B1, Wilderness: Manage to preserve, protect, and improve the resources and values of the wildernesses, as directed by the Wilderness Act of 1964.

Management Strategy C1, Dedicated Old Growth: Provide and protect sufficient suitable habitat for wildlife species dependent upon mature and/or overmature forest stands, and promote a diversity of vegetation conditions for such species.

Management Strategy C2, Managed Old Growth: Provide and protect sufficient suitable habitat for wildlife species dependent upon mature forest stands, and promote a diversity of vegetation conditions for such species.

Management Strategy C3, Big Game Winter Range: Manage big game winter range to provide high levels of potential habitat effectiveness and high quality forage for big game species.

Management Strategy C4, Wildlife Habitat: Manage Forest lands: provides high levels of potential habitat effectiveness for big game and other wildlife species with emphasis on size and distribution of habitat components (forage and cover areas for elk, and snags and dead and down materials for all cavity users). Unique wildlife habitats and key use areas will be retained or protected.

Management Strategy C5, Riparian (Fish and Wildlife): Maintain or enhance water quality, and produce a high level of potential habitat capability for all species of fish and wildlife within the designated riparian habitat areas while providing for a high level of habitat effectiveness for big game.
Management Strategy C8, Grass Tree Mosaic (GTM): On areas known as grass-tree mosaic (GTM), provide high levels of potential habitat effectiveness, high quality forage for big game wildlife species, visual diversity, and protect erosive soils.

Management Strategy D2, Research Natural Area: Preserve naturally occurring physical and biological units where natural conditions and processes are maintained, insofar as possible, for the purposes of: 1) comparison with those lands influenced by man, 2) provision of educational and research areas for ecological and environmental studies, and 3) preservation of gene pools for typical and rare and endangered plants and animals.

Management Strategy E2, Timber and Big Game: Manage Forest lands to emphasize production of wood fiber (timber), encourage forage production, and maintain a moderate level of big game and other wildlife habitat.

Appendix I: PACFISH Guidelines

SCIENCE AND MANAGEMENT COLLABORATION

Success Stories Number 3 June 1995

Interim Strategies for Managing Anadromous-Fish-Producing Watershed
PACFISH

Purpose

Over the past 4 years, several studies have chronicled the decline of numerous stocks of Pacific salmon, steelhead, and sea-run cutthroat trout (Anadromous salmonids). In February 1995, the Chief of the Forest Service and Director of the Bureau of Land Management (BLM) signed a Decision Notice/Decision Record to provide an interim strategy for the management of Anadromous-fish-producing watersheds on Federal lands in eastern Oregon and Washington, Idaho, and portions of California. The interim management strategy, commonly referred to as PACFISH, is designed to arrest the degradation and begin the restoration of habitat for Pacific salmon, steelhead, and sea-run cutthroat trout.

The impact of the PACFISH strategy is far-reaching. Activities to protect and restore anadromous fish habitat will be initiated in 15 National Forests in 4 Forest Service regions and 7 BLM districts. This timely and extensive conservation action was feasible only through the mobilization of the effective collaborative network involving more than 100 managers, scientist, and technical specialists representing 5 Forest Service regions and 3 experiment stations, as well as 4 BLM State offices.

Background

In 1991, the American Fisheries Society published an assessment of the status of anadromous fish stocks in California, Oregon, Idaho, and Washington. The assessment indicated that 214 native, naturally spawning stocks of salmon, steelhead, and sea-run cutthroat trout were at risk of extinction or of special concern. In the early 1990's, the National Marine Fisheries Service (NMFS) proposed five stocks of salmon in the Columbia River basin for Federal protection under the Endangered Species Act. Additional studies, surveys, and assessments identified several factors associated with the population declines, including inherently variable environmental conditions, dam construction and operation, water diversion, habitat modifications, fish hatchery operations, and fish harvest. Findings from a study by Pacific Northwest Research Station researchers were of particular interest and concern to Forest Service officials. Surveys of 116 stream systems in Washington, Oregon, and Idaho indicated that, over the past 40-50 years, in-stream habitat conditions in managed forested watersheds had declined dramatically due to cumulative effects of activities such as livestock grazing, road construction, timber harvest, and recreational use.

With mounting evidence and concern about the serious declines of many stocks of Pacific Coast anadromous salmonids, in September 1992 the Forest Service Chief appointed three teams – a Washington Office Policy Group, a Washington Office Technical Work Group, and a Technical Field Team – to assess the situation and develop an array of possible alternative actions. Each team was deliberately constituted to include both managers and researchers. Over the next 2 ½ years, these three teams spearheaded the effort that we not refer to as PACFISH and that, when fully implemented, will fundamentally change the conservation of aquatic and riparian ecosystems in the Pacific Northwest.

The basic components of the PACFISH aquatic conservation strategy are:

Riparian habitat conservation areas: Lands along streams and unstable areas where special standards and guidelines govern land use.

Key watersheds: A system of large refugia comprising watersheds that are crucial for protecting at-risk fish stocks and providing high-quality water.

Watershed analysis: Procedures for evaluating geomorphic and ecological processes to guide watershed restoration and monitoring programs and delineate riparian reserves.

Watershed restoration: Comprehensive and long-term land management activities to restore watershed health, riparian ecosystems, and other management activities.

Monitoring: Continuing, interdisciplinary assessment of how fish habitats and populations respond to watershed restoration and other management activities.

Roles and Responsibilities

Forest Service Research:

- Reviewed and synthesized over 1,500 scientific and technical articles to assess the status of fish stocks and habitats and identify conservation opportunities.
- Analyzed habitat conditions and trends in watersheds in three States to determine habitat management needs and opportunities.
- Identified declining habitat conditions as one important factor associated with declining salmonid populations.
- Developed the conceptual framework for a comprehensive conservation strategy.

National Forest System:

- Translated the technical information provided by researchers into operationally feasible management standards and guidelines.
- Conducted over 75 technical briefings to congressional delegations, conservation groups, State and Federal agencies, Native American tribal governments, and industry and commodity groups to facilitate public awareness and interagency support and cooperation.
- Coordinated management planning among Forest Service deputy areas and staffs, and between the Forest Service and BLM.

- Developed the technical and administrative documentation required for compliance with the National Environmental Policy Act and the Endangered Species Act.

Benefits to the Forest Service

- Decision makers were provided a thorough and objective analysis of all available information on the status of fish stocks and habitats, and opportunities to improve habitat conditions.
- Comprehensive, professionally objective data bases facilitated communication and cooperation with other agencies, such as the BLM and NMFS.
- Active collaboration between managers and researchers demonstrated that the Forest Service could process and consider "new information" in a timely manner and expeditiously amend forest plans.

Benefits to the Public

The President of the United States advised the American people that his conservation policies would avoid "train wrecks." Federal agencies would work together and coordinate conservation efforts rather than develop conflicting strategies and dispute their merits in the press and courts. The public would benefit through clearer understanding of public policies, more efficient and effective Government service, and more professional natural resource stewardship.

These promises have been realized through the PACFISH effort. The implementation of the PACFISH strategy was crucial in averting an injunction of all Federal land management activities that may have adversely affected listed salmon in the Snake River basin. The strong scientific foundation of PACFISH has resulted in greater efficiency in concluding Endangered Species Act consultations on Forest Service and BLM actions. And the thorough compilation, analysis, and sharing of technical information have greatly facilitated cooperation and coordination among the various Federal agencies involved in protecting and restoring Pacific salmonid stocks.

Contracts

Mr. Havr Forsgren, Wildlife, Fish and Rare Plant Staff, Washington Office, 202-205-1205 (DG:W01A).

Mr. Jim Sedell, Pacific Northwest Research Station, Corvallis, OR, 503-750-7315 (DG: S26L05A).

FINDING OF *NO SIGNIFICANT* IMPACT

For The
Interim Strategies For
Managing Anadromous Fish-Producing Watersheds
In Eastern Oregon And Washington, Idaho,
And Portions Of California

USDA Forest Service and USDI Bureau of Land Management

The Chief of the Forest Service and the Director of the Bureau of Land Management (BLM) have analyzed a proposal for Interim direction intended to arrest the degradation and begin the restoration of habitat for Pacific anadromous flab (salmon, steelhead and sea-run cutthroat trout). The proposal addresses habitat on lands administered by the Forest Service and the Bureau of Land Management in Eastern Oregon and Washington, Idaho, and portions of California. The proposal does not include areas under the Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (Northern Spotted Owl ROD).

The proposal for interim management and four alternatives, associated design features, and potential mitigation measures were described and analyzed in an Environmental Assessment (EA) dated March 18, 1994. The Proposed Finding of *No* Significant Impact (FONSI) and the EA were made available for public review and comment. Although the public comments did not warrant a modification in the FONSI, the U has been modified to disclose the nature of the comments and the Agencies' responses to than. The modified PA also affords the Agencies opportunity to provide clarification on selected points.

Other related environmental documents which were taken into account include: Regional Guides, Land and Resource Management Plans (forest plans) and associated National Environmental Policy Act (NUA) documents in the 15 national forests, the Land Use Plans *(LUPs)* and associated REPA documents In the 7 BIM districts, and the Northern Spotted Owl ROD and associated NEPA documents.

REASONS FOR FINDING OF *NO SIGNIFICANT IMPACT*

In consideration of the analysis documented in the EPA and in light of the reasons set forth below, we find that adoption of Alternative 4 as the interim strategy will not significantly impact the human environment.

1. The interim strategy would be limited in geographic application (40 CFR 1508.27(a)). The interim strategy would apply to projects within Riparian Habitat Conservation Areas (RHCAs) or that degrade RHCAs on lands administered by the Agencies in the States of Oregon, Washington, Idaho, and California (excluding those areas under the Northern Spotted Owl ROD) (EA, p. 16 and Appendix C, p. C-9).

2. The interim strategy would he limited to certain projects and activities. The interim strategy would apply only to proposed or new projects and activities* and ongoing projects and activities that pose an unacceptable risk** involving the management of timber, roads, grazing, recreation resources, riparian areas, minerals, fire and fuels, and land uses such as leases permits, rights-of-way and easements, as well as the restoration of watershed, fisheries, and wildlife habitat (EA, p. 16 and Appendix C, p. C-9). Thus, resource effects would not be significant, given the short duration of interim direction and the ability of the Agencies to relocate Activities outside the RHCAS. The interim strategy will reduce the potential environmental impacts of project decisions.

3. The interim strategy would not significantly affect public health or safety (40 CFR 150B.27(h)(2)). The interim strategy does not, on Its own, authorize any ground-disturbing activities or direct changes to the environmental status quo. Instead, It provides programmatic direction and mitigation measures to be applied to site-specific projects and activities. New project decisions will be preceded by site-specific NEPA and endangered Species Act (ESA) analysis (U. pp. 17, 36). Thus. the selected alternative does not have significant offsets on human health and safety beyond those already documented in existing plan EISs and site-specific analyses of ongoing projects and activities or might be identified in such future analyses of proposed projects and activities. Environmental effects on some resources (e.g., aquatic, riparian) will be reduced. These beneficial effects will not be significant due to the short time frame involved, the limited area affected, and the limited intensity of the beneficial effects.

*'Proposed or new projects and activities are defined as those actions
that have not been implemented, or for which contracts have not been awarded, or for which permits have not bean Issued, or (within the range of listed anadromous fish) continuing actions for which the Biological Assessments have not 'been prepared and submitted for consultation, prior to signing of this decision (EA, pp. 17 and Glossary-5).

**'Ongoing projects and activities, are defined as those actions that have bean implemented, or that have contracts awarded, or permits Issued, and (within the range of listed anadromous fish) for which Biological Assessments have been prepared and submitted for consultation, prior to the signing of this decision (EA, pp. Glossary-5). The Glossary defines "unacceptable risk" as a level of risk from an ongoing activity or group of ongoing activities that is determined through NEPA analysis or the preparation of Biological Assessments/Evaluations, or their subsequent review, to be: --"likely to adversely affect", listed anadromous fish or their designated Critical habitat. or --"likely to adversely impact, non-listed anadromous fish (EA, pp. 18 and Glossary-7).

Habitat Conservation Areas (RHCAs) or that degrade RHCAs on lands administered by the Agencies in the States of Oregon, Washington, Idaho, and California (excluding those areas under the Northern Spotted Owl ROD) (EA, p. 16 and Appendix C, p. C-9).

4. The interim strategy would not significantly affect any unique characteristics of the geographic area (40 CFR 1508.27(b)(3)), does not adversely affect anything listed or eligible for listing in the National Register of Historic Places, nor does it cause loss or destruction of significant scientific, cultural, or historic resources (40 CRF 1508.27(b)(8)). As discussed in the EA, the interim strategy does not alter the environmental protection afforded to such unique lands and resources as wild and scenic rivers (EA, p. 61), ecologically important plant communities such as are found in riparian areas (EA, pp. 45, 48-49, 52, and 55), cultural resources (EA. P. 60),

and Tribal heritage sites with archeological and religious importance (EA, pp. 61-62). The interim strategy is not applied to any park lands or prime farm land.

5. The interim strategy does not involve physical or biological affects that are likely to be highly controversial (40) CFR 1508.27(b)(4)). The scientific basis for this interim direction has been thoroughly evaluated (EA, pp. 2 to 6, 8 to 11, and Appendix A). The declines of anadromous fish stocks and degradation of their associated freshwater habitat have not been disputed. Any controversy pertains to the best approach to correct the problems or maintain the status quo while the long-term environmental analyses are completed, not the magnitude of the problem (EA, Appendix F, Response to Public Comments).

6. The interim strategy does not involve social or economic effects that are likely to be highly controversial (40 CRF 1508.27(b)(4)). Controversy in this context refers to cases where there is substantial dispute as to the size, nature, or effect of the Federal action, rather than to opposition to its adoption. Some individuals who are likely to experience adverse economic effects, however, have taken exception to the proposal (EA, p. 59 and Appendix F). Other argued for more restrictive protective measures than the proposed action, and urged the adoption of Alternative 5. On the acres affected, the short-term nature of the effects is within allowed fluctuations in the ten year planning period.

7. The interim strategy would not impose any highly uncertain, unique, or unknown environmental risks (40 CRF 1508.27(b)(5)). The best available scientific information provided the foundation for designing the interim strategy (EA, pp. 2 to 6, 8 to 11, 36-39, Appendix A, Appendix C). Measures similar to the ones described in Appendix C are used for management of anadromous fish habitat in areas subject to the Northern spotted Owl ROD.

8. The interim strategy does not establish a precedent for future actions with significant effects and does not represent a decision in principle about a future consideration (40 CRF 1508.27(b)(6)), nor is it related to other actions whith individually insignificant but cumulative significant impacts (40 CRF 1508.27(b)(7)). The interim strategy is a short-term effort to retain the environmental status quo while the Agencies develop and evaluate long-term strategies. The interim strategy will be applied during a limited period of 18 months from the date of the decision. The temporary nature of the interim strategy will limit its effects (EA, p. 12). The EA discloses the cumulative environmental effects of short –term incremental improvements in habitat conditions and trends on lands within the anadromous watersheds that are administered by the Agencies (EA, pp. 38-39).

The environmental analyses being prepared for the long-term environmental strategies will produce long term cumulative effects information. Because recovery processes within riparian areas and aquatic habitat are gradual, such short-term adjustments in management practices are unlikely to result in significant effects on future actions on these Federal lands (EA. Pp. 38-39). The interim strategy is not binding on any future decisions mad on long-term strategies (EA, p. 20).

9. The interim strategy will not adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act (40) DFR 1508.27(b)(9)). A Biological Evaluation and a Biological Assessment completed by the Agencies' scientists have adoption of the proposed measure would not produce significant impacts. Because fish listed pursuant to the ESA are involved, the Agencies have consulted with the United States Department of Interior, Fish and Wildlife Service (FWS) and the United States Department of Commerce, National Marine Fisheries Service (NMFS) in accordance with established requirements. The FWS, through a letter of concurrence, found that the proposed action would have a neutral or beneficial effect on listed species under their jurisdiction. The NMFS, through a biological opinion, has determined that the proposed action is not likely to jeopardize the continued existence of listed species under their jurisdiction or result in destruction or adverse modification of critical habitat. The EA reflects the results of these consultations, and the consultation documents are included in Appendix J to the EA. Site specific projects will be preceded by biological evaluations where listed species may be affected.

10. The interim strategy does not threaten a violation of Federal, State or local law or requirements imposed for the protection of the environment (40 CFR 1508.27(b)(10)). The Forest Service and the Bureau of Land Management have jointly issued notices announcing the development of the long-term environmental analyses (EA, Appendix I). In accordance with Section 1506.1(a) of the Council on Environmental Quality regulations implementing NEPA, upon issuance of the Notice of Intent, and until issuance of the Record of Decision, the Agencies will take no actions which have an adverse environmental impact or limit the choice of reasonable alternatives. Additionally, adoption of the preferred alternative would not significantly affect the following elements of the human environment, which are specified in statutes, regulations or executive order: Air Quality, Areas of Critical Environmental Concern, Cultural Resources, Farm Lands (rime or unique), Floodplains, Native American Religious Concerns, Threatened or Endangered Species, Hazardous or Solid Wastes, Water Quality, Wild and Scenic Rivers, and Wilderness.

DETERMINATION

On the basis of the information and analysis contained in the attached EA and all other information available as summarized above, it is our determination that adoption of the interim

direction over the next 18 months (wile environmental analyses of long-term strategies are being prepared) does not constitute a major Federal action significantly affecting the quality of the human environment. Therefore, an Environmental Impact Statement is not needed.

signature not transferable

JACK WARD THOMAS
Chief, USDA Forest Service

Date: February 24, 1995

signature not transferable

Acting

MIKE DOMBECK
Director, SDI Bureau of
Land Management

Date: February 24, 1995

Appendix J: U.S. Forest Service Prescribed Fire

Existing Conditions

Prescribed Fire in the past, the conditions of the vegetation of Tucannon River drainage were changed by the disturbance regimes of fire, insects, and disease, with the three often acting in concert. It is clear that fire was a major factor in determining historical conditions and shaping the landscape that we now see in the area. The historical nature of the area was largely determined by the frequency, intensity, and extent of the natural fire regimes. These regimes were reflective of the moisture and temperature of this area, primarily during periods of low rainfall in the summer (Norris 1990).

The natural fire regimes that existed in Tucannon watershed were a function of the growing environment (temperature and moisture patterns), ignition patterns (lightning or human), and plant species characteristics (fuel accumulations and adaptations to fire). These fire regimes were determined by environmental gradients of temperature and moisture, which are largely dependent on the elevation and aspect of a site and which determines the vegetation type, which can exist.

Three different categories of fire regimes existed naturally within the analysis area. There were low-severity fire regimes in areas where there was near continual summer drought. In these areas, fires were widespread and frequent, occurring every 5 to 25 years (Agee 1990). Moderate-severity fires occurred in areas with typically long summer dry periods. Fires were rather infrequent, occurring every 25 to 100 years. Fires showed a wide range of effects from high to low severity and often caused partial stand replacement.

The frequent fires of the grasslands and ponderosa pine sites (Ponderosa Pine and Grass Biophysical Groups) limited the amount of time for fuel to accumulate, thus the fires were of low intensity with few overstory effects. These low intensity fires produced the vertical stratification of the fuels, keeping a large gap between the overstory and the ground. This reduced the probability of crown fires, kept vistas clear, and allowed for the subsequent re-establishment of conifers, shrubs, and grasses. The fires in the grasslands prevented the trees from encroaching, hence maintaining a high forage production for the area. These fires in the low-severity regime were associated with ecosystem stability, as the system is more stable in the presence of fire than in its absence (Agee 1990).

The drier mixed conifer sites (Douglas Fir Biophysical Groups) had a similar low-intensity fire regime to the ponderosa pine sites, even though they are moister. The fire occurrence may have actually even been more frequent because of an increased litter load. The dry mixed conifer type contained ponderosa pine in addition to western larch, Douglas-fir, grand fir, and small numbers of other species. The stand thinning and underburning favored pine and larch and decreased the shade-tolerant, fire-intolerant fir understory. These stands were often single, storied with an open, park-like appearance (Agee 1990).

The cooler, moister mixed-conifer sites (Grand Fir Biophysical Groups) experienced moderate-severity regimes. In these stands, summer moisture was almost always quite limiting. Thus, adequate growing space for regeneration was reliant upon forest disturbance. Fire was the most prominent

disturbance in such stands. Fire, which killed the overstory resulted in the creation of sites for tree establishment. Some of the trees were only weakened or scarred by the fire and died slowly from decay. Thus, fire created growing space for decades after it had occurred (Agee 1990).

The small stands of subalpine fir experienced a high severity fire regime, which consists of infrequent crown fires. Fire in this forest type is an agent of ecosystem instability and causes major shifts in forest structure and function (Agee 1990).

In the past, the disturbance factors of fire, disease, and insects worked together in the Tucannon Watershed to effectively selectively thin stands or to cause total stand replacement. These factors worked differently on the different sites. Although the naturally occurring disturbance regimes worked differently on specific types of environments, the end results were the same: a reduced stand density which maintained the health and vigor of individual trees and a reduced fuel loading and modified fuel structure which decreased the probability for a large, high intensity crown fires.

Existing Condition

Land management activities have greatly altered the disturbance regimes in the Tucannon River watershed. The management practice of fire exclusion in this fire disclimax ecosystem has altered successional patterns and created stand and forest conditions that differ from those that occurred in the past. Altering the natural disturbance regimes has changed the historical stand structure, tree species compositions, tree stocking levels, and fuel loadings in the Tucannon Watershed ecosystems.

The frequent surface fires that characterized the ponderosa pine and mixed conifer forests in the analysis area have been effectively eliminated. Hence, the stands have become dominated and overstocked by shade tolerant fir species. These stagnant stands contain trees with low vigor and less fire resistance, more uniform and larger fuel loadings, and a higher occurrence of ladder fuels.

By allowing Douglas fir and true firs to become dominant and to overstock the stands in the Tucannon drainage, a fire hazard has been created that did not exist in the past, especially on the drier mixed-conifer and ponderosa pine sites. These sites did not typically have a fir understory to provide ladder fuels to the crowns. In many stands, it is these ladder fuels that pose the biggest fire hazard threat.

The amount of down woody debris on the ground is also higher than would be expected to occur in a natural fire regime. Without treatment, these ground fuel loadings will continue to accumulate at even a higher rate as stress-induced mortality within the stands increases. The higher than natural ground fuel loadings doubled with the fir understory create a crown fire condition rather than an underburning environment. The result is the potential for more severe and catastrophic fire effects on sites, which naturally experienced a low-intensity fire regime.

The stands, within the proposed Tucannon EIS analysis area, are classified by biophysical group and existing fuel models. Table 33 below displays the current and maximum desired fuel loading for the stand types that are currently posing a fuel hazard problem.

Biophysical Group	Fuel Model	Current Fuel Loading	Desired Fuel Loading
Subalpine Fir	8	20.5	13.7
Grand Fir	8	20.4	11.9
Grand Fir	10	31.8	20.9
Douglas Fir	2	13.8	5.6
Douglas Fir	8	20.4	11.1
Douglas Fir	10	28.1	13.7
Ponderosa Pine	2	9.6	3.2

Table 33. Estimated average current and desired ground fuel loadings in tons per acre. Current fuel loadings were estimated using the Photo Series for Quantifying Natural Forest Residues in Common Vegetation Types of the Pacific Northwest (Maxwell and Ward 1980). Desired loadings are based on predictions of ground fuel loadings that may have occurred under the natural fire regime.

The Fire Behavior Prediction System (FBPS) fuel models are classified into four groups-grasses, brush, timber, and slash. The differences in fire behavior among these groups are related to the fuel load and its distribution among the fuel particle size classes. The following are descriptions of the timber fuel models represented in the Table 1:

Fuel Model 2: Open timber stands with grass. Fire spread is primarily through the fine herbaceous materials. Fires are surface fires where the herbaceous material , in addition to the dead down stemwood from the timber overstory, contribute to the fire intensity.

Fuel Model 8: Closed timber stands with little surface fuel loading. Slow burning ground fires with low flame lengths are generally the case.

Fuel Model 10: Closed timber stands with moderate to heavy litter and surface fuel. Fires burn in surface and ground fuels with greater intensity. Crowning out, spotting, and torching of individual trees are more frequent in this fuel situation.

Figure 26. USFS Fire Behavior Prediction System.

Fire exclusion has also allowed stands, which may have been totally or partially replaced by fire to remain fully in tact. In the moister mixed conifer sites, fire suppression has eliminated the mosaic pattern of stand age classes and created more continuous stands, which allow stand replacement fires to attain larger size (Agee 1990).

These three conditions --- too many trees, too much fuel on the ground, and more continuous stands --- have made the Tucannon River landscape no longer crown-fire safe. There is simply too much biomass, thus there is a high probability of initiating and sustaining crown fire activity. Crown bulk density can be used as a limiting parameter for crown fire behavior. By maintaining stands at a crown bulk density of less than 0.10 kilograms per cubic meter, active or independent crown fire activity can be limited (Agee 1995). There is insufficient data to determine a legitimate average crown bulk density for the Biophysical Groups within the Tucannon Analysis Area. Although there is no direct correlation between canopy cover and crown bulk density, more canopy cover usually means more bulk density.

Often a canopy cover of greater than 35% correlates to a bulk density of over 0.10 kilograms per cubic hectare (Agee 1998). At least half of the stands in the Tucannon Analysis Area have a canopy cover greater than 40%.

Current conditions in the Tucannon watershed as a whole are ripe for disturbance by fire. However, because of the conditions created by past fire suppression, it is likely any wildfire activity would occur with a higher intensity over a larger area than would have usually occurred in the past. The potential for catastrophic changes caused by fire exists in large portions of this area could have negative impacts on the fish and wildlife habitat, riparian vegetation, timber, wildlife, soil, and water quality.

The purposes of the prescribed fire and fuels treatment projects are:

- Reduce the risk of large, high intensity wildfire and the associated negative effects of wildfire
- Begin the reintroduction of disturbance regimes which support a resilient and sustainable ecosystem
- Aid in achieving the desired future condition of a healthy, resilient, and productive forest and establishing sustainable, vigorous, and resistant stands, while retaining a natural appearing landscape.
- Help facilitate the recovery and improvement of fish and wildlife habitat

Proposed Action

The proposed action is to use landscape prescribed fire and mechanical fuels removal methods in conjunction with silviculture treatments within the watershed for forest health, fuels reduction, and wildlife habitat enhancement. The following are general descriptions of the proposed fuels treatments:

RXF : Landscape prescribed fire in fall conditions would be implemented with no pretreatment required. Some stands may be pretreated with a cool, moist underburn.

FYRXF : Stands would be mechanically thinned and some or all of the felled material, as well as some ground fuels, would be yarded to landings. If necessary, jackpots of fuel concentrations would be hand piled or grapple piled and burned prior to implementation of the landscape prescribed fire.

FYJP : Stands would be mechanically thinned and some or all of the felled material, as well as some ground fuels, would yarded to landings. If needed, slash residue would be grapple piled. Jackpots of fuel concentrations would be burned .

THRXF : Stands would be mechanically thinned and jackpots of fuel concentrations would be burned. If necessary, jackpots of fuel concentrations would be hand piled or grapple piled and burned prior to implementation of the landscape prescribed fire. Landscape prescribed fire would follow in subsequent seasons if needed.

DFRXF : Stands would be mechanically treated with directional felling of smaller trees away from selected large pine as well as slash removal and scraping of duff around large pine if

needed. The areas would then be jackpot burned to remove heavy fuel concentrations. Drier landscape prescribed fire would follow in subsequent years.

The landscape prescribed fire treatments would generally occur in the fall. Burning may occur in the late winter/early spring in the areas, which are mostly grass. The cool, moist under burns may occur in spring as well as late fall. Hand ignition methods would be used to create a mosaic of burned and unburned areas within the treated areas.

Wherever possible, existing fuel breaks in conjunction with light handed suppression methods would be used to contain the prescribed fires. Minimal hand fireline (1-2 foot mineral soil with a 12-15 foot brush out) would be constructed where needed. On flat ground, brush out may be done with a tractor and brush-out blade

To minimize fireline construction and to facilitate holding efforts, there would be some instances where it would be prudent, reasonable and/or necessary to establish fire control lines outside the pre-established fuels unit or harvest unit boundaries, but within the analysis boundary. These small adjacent areas would be of a similar vegetation and fuel type as the project areas and the same prescription parameters and project objectives would apply.

Seeding of desirable native herbaceous and shrub forage species following burning would be considered where needed and if funding is available.

Project Goals

The implementation of the proposed fuels projects would achieve the following:

- Reduce the potential size and intensity of wildfires and the potential damage that can be caused by wildfire by:
    1. Decreasing downed woody fuel loads
    2. Reducing understory ladder fuels
- Aid in achieving the desired future condition of a healthy, resilient, and productive forest and establishing sustainable, vigorous, and resistant stands while retaining a natural appearing landscape by:
    1. Beginning the return of the vegetative composition and stocking to a sustainable level. These include grass and forb species as well as tree species.
    2. Promoting a landscape in which the forested areas are dominated by large trees in which some areas have little understory and some areas have multi-layered canopies.
    3. Promoting the regeneration and growth of early seral species such as ponderosa pine and western larch.
    4. Reducing levels of fire and disease susceptible tree species
    5. Creating small naturally shaped openings
    6. Using management practices that mimic natural processes
- Help facilitate the recovery and improvement of fish and wildlife habitat by:
    1. Protecting the soil and water resource
    2. Increasing the quality and quantity of forage for big game
    3. Protecting big game hiding and thermal cover from loss due to disease and/or fire
    4. Improving vegetation health, resiliency, sustainability, and productiveness

- Increase the quality and quantity of big game forage by:

1. Increasing vegetation growth and vigor
2. Rejuvenating brush and increasing brush sprouting
3. Stimulating grass production by the removal of decadent grass
4. Increasing the amount of area producing grass by reducing canopy closure
5. Minimizing the mortality to native Idaho Fescue

- Protect the soil and water resource by:
  1. Maintaining adequate levels of large woody debris in riparian areas
  2. Promoting the overall health and vigor of the vegetation, especially in the riparian areas
  3. Minimizing the associated impacts that wildfire can have on soils and vegetation

Prescription Parameters for Prescribed Fire and Fuels Management Projects

The following section describes the objectives of the landscape prescribed fire projects. It includes all areas that have landscape prescribed fire in the treatment prescription.

Project Objectives

The prescription parameters for the landscape prescribed fire and mechanical fuel treatment projects (both those with pre-treatments and without pre-treatments) would designed to meet the following measurable management objectives. By meeting these objectives, the project goals previously stated would be attained.

Ecosystem Sustainability/Forest Health/Silviculture

- Begin the change to the long term desired stocking levels. A desired stocking level and silviculture/fuels prescription will be determined for each stand.
- Begin the change in species composition to reflect a majority of fire and pest resistant trees:

On south slopes, desirable stands will have a composition of 40 to 100% ponderosa pine with mosaic pattern and mixture of Douglas-fir, western larch and a small amount of grand fir occupying the remaining area.

On north slopes, desirable stands will include nearly equal amounts of ponderosa pine, Douglas-fir, and western larch and a small amount of grand fir (less than 10 %).

- Create naturally shaped openings (90% of which are less than 3 acres is size) throughout the forested portions of the project area.
- Create a mosaic of burned (70% or less of project area) and unburned (30% or more project area) patches

Fire Protection

- Begin reducing the fuel loadings in the 0-3 inch size class to nine tons per acre or less.
- Begin reducing the ladder fuel coverage to 50% or less of the forested area.

Watershed/Soils/Fisheries

- Maintain and promote effective ground cover (herbaceous and shrub) on 60% or more of the area.

Wildlife/Range

- Increase the area coverage of desired grasses and forbs by 20% or more
- Maintain cover values on in the forested areas to the degree specified by the wildlife biologist

Project Weather

Weather (and the closely related fuel moistures) is the most variable as well as a very influential factor in determining fire behavior and prescribed fire effects. The landscape prescribed fire projects could be implemented in fall or early spring. Fall burning is the best suited to meet the prescribed objectives for this project for the following reasons:

The native plant species are adapted to a late summer and fall fire occurrence. Burning during plant dormancy would minimize damage and/or mortality and increase the beneficial effect on many of the native grass and forb species.

1. Large trees are more resistant to fire damage in the late fall.
2. Fuel moistures allow for a more desirable reduction of the down woody fuel load and ladder fuel
3. There are limited opportunities (both in number of days in one year and the number of years in which any days occur) in the spring in which the environmental conditions meet the conditions that allow for the project objectives to be met.
4. Young animals are old enough to move out of harms way and birds are done nesting.

The weather conditions that are conducive to meeting all project objectives would be temperatures ranging from 50 to 80 degrees Fahrenheit with a relative humidity of 18 to 40 percent. Optimal burning conditions would be temperatures near 70 degrees and relative humidities near 30 percent. Under the above conditions, 20-foot windspeeds of 15 mph or less are acceptable.

The optimal burning weather conditions correlate to approximately 9% 1-hour fuel moisture, 11% 10-hr fuel moisture, 13% 100-hour fuel moisture, and 16% 1000-hour fuel moisture on the northwest facing slopes. These fuel moisture percentages would be greater in the Class I and II RHCAs where the relative humidity would be higher. The fuel moisture percentages would be slightly lower on the southeast facing slopes.

Management Measures and Practices Applicable to Project

The PACFISH interim standards would apply to all Riparian Habitat Conservation Areas (RHCA's) and to the activities in areas outside of the RHCA's that would have the potential to degrade those streams. Stream classifications I, II, III, IV, and ephemeral exist within the Tucannon Watershed Analysis Area. Ignition would not occur in these buffers. However, it is expected that fire would continue to slowly back downhill through the RHCA's in many areas. This would begin to accomplish the fuel load reductions that are desired in the RHCA's.

The following no-ignition buffers would be applied:

- Fish bearing streams - 300 foot slope distance
- Non-fish bearing perennial streams - 150 foot slope distance
- Intermittent seasonal flow with channel scours - 100 foot slope distance

PAC-FISH Best Management Practices

- **FM-1** - Design fuel treatment and fire suppression strategies, practices, and actions so as not to prevent attainment of Riparian Management Objectives, and to minimize disturbance of riparian ground cover and vegetation. Strategies should recognize the role of fire in ecosystem function and identify those instances when fire suppression or

fuel management actions could perpetuate or be damaging to long-term ecosystem function, listed anadromous fish, or designated critical habitat.

- **FM-4** - Design prescribed burn projects and prescriptions to contribute to the attainment of the Riparian Management Objectives.

Other Measures

- **State Smoke Management Plan regulations** would be followed to protect air quality and avoid smoke intrusion into sensitive areas. The Washington State Department of Natural Resources confirmation would be obtained prior to and maintained throughout burning.
- Impacts to air quality would be minimized by **burning during conditions that are conducive to rapid fuel consumption**, such as in well-cured fuels during times of low relative humidity to reduce smoldering. Burning would not take place during air inversions.
- The **prescribed fire plan and project burn plans** would be followed throughout implementation. District, Forest, and Regional contingency plans and contingency force availability would be reviewed regularly to ensure adequate resources are available to promptly control any escaped fire.
- **Fireline construction would occur only where absolutely necessary**. Any fireline, which is constructed would be to minimal standard. Fireline would be water-barred and rehabilitated at the completion of the project if needed.

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Lyons Ferry Complex – Lyons Ferry Hatchery and Tucannon Hatchery
Species or Hatchery Stock:	Tucannon River Summer Steelhead
Agency/Operator:	WDFW
Watershed and Region:	Tucannon River / Snake River / Columbia Basin, Washington State
Date Submitted:	September 29, 2000
Date Last Updated:	February 16, 2001

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Lyons Ferry Complex

1.2) Species and population (or stock) under propagation, and ESA status.

Summer Steelhead *(O. Mykiss)*, Tucannon River (Snake River ESU)

1.3) Responsible organization and individuals

Lead Contact

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Operations Staff Lead Contact

Name (and title):	Harold Harty, Complex Manager
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Fish Management Staff Lead Contact

Name (and title):	Glen Mendel, District Fish Biologist
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Fax:	(509) 382-1267
Email:	mendegwm@dfw.wa.gov

Other agencies, tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

Confederated Tribes of the Umatilla Indian Reservation – co-manager
Nez Perce Tribe – co-manager

1.4) Funding source, staffing level, and annual hatchery program operational costs.

The Lower Snake River Compensation Plan (LSRCP – US Fish and Wildlife Service) presently funds mitigation production. Actions described here constitute a re-direction of mitigation actions to align the LSRCP mitigation program with recovery requirements of the ESA. The NMFS issued an opinion that continued operation of the LSRCP hatchery program would jeopardize the recovery or continued existence of Snake River steelhead. That, coupled with the desire of WDFW to recover depressed Snake River wild steelhead stocks has prompted these actions. LSRCP funding presently covers Operational and Evaluation costs, but additional funding will likely be required to fully develop the program and evaluate its effectiveness.

1.5) Location(s) of hatchery and associated facilities.

Lyons Ferry Hatchery – Snake River in Franklin Co. Washington (RM 58)
Tucannon Hatchery – RM 36 on the Tucannon River (WRIA 35)
Temporary Adult Trap – RM 11 on the Tucannon River (WRIA 35)
Permanent Adult Trap – RM 36.5 on the Tucannon River (WRIA 35)

1.6) Type of program.

Integrated Recovery / Harvest

1.7) Purpose (Goal) of program (based on priority).

1. **Conservation:** Artificially maintain and/or increase numbers of naturally reproducing Tucannon River steelhead that successfully produce viable progeny which contribute to the conservation and recovery of the Tucannon River population and Snake River ESU.
2. **Mitigation:** Provide mitigation under the LSRCP program for losses to Tucannon River steelhead due to construction of Snake River Dams while meeting conservation and recovery criteria established for the Tucannon River population and Snake River ESU. Provide harvest opportunities established under *US v Oregon* for tribal and recreational fisheries.

1.8) Justification for the program.

The endemic population in the Tucannon River experienced a decline in abundance in the 1990s,

culminating in its being listed as threatened under the ESA as part of the Snake River ESU (August 18, 1997; 62 FR 43937). The LSRCP program has been operated since 1983 to provide mitigation for adult steelhead lost because of the construction of the four lower Snake River dams. The program has used Lyons Ferry Hatchery (LFH) stock since the late 1980s (Schuck et al 1998). The most recent Biological Opinion (April 2, 1999) by NMFS on the LSRCP-produced hatchery steelhead concluded that the continued use of hatchery steelhead stocks in the Snake River (including Lyons Ferry stock) jeopardized the continued existence and chance for recovery of wild steelhead populations within the Snake River. Recent genetic information from the Tucannon River also indicates that having LFH stock adults spawning in the Tucannon River may be contributing to the wild population's current depressed condition.

Development of a hatchery stock based on the endemic stock from the Tucannon River for mitigation production will not increase natural productivity, but can serve several purposes. 1) Hatchery production can attempt to maintain or increase the numbers of naturally-reproducing Tucannon River steelhead in under-utilized spawning and rearing habitat. The intent of efforts within this ESU is to reduce the short-term extinction risk to the existing wild population and to increase the likelihood of their recovery to a healthy status. These objectives may be accomplished through the establishment of a supplemented population using an endemic brood stock. 2) Minimize the potential for genetic introgression and depression that may occur with continued use of the existing hatchery stock. Allozyme and DNA data collected by WDFW indicates little introgression by the hatchery stock into the endemic population has occurred, despite large releases of hatchery fish for three generations. Given that information, interbreeding among hatchery and natural fish may be reducing productivity and fitness within the natural population. 3) Speed the recovery of Tucannon River steelhead once natural productivity has reached or exceeded replacement as a result of habitat improvements within the basin. 4) Provide mitigation production under LSRCP while complying with NMFS's Reasonable and Prudent actions as listed in their Biological Opinion. Washington Department of Fish and Wildlife desires to maintain healthy, abundant populations of steelhead within the Snake River, but also wants to provide abundant fishery opportunities as provided for under the LSRCP mitigation program. 5) Potentially reduce straying within the Snake basin. Hatchery fish from the LFH program have been shown to stray into other Columbia basin steelhead rivers. While this program will consist of hatchery fish, the chance for straying may be reduced because the new hatchery stock will be developed from the endemic population. Mitigation goals will be fully integrated as conservation and recovery goals are achieved.

1.9) List of program "Performance Standards".

(From NMFS *Artificial Production Review*, Revised Draft Performance *Standards and Indicators*, August 27, 2000)

(1) Conduct artificial production and harvest activities in a manner consistent with policy and legal mandates.
(2) Use artificial production to increase harvest rates while minimizing the impact to non-target species.

(3) Use artificial production to conserve wild/naturally-spawning populations.
(4) Use artificial production in a manner that maintains or increases bio-diversity.
(5) Artificial production is implemented in a manner that minimizes adverse genetic effects on underlying natural populations.
(6) Operate artificial production facilities in a manner that minimizes adverse impacts associated with program operation.

1.10) List of program "Performance Indicators", designated by "benefits" and "risks."

1.10.1) "Performance Indicators" addressing benefits.

(From NMFS *Artificial Production Review*, Revised Draft Performance *Standards and Indicators*, August 27, 2000: numbers specific to that document)

1.1 Harvest objectives
- *Annual number of fish caught in all fisheries.*

2.3 Release groups sufficiently marked to assess impacts.
- *Marking rate by type in each group*
- *Number of marks by type documented by fishery.*

3.1 Number of natural adults is greater than expected without artificial propagation.
- *Number of spawners by origin documented at traps.*

3.2 Spawner-to-spawner survival is greater than expected without artificial propagation.
- *Spawners on spawning ground and at hatchery by age.*
- *Estimated spawners, which produced escapement.*

3.3 Spawner-spawner survival sufficient to average at or above replacement.
- *Spawners on spawning ground and at hatchery by age.*

3.4 Juvenile releases are sufficiently marked for evaluation.
- *Mark rates by type*
- *Mark recoveries for juveniles and adult returns.*

3.5 Artificial production contributes to enhancement of nutrients.
- *Number of carcasses distributed.*

3.6 Juveniles released at same size and time as natural population.
- *Size and time of release compared to natural population.*

Using the above information, determine whether the population has declined, remained stable, or has been recovered to sustainable levels. The ability to estimate hatchery and natural proportions will be determined by implementation plans, budgets, and assessment priorities.

1.10.2) "Performance Indicators" addressing risks.

(From NMFS *Artificial Production Review*, Revised Draft Performance *Standards and Indicators*, August 27, 2000: numbers specific to that document)

2.1 Incidental impacts to non-target species.
- *Catch and release of non-target species documented*

2.1 Proportion of non-target species is decreasing.
- *number of non-target species is documented*

4.1 Fish collected for broodstock are taken throughout the return in proportions to the run distribution.
- *Frequency of broodstock collection is documented.*

4.2 Life history characteristics of artificially produced population do not diverge from natural population.
- *Life history characteristics of natural and hatchery population are measured (age composition of smolts, size at smolting, smolt to adult return, adult sex ratio, age of adult return, length/weight at age of return, temporal and spatial spawning distribution of returning adults).*

4.3 Broodstock collection does not reduce potential juvenile production in natural areas.
- *Broodstock collection numbers are documented.*

4.4 Annual release numbers do not exceed local, basin and migratory corridor capacities.
- *Annual release numbers, locations and times documented.*
- *Natural production documented.*

5.1 Patterns of genetic variation with natural populations do not change appreciably.
- *Genetic composition of natural and artificial propagated adults is monitored.*

5.2 Broodstock collection does not reduce natural populations below minimum effective population size.
- *Spawning escapement and composition documented.*
- *Timing of brood collection is documented.*

5.3 Release groups are sufficiently marked to assess escapement into natural spawning areas.
- *Artificially produced returning adults are documented for spawning escapement.*

5.4 Artificially produced adults do not exceed appropriate proportion within the naturally spawning population.
- *Observed and estimated numbers of natural and hatchery adults passing traps are documented.*

5.5 Juveniles are released to maximize homing ability.
- *Time, type and locations of hatchery releases are documented.*

5.6 Fully smolted juveniles are released from hatchery program.
- *Level of smoltification at release is documented.*
- *Size at release of fry plants is documented.*

6.1 Artificial production facilities are operated in compliance with all applicable operational and fish health standards and protocols.
- *Compliance with standards and protocols is documented in annual reports.*

6.2 Facilities are operated in compliance with NMFS screening criteria.
- *Reports document compliance with standards.*

6.3 Effluent from facilities will not detrimentally affect natural populations.
- *Discharge water complies with applicable water quality standards.*

6.4 Water withdrawls will not significantly impede migration or affect spawning behavior of natural populations.
- *Water withdrawls are documented.*

6.5 Releases do not result in introduction of pathogens into natural production areas.
- *Fish health certified prior to release.*

6.6 Broodstock collection does not significantly impede passage or alter spatial / temporal distribution of natural population.
- *Temporal / spatial distribution of population around traps is documented.*

6.7 Weirs/ traps do not result in significant stress/injury/mortality to natural population.
- *Mortality rates in traps are documented.*

1.11) Expected size of program.

1.11.1) Proposed annual broodstock collection levels (maximum number of adult fish).
Eighty-eight fish annually (44 females, 44 males).

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.

The program intends to release smolts into the Tucannon River. The potential exists at a hatchery to have higher than expected egg-to-smolt survival All fish which were removed from the river for broodstock must have the chance to contribute to the population (because endemic, listed adults will be used for broodstock). Therefore, juvenile steelhead excess to the smolt goal will be identified in October of the year prior to release and will be released into the Tucannon River as fingerling (see table below). Although the survival of juveniles released as fingerling will be far less than for juveniles released as smolts, Washington's Wild Salmonid Policy restricts the release of out-of-basin stocks. Since these fish could not be released elsewhere, WDFW believes the best option is for a fingerling release.

Life Stage	Release Location	Annual Release Level
Eyed Eggs		0
Unfed Fry		0

Life Stage	Release Location	Annual Release Level
Fry		
Fingerling	Tucannon R. above RM 41	25,000
Yearling	Tucannon R. above RM 41	150,000

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

This is a new program and has no pre-existing performance data for endemic Tucannon steelhead stock. We expect the performance of this new stock to equal or exceed the performance of LFH stock, which has been used in the Tucannon for many years. Following are smolt to adult return rates (SAR) for several recent release years of LFH stock steelhead into the Tucannon River.

Release Year	Survival to LSRCP area (%)	Survival to Columbia R. Basin (%)
1987	0.241	0.394
1988	0.379	0.549
1989	0.296	0.449
1990	0.255	0.714
1991	0.980	1.235
1992	0.181	0.208
1993	0.720	1.041
1994	0.292	0.520
1995	0.724	0.916

Estimated natural escapement into the Tucannon River is believed to be below replacement in most run years, thus contributing to the decline of the population within the basin and within the ESU. Recent and historical performance of hatchery-reared steelhead in the Tucannon has shown the program capable of returning adults above the replacement line in all but one year (see above). Washington Department of Fish and Wildlife expects survival of the endemic brood hatchery reared fish to equal or exceed the SARs for its long-term hatchery stock. Early rearing survivals (egg to pre-smolt) within the hatchery will far exceed those observed in the Tucannon wild population. Fish returning from hatchery production of endemic brood will be allowed to spawn in the wild and contribute to filling available habitat, and increasing the number of naturally-produced fish spawning in the wild one generation later. Spawner-to-spawner survival is expected to increase because of the broodstock program, but

spawner-to-spawner survival of subsequent natural populations will depend upon improvements in basin productivity and migratory corridor survival.

1.13) Date program started (years in operation), or is expected to start.
BY 2000

1.14) Expected duration of program.

Conservation and recovery actions will continue until productivity within the basin has improved to a level where populations are at or above replacement. A portion of production may be curtailed when supplementation is no longer necessary to achieve or maintain recovery. Production is expected to continue indefinitely to provide mitigation under the LSRCP program.

1.15) Watersheds targeted by program.

Tucannon River (WRIA 35)

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

The LSRCP mitigation program has been active within the Tucannon basin since 1983. A non-endemic hatchery origin steelhead broodstock has been used to achieve the mitigation goal. However, allozyme and DNA data collected in the late 1980s and during the 1990s indicates that distinct Tucannon River steelhead persist in the basin. The NMFS Biological Opinion concluded that the LSRCP hatchery steelhead program jeopardized the listed population. The only other action WDFW considered to developing a new broodstock was the elimination of hatchery steelhead from the basin. As this option would prevent WDFW from achieving mitigation under LSRCP. Developing an endemic broodstock for use in the program was selected as the preferred action.

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.

2.1) List all ESA permits or authorizations in hand for the hatchery program.

Permits Research #1126, and Supplementation #1129 (Tucannon River Spring Chinook), USFWS Consultation with NMFS for LSRCP actions and NMFS Biological Opinion for Snake River Hatchery Operations.

2.2) Provide descriptions, status, and projected take actions and levels for ESA-listed natural populations in the target area.

2.2.1) Description of ESA-listed salmonid population(s) affected by the program.

Washington Department of Fish and Wildlife has estimated natural steelhead escapement into the Tucannon River since 1987. The largest escapement was seen in 1988 when an estimated 525 fish spawned (WDFW 1999). Numbers have decreased steadily since 1990 and the spawning population was estimated at only 71 individuals in 1996 and 85 in 1999. Trapping data from the Tucannon Hatchery adult trap show the population to be made up of 3 and 4 year old individuals (primarily 2 year old freshwater age and one or two year ocean age). Rarely have 2 and 5-year-old individuals been identified in the population. Tucannon steelhead are typical of "A" run summer steelhead with more fish returning as 2 fresh + 1 salt age (55-70%) than as 2 salt (30-45%). One-saltwater age fish average 59 cm in length while two-salt age fish average 67 cm with individuals as large as 80 cm (Martin et al 2000). Sex ratio varies between years and can be heavily skewed to females (70%) but is generally believed to average between 50-60% females for most years.

Fish enter the river as early as July and as late as the following April. Spawning in the Tucannon has been observed from RM 3 upstream to RM 52, and in Tumalum, Cummings, Little Tucannon, and Panjab creeks. Spawning is believed to begin as early as late February and continue through May. Hatchery and natural fish enter and spawn concurrently throughout the basin. Anecdotal observations of hatchery fish spawning as early as late January have been reported.

Juvenile salmonids rear successfully in the Tucannon from RM 8-60 inclusive. Rearing success is dependent upon habitat and water quality, which is poor below RM 12 and only moderate between RM 12-20. Above RM 20 rearing conditions are generally good for steelhead. Based on smolt trapping data since 1997, juveniles will typically spend from one to three years in the Tucannon River before migrating as smolts. Age of smoltification is likely determined by both genetic and environmental factors (temperature). The river is productive and yearling smolts have been identified emigrating from the lower reaches where spring/summer water temperatures allow for accelerated growth.

Yearling and age two and three smolts leave the river primarily during early April and May. Smolt size is highly variable (145 – 265 mm) but averages 185 – 195 mm. Hatchery smolts have averaged 195 – 215 mm at release for the duration of the program and were released from Curl Lake Acclimation Pond (RM 41) between 1986 and 1997. Since 1998, hatchery steelhead have been released at or below RM 24.7.

Identify the ESA-listed population(s) that will be <u>directly</u> affected by the program.

Tucannon River natural origin steelhead are part of the listed Snake River ESU and will be used to establish the new broodstock for conservation / mitigation.

- Identify the ESA-listed population(s) that may be <u>incidentally</u> affected by the program.

Tucannon River spring and fall chinook and Columbia River basin bull trout may be incidentally affected. Juvenile steelhead may compete for food and space with naturally rearing salmonids as some

degree of extended rearing by steelhead is expected for fish released from the hatchery program. Also, fingerling may provide food for mature char in the system.

2.2.2) Status of ESA-listed salmonid population(s) affected by the program.

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds.

Tucannon summer steelhead were classified as depressed because of chronically low escapement by WDFW (SASSI 1992). The population is likely at a "critical" population threshold because it is chronically depressed. The population is believed to be below replacement in most years, and stochastic events pose significant genetic risk to the population because of low absolute population numbers. Washington established a interim escapement goal in the 1992 SASSI document of 1,200 spawners. Present escapement is far below that goal (see table below).

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

The data are not currently available, but WDFW monitoring and evaluation actions have been undertaken to gather parent-progeny data. WDFW has juvenile production estimates for most years between 1986 – 2000 that can be used to estimate survivals for early life stages. WDFW has smolt production estimates since 1996.

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

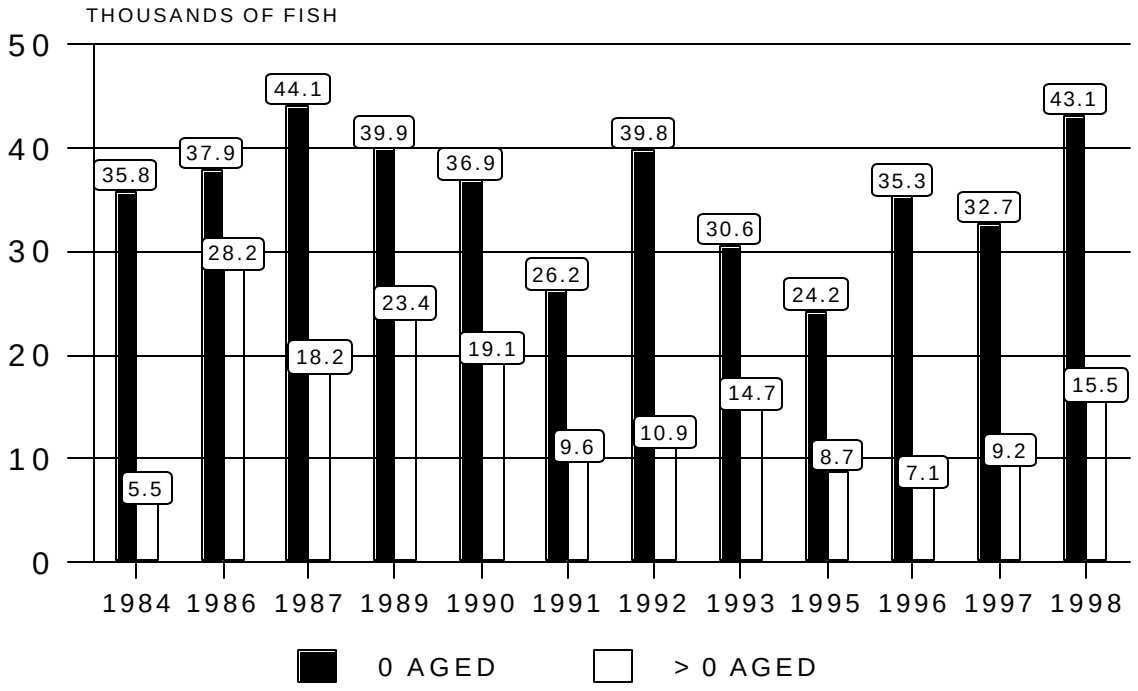
Estimated natural and hatchery adult steelhead escapement into the Tucannon River.

Year	Natural	Hatchery
1988	525	787
1989	319	388
1990	416	343
1991	210	256
1992	166	513
1993	94	475
1994	151	96
1995	147	230
1996	71	322
1997	no data *	no data *
1998	no data *	no data*

1999	85	340

* Flood conditions precluded spawning survey estimates of redds, which are the basis for escapement estimates.

Estimated juvenile steelhead abundance (# x 1,000) in the Tucannon River between RM 34.6 and RM 46.2 for recent years are shown below. Washington Department of Fish and Wildlife has estimated that the river reach for which the estimates are provided could produce 35,625 parr (> 0-age) at full seeding (unpublished WDFW data).



- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

See above

2.2.3) <u>Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take</u>.

<u>Broodstock Trapping:</u> Listed summer steelhead adults will be trapped and collected for broodstock from October through April, which constitutes a direct take. Other listed summer steelhead adults will be trapped, handled, and passed upstream during trap

operation, which may lead to injury to listed fish. The lower temporary trap is located on private property. Human disturbance or poaching of summer steelhead held in the trap was not experienced during operation of the trap in 1999-2000. The upper trap (Tucannon Hatchery) is permanent, with security measures to keep the general public away from the listed fish. Takes associated with the upper trap have been minimal since 1997.

Spring and fall chinook salmon and bull trout are indigenous to Tucannon River, and takes of all species are anticipated through the broodstock collection program. Any chinook salmon or bull trout encountered at the lower temporary trap will be passed by hand upstream or downstream daily, with minimal delay. Any spring chinook or bull trout encountered at the Tucannon Hatchery adult trap will be handled, collected (spring chinook only), sampled (length, sex, scale sample and DNA sample), and passed upstream with minimal delay. Trapping and collection of ESA listed Tucannon River spring chinook is currently permitted by Section 10 Permit #1129 authorized by NMFS. Trapping and sampling of bull trout has been authorized by USFWS in accordance with a Section 6 Cooperative Agreement for the Endangered and Threatened Fish and Wildlife Program – Washington.

Spawning, Rearing and Releases: Spawning, incubation, rearing and release of summer steelhead for 14 months from March through the following April has a high potential for lethal take of listed summer steelhead. Mortality can occur in association with fish culture activities and conditions which affect fish health and development, from handling procedures, fertilization procedures, water temperature, water quality, water flow, feeding success, transport. The release of endemic origin hatchery-reared Tucannon River summer steelhead may incidentally affect (take) other listed salmonids in the Snake and Columbia basins.

Monitoring and Evaluation: Contact with summer steelhead during spawner escapement surveys (March through May), smolt trapping operations (October through June), summer population monitoring (snorkeling / electrofishing), and PIT tagging programs have a potential to take listed summer steelhead. Each of these activities is described in more detail below.

Spawning Ground Surveys: Takes (see Take Table 2) associated with spawning ground surveys will occur in the form of "observe/harass" and from occasional carcass recovery of kelts. Spawning surveys for listed steelhead are conducted from February through May, and conducted once a week, with the intent to estimate total spawning escapement into the Tucannon River. Index sections, about 2-3 miles in length, are surveyed multiple times throughout the season to document redds and how quickly redds fade from sight of the surveyors. During each survey, surveyors walk out of the water when possible. Experienced surveyors look for redds, record and mark their location, and look for live and dead fish, with little disturbance. At the end of the

season, more extensive areas of the river are walked. The "final survey" and redd visibility rate are then used to estimate spawning escapement. Properly conducted surveys are not expected to result in any direct mortality to spawning steelhead .

Snorkeling: Takes in the form of "observe/harass" occur during snorkel surveys (see Appendix Table 2). Snorkel surveys occur July-September, and are conducted to monitor distribution and abundance of juvenile salmonids (chinook salmon and steelhead) in the Tucannon River. Surveys are conducted with two people, both starting at the lower end of an index site. Each snorkeler moves upstream counting about ½ of the river. The total number of fish is then recorded and the site length and width are measured for total surface area. Total time to complete an index site varies, but is generally less than 15 minutes. Washington Department of Fish and Wildlife has no estimate of the degree of harm, injury, or mortality to listed fish associated with snorkeling activities, but it is believed to be very low. Based on observations during snorkeling, this fish observed move slightly when the snorkelers pass, but quickly re-establish themselves near their original location.

Electrofishing: Takes of listed natural origin steelhead in the Tucannon River will occur during electrofishing surveys (see Appendix Table 2). Electrofishing surveys occur during July through September, and are conducted to monitor distribution and abundance of steelhead (similar to snorkeling). WDFW determined through previous studies that Age 0 steelhead juveniles cannot accurately be snorkeled in some areas of the river, hence electrofishing surveys are necessary to estimate the production of Age 0 natural steelhead. Estimating the abundance and density of age-0 steelhead will be critical in the overall evaluation of success from the proposed hatchery program.

A modified Smith-Root Type 11A backback electroshocker with upgraded, state of the art electronic components is used. Use of this programmable output waveform electroshocker has decreased the incidence of injury to small fish within the basin. Electrofishing guidelines from NMFS and WDFW will be followed when conducting all surveys. Washington Department of Fish and Wildlife personnel will also record all pertinent environmental information during surveys (conductivity and temperature for each site), as specified in Section 10 Permit #1126.

PIT Tagging: Takes of listed natural and hatchery origin steelhead will occur during PIT tag studies (see Appendix Table 2). Tagging will occur at the hatchery prior to smolt release, and at the Tucannon River smolt trap (described in the next section). Tagging of listed hatchery-reared fish will provide information on downstream migration performance (relative survival, migration speed, and timing) from various release points in the Tucannon River. PIT tagging procedures follow established protocols used throughout the Snake River Basin by other agencies. Mortality of the fish PIT tagged is expected to be less than 1%.

Smolt Trapping: Takes of outmigrating listed juvenile steelhead (natural and hatchery origin) will occur at WDFW's smolt trap located on the lower Tucannon River (see Appendix Table 2). The trap is operated October-June to capture natural and hatchery chinook salmon and steelhead to enable WDFW staff to estimate smolt production from the basin. Fish generally are captured, measured, weighed and released. Small groups of fish receive a partial caudal fin clip for identification and are transported back upstream one mile and released to calculate trap efficiency. Other groups of fish (~100/group) may be PIT tagged from the smolt trap to determine migration speed and relative survival. During peak outmigration fish may be held in live boxes for two to three hours before release (mark/recapture trial, or PIT tagged). At other times of year the trap may be checked only once a day. Delayed migration will result for fish captured in the trap, and delayed mortality as a result of injury or increased susceptibility to predation may also result. All trap operations pertaining to spring and fall chinook are currently covered under Section 10 permit # 1126.

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

Operation of the lower weir/trap during fall and early spring has a low potential to take listed fall chinook salmon, bull trout and spring chinook salmon. Trap operation occurs above most fall chinook spawning but may prevent or delay upstream migration of a very small number of salmon that approach the weir. Bull trout may encounter the weir post-spawning as adfluvial spawners from high in the basin move downstream into the Snake River. Fish may be delayed or descaled as they pass over the weir downstream. Bull trout could also impinge upon the weir while attempting to pass downstream if individuals are weakened from spawning. Spring chinook may experience a slight migrational delay, or capture and handling associated with the lower weir. The chance is very low of spring chinook encountering the weir however, as it will be removed before most spring chinook enter the river.

- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.

Washington Department of Fish and Wildlife personnel operated the lower trap (RM 11) during fall 1999 and spring 2000. Thirty-two natural steelhead were collected for broodstock with no observed trap related mortality. An additional 14 adults were hook & line captured during December 1999 and January 2000. Of the 24 males and 22 females transported to LFH for spawning, one male died from injuries sustained from hooking. Pre-spawning mortality claimed seven females and two males, most mortality occurring after commencement of spawning and likely a result of handling stress, and fungus resulting from handling. Fish were live spawned and retained at LFH for rejuvenation and possible re-use. However, rejuvenation efforts failed and all fish died. No further attempts at rejuvenation will be made until current research in the Columbia basin on kelt rejuvenation has been completed.

WDFW has operated a trap at the Tucannon Hatchery intake (RM 36.5) for spring chinook salmon since 1986 (NMFS Section 10 Permit #1129). Steelhead are regularly trapped in the facility which was redesigned and updated in 1997. From 9-56 natural steelhead are trapped annually at this location with no mortality expected that is directly related to the trap facility. Handling may induce delayed mortality but the level of that mortality has not been documented. In spring 2000, 16 natural steelhead were passed above the trap with no direct mortalities documented. During high river flows, steelhead are capable of passing the diversion dam which directs fish through the ladder and trap.

- **Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).**

  See Appendix Table 1.

- **Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.**

  The temporary trap located in the lower river is not 100% efficient at trapping steelhead. The design allows fish to pass over the structure during high flows. To further allow for unrestricted passage of steelhead, a slide gate in the trap box can be opened to allow free passage through the trap. In cases where WDFW personnel are unable to check the trap daily, it is opened to allow unrestricted passage. This ensures that fish are not injured or unnecessarily delayed. Where projected take may be exceeded, the trap is easily removed from the river channel. Operation of the Tucannon Hatchery intake trap functions integrally with a ladder designed to pass fish around the diversion dam. The trap can be opened; allowing fish unrestricted passage through the ladder.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

Lyons Ferry Complex is part of the LSRCP Program. The program's steelhead actions were considered jeopardy under the NMFS Biological Opinion, and actions proposed under this HGMP are consistent with NMFS recommendations to alleviate jeopardy (Reasonable and Prudent Actions). Implementation of this HGMP will likely result in reduced steelhead releases within the Tucannon basin.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates. *Indicate whether this HGMP is consistent with these plans and commitments, and explain any discrepancies.*

- *U.S. v. Oregon* Management Plan for the Columbia River (currently under negotiation).
- Lower Snake River Compensation Plan goals as authorized by Congress direct actions to mitigate for losses that resulted from construction of the four Lower Snake River hydropower projects.
- No other comprehensive management agreements are in effect. State and Departmental management guidelines to conserve and protect fish and wildlife populations within Washington (eg: WDFW Wild Salmonid Policy) direct WDFW.
- Fisheries Management and Evaluation Plan (FMEP). A plan is currently being developed by WDFW for Snake River Basin fisheries management. Fishery management objectives within the FMEP and HGMP are consistent.

3.3) Relationship to harvest objectives.

As an integrated conservation/mitigation program, development and use of local Tucannon River broodstock is intended to fulfill both conservation and mitigation harvest goals. The LSRCP, as a mitigation program, defined replacement of adults "in place" and "in kind" for appropriate state management purposes. Maintenance of abundant naturally spawning populations and harvest have been identified as valuable management goals by Washington (WDFW Wild Salmonid Policy, 1999).

3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

During the period 1986–1998, recreational harvest from the Tucannon ranged between 180-842 fish annually during a September through March fishery (WDFW 1987-1999). This represents a 25% -70% harvest rate on fish estimated to have returned to the Columbia River basin (Tucannon origin fish have also contributed to fisheries in the Columbia and Snake Rivers). These fisheries are consistent with LSRCP goals and with *U.S. v. Oregon* management plans and principles for Tribal and recreational fisheries. All sport fisheries within the region are selective for hatchery-reared fish and require release of natural origin fish. Recreational fishing regulations within the Tucannon River have been altered in recent years to reduce the incidental catch of wild fish by closing spawning areas of the river. These actions work in concert with focused fishing effort on hatchery origin fish to maximize wild escapement and minimize escapement of hatchery fish of an unacceptable stock. Selective marking of endemic brood releases will regulate their take in fisheries.

There is no harvest history on endemic Tucannon River steelhead. The existing LFH stock used within the Tucannon River has provided harvestable steelhead annually since 1985. No

harvest is expected to occur on adults returning from local broodstock smolt releases until full production is reached and return goals have been met. Limited hooking mortality is expected to occur as a result of recreational fisheries on adults returning from local stock smolt releases. Eventually all LFH origin steelhead releases may be discontinued and replaced with local brood smolt releases. At full production, WDFW desires that all or most of the smolts will be marked to allow harvest. This action will require agreement by NMFS to allow harvest of returning "hatchery-reared" endemic origin steelhead.

3.4) Relationship to habitat protection and recovery strategies.

The Tucannon Model Watershed Management Plan (CCD 1996) reviewed the ecological health of the Tucannon Watershed in relation to salmonid population status and recovery. Limiting factors such as water temperature, channel stability, sediment, and instream habitat were addressed. Fish & Wildlife and landmanagers, in association with private landowners and the Columbia Conservation District, described approaches to habitat improvement, both instream and upland, that are required as part of salmonid recovery in the Columbia basin. The plan has been used as a template to guide actions taken by multiple agencies to request funds for habitat improvement. Short and long term goals included bank stabilization, constructing instream fish habitat, riparian revegetation, meander reconstruction, construction of sediment basins, and altered farming practices to decrease sediment delivery to the river. This suite of actions will have increasing benefits (eg: maturing trees planted in riparian areas) over time. Managers were committed to improving habitat as fish and wildlife programs strive to increase escapement of salmon and steelhead to spawning/rearing areas.

3.5) Ecological interactions.

Natural predators such as bull trout and northern pikeminnow live sympatrically with Tucannon River natural steelhead. These species may incidentally prey upon released hatchery reared smolts. Additionally, kingfishers, mergansers and other predators may prey on hatchery-reared juveniles.

The release and subsequent return as adults, of local brood steelhead could affect existing ESA listed populations of bull trout, summer steelhead, and spring chinook salmon. However, temporal and spatial overlap that could give rise to competitive or aggressive interactions for food and space will be minimized by the release of smolts. Some residualization of small juvenile fish leading to their outmigration as a 2-year old smolt may occur. Returning adults are expected to spawn concurrently with natural steelhead throughout their entire range in the Tucannon, increasing the abundance of juvenile steelhead throughout the basin and filling available habitat. Complete marking of hatchery-reared endemic brood juvenile will allow returning adults to be enumerated and their contribution to the escapement (in absolute numbers and as a proportion of the run) documented. Some studies suggest that domestication of hatchery-reared salmonids may decrease their reproductive fitness. This loss of fitness could be transmitted to the offspring of these spawning adults. Life history characteristics of the hatchery-reared fish will be documented to compare their performance with the natural

population. Size at migration, migration timing and performance, adult return timing and spawn timing will be documented and reported as part of the LSRCP Monitoring and Evaluation project.

The development of a local broodstock from natural fish will provide the greatest opportunity for successful rebuilding of the depressed Tucannon steelhead population. For the first several years of production, returning adults from the program will not be subject to harvest and will be allowed to escape in the basin to supplement naturally-produced steelhead. Supplementation is an experimental procedure to stabilize or increase depressed populations while actions are taken to correct basin specific and out-of-basin productivity problems. Tucannon natural steelhead have been affected by numerous long-term and stochastic habitat degradations. The LSRCP program has been shown to effectively return adult steelhead to their point of release (i.e. Snake River Mitigation), but has used an unacceptable stock for this mitigation to date. Once full production has been achieved with the new stock, replacing the existing stock will provide the opportunity to allow supplementation to work, while concurrently providing mitigation (harvest opportunity). There may be short-term (3-5 years) increases in steelhead production from LFH while the endemic broodstock is being developed and mitigation production continues.

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

Presently, LFH will be where adults are held and spawned, eggs hatched, and juveniles reared through the pre-smolt stage. Because of good water quality and improved prespawning survival that results, adult fish are held at LFH rather than TFH. Eight wells produce up to 59,000 gpm of nearly constant 52 ^{0} F, pathogen free water for LFH. Discharge from LFH enters the Snake River and does not affect Tucannon River water quality. LFH complies with all NPDES standards for pollution discharge. The Tucannon River is a productive watershed flowing from the Blue Mountains of southeast Washington. Winter temperatures approach freezing and rise to 80 ^{0} F or greater during the summer near the mouth. Water for Tucannon Fish Hatchery (TFH) is provided by springs, wells and from the Tucannon River. Water withdrawls for hatchery use do not significantly reduce natural production capabilities nor affect adult upstream or downstream passage within the 0.75 miles of affected river reach (hatchery withdrawl to hatchery outfall). Steelhead spawn in the Tucannon River during spring when high river flows provide ample water for passage and spawning.

Acclimation of pre-smolts within the Tucannon basin may occur at Tucannon Hatchery. Located at RM 36 on the Tucannon River, the hatchery has the capability to hold fish in river water. Five to six weeks of acclimation may occur before releasing local brood smolts into the upper river. Water for the Tucannon Hatchery is removed from the river under permit for non-consumptive fish propagation purposes. Additional water for rearing is provided by springs and

wells location on the hatchery site. Tucannon Hatchery complies with all NPDES standards for pollution discharge.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

Hatchery intake screens meet current NMFS screening guidelines, and effluent discharge is monitored, reported, and currently complies with NPDES standards.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Broodstock will be collected at a temporary/portable trap in the lower river (see above) and possibly at the Tucannon Hatchery trap (see also above). Either one of these traps does not permanently alter or degrade Tucannon River habitat. The temporary trap consists of a metal pipe picket weir and a trap box. The trap box is constructed of extruded steel mesh with an 8" x 8" inlet opening, and fitted with an openable bypass gate to allow unrestricted passage. Each day the trap is operated, personnel will check for fish. The trap may be checked more than once during the day if a large number of fish is expected to be captured . Fish are netted from the trap box, and placed in a v-shaped trough. Keeping water in the trough has a calming effect on the fish so they can be sampled. After origin (natural, hatchery supplementation, or hatchery production-LFH stock) has been determined, the fish will either be collected for broodstock or passed upstream. Some natural origin fish may have scales and DNA samples collected from them before release.

The TFH trap consists of a concrete ladder associated with the hatchery water intake. An enlarged section of the ladder is designed to operate as a trap or counting channel where fish can be enumerated without handling. When fish are sampled from the trap, they can be released into the ladder and allowed to migrate upstream, or removed and hauled to TFH/LFH for holding.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

Following sampling and origin determination, adults from the temporary trap are netted into a plastic transport tank fitted with re-circulation/aeration capability, and hauled in the back of a pickup truck. Up to five adults can be transported in the tank. Broodstock trapped at TFH would be hauled by tank truck, fitted with re-circulation and oxygenation capability, to LFH.

5.3) Broodstock holding and spawning facilities.

Fish are hauled to LFH where they are placed in an adult holding raceway (10'x 6'x 80')which receives constant temperature well water. Adults are held separate from other hatchery stock adults to prevent any accidental co-mingling of the stocks and to control disease transmission. The raceways are enclosed over the middle one-third of the raceway length by the spawning building, where spawning occurs. Gametes are crossed, and water hardening begins within the spawning building. Fertilized eggs are then transported to the hatchery building for incubation.

5.4) Incubation facilities.

The incubation room at LFH is designed to accept and incubate eggs from individual females, through the eyed stage. Colanders nested in PVC buckets receive water via individual plastic tubes. Isolated incubation vessels allow disease sampling, detection and control. After eyeing is complete and virus sample results are received, eggs are consolidated into hatching baskets and transferred to hatching troughs.

5.5) Rearing facilities.

Lyons Ferry Hatchery has four intermediate indoor rearing tanks and 37 outside raceways available for rearing juveniles. Water is supplied from wells as previously described. Feeding occurs by hand, through demand feeders, or by pneumatic feeders that can be programmed to feed throughout daylight hours.

Tucannon Hatchery has six round ponds, a large raceway designed for rearing spring chinook salmon and two large raceways designed to rear and release steelhead/trout. Water is supplied from river, well and spring sources as described above. Feeding is by demand feeders or automatic broadcast feeders programmed to dispense several times daily.

a. Acclimation/release facilities.

An extended acclimation period of 5-10 weeks is planned for smolts at Tucannon Hatchery. Fish will be reared at LFH through January, then transported to raceways at Tucannon Hatchery that allow for acclimatization to river water. After acclimation, fish will be pumped from the raceways and trucked to numerous locations at or above RM 41 and released directly into the Tucannon River.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

No significant mortality of Tucannon natural steelhead has occurred to date. Pre-spawning mortality of BY2000 broodstock was attributed to stress of handling during the spawning process (checking weekly for ripe fish) and fungus. Aggressive fungus control actions as prescribed by a WDFW fish health specialist effectively reduced mortality.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from

equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

Lyons Ferry Hatchery follows strict operational procedures as laid out by the Integrated Hatchery Optimization Team (IHOT 1993). Where possible, remedial actions identified in a 1996 IHOT compliance audit were implemented. Staff is available to respond to critical operational problems at all times. Both LFH and TFH are equipped with water flow and low water alarm systems and with emergency generator power supply systems to provide incubation and rearing water to the facilities. Fish health is monitored monthly or more often, as required, in cases of disease epizootics. Fish health practices follow PNWFHPC (1989) protocol.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

Only natural steelhead captured within the Tucannon River above RM 5 will be used for broodstock. A combination of fish captured hook and line, trapped at a lower-river temporary adult trap, or trapped at Tucannon Hatchery may be used in some years. Propagation and release of LFH stock will continue for several more years until the local stock can be documented to be performing as expected.

6.2) Supporting information.

6.2.1) History.

Mitigation production releases into the Tucannon River began in 1983. Broodstock originated from the Wells Hatchery (upper Columbia) and/or the Wallowa Hatchery (Snake River) programs through 1986. Beginning in 1987, a newly developed Lyons Ferry Stock (LFH) was used as the primary source for releases. The new stock was built from adult returns of Wells stock and Wallowa stock origin releases at the hatchery. Complete losses at LFH of the BY1989 production because of IHNV caused the release of Idaho origin (Pahsimeroi Hatchery) steelhead in 1990. Since 1991, only LFH origin broodstock have been used for Tucannon River releases. Because of the inconsistent and incompatible nature of broodstock used in the past, as well as generally poor stock performance in the Tucannon, WDFW and co-managers desire to transition to a local broodstock to continue mitigation and assist with recovery under ESA. In 1999-2000 broodstock was taken randomly from the endemic population, so no direct or unintentional selection is believed to have occurred. Samples for DNA characterization were collected from broodstock in 2000 and from juvenile populations throughout the basin, and will serve as a baseline to measure potential future genetic changes.

6.2.2) Annual size.

The proposed use of 40 pair of steelhead for broodstock represents between 15% and 112% of the estimated natural fish escaping to spawn in the Tucannon since 1989. Collection is targeted to produce a yearly release group of artificially propagated, Tucannon River steelhead smolts without jeopardizing natural production. Listing under ESA and the critical population level have spurred WDFW and co-managers to replace existing hatchery broodstock with a local broodstock. The direct and indirect supplementation effect, coupled with habitat restoration efforts ongoing in the basin, are expected to aid in boosting the population to above the viable threshold.

6.2.3) Past and proposed level of natural fish in broodstock.

The broodstock will consist entirely of endemic, naturally-reared fish through BY2001. All returning adults from BY2000 and BY2001 will be allowed to spawn naturally and not be used for broodstock (because the small founding population for these two years may present genetic concerns). Starting in BY2002 the collection of endemic brood is expected to increase as the program is evaluated for success. Beginning in BY2005, up to 30% of the broodstock collected will be of first generation hatchery-reared endemic brood. At full production (40 spawning pairs), no more than 50% of the brood will be of hatchery origin.

6.2.4) Genetic or ecological differences.

Hatchery broodstock will be developed solely from endemic origin adults and should retain the genetic structure of the natural population.

6.2.5) Reasons for choosing.

Endemic steelhead are optimally adapted for survival in the Tucannon River. They will be most capable of surviving, returning to and effectively spawning in the Tucannon River.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

Use of endemic adult steelhead for broodstock will provide the greatest protection of the population's genetic structure in a conservation/mitigation program. Broodstock will be collected from the entire run. Further, adults will be collected from the lower river site whenever possible to reduce the relative impact to the population arriving at the TFH trap (RM36).

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Adults.

7.2) Collection or sampling design.

Natural steelhead may enter the Tucannon River from September through April, but their most active entry and migration times occur in the fall (September-October) and in early spring (February-March). Trapping operations will occur primarily in the lower river where adults from the entire watershed pass the trap site. Hook and line sampling for broodstock may also occur in some years. Because of the trap design, fish can pass the trap at higher flows, ensuring that the run is not delayed by trapping efforts. Fish entering the trap (or captured hook and line) are considered to be a random sub-sample of the population, but WDFW will strive to collect equal numbers of adults from the fall and spring migration periods to ensure a full representation of the run. Trapping in 1999-2000 occurred through March, effectively sampling nearly the entire run time. During stock development years, trapping of broodstock from the upper site will only occur if the lower trap is disabled.
After full production with endemic broodstock has been attained, broodstock could then be collected at the TFH trap (RM 41.5). The trap would be operated for steelhead collection from September through May. Brood fish would be collected in proportion to the expected run timing.

7.3) Identity.

Endemic origin naturally produced steelhead are unmarked. All hatchery fish presently released into the Tucannon River receive an adipose clip or a combination adipose/left ventral/CWT. Releases of smolts from endemic origin fish will receive a CWT/visual implant elastomer (VI) tag in the adipose eye tissue for external identification, or some other effective mark that can be identified upon return.

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults): 88 adults

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Brood Year	Adults Females	Males	Jacks	Eggs	Juveniles

Brood Year	Adults Females	Males	Jacks	Eggs	Juveniles
2000	22	24		81,000	

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.

Hatchery origin (LFH stock) fish collected at the lower trap are passed upstream into a recreational fishery. LFH stock fish collected at the Tucannon Hatchery trap may be passed or removed from the river depending upon agreement of management intent among WDFW, NMFS and co-managing Tribal organizations. Returning hatchery-reared adults of endemic origin will be passed at both traps to contribute to the spawning population. Until run size has rebuilt to a level which will allow WDFW to collect the required broodstock for full program (88 adults), only a limited number of hatchery reared endemic origin adults (F_1 generation) will be used for broodstock (see 6.2.3 above).

7.6) Fish transportation and holding methods.

Adults are transported in plastic tubs or tank trucks with re-circulation aeration and/or oxygenation. To ameliorate hauling stress, salt (NaCl) is added to the water in quantities appropriate to the tank volume (as described in WDFW fish health manual). Hauling time from the lower river trap site to LFH is approximately 15 minutes. Hauling time from TFH to LFH is approximately one hour.
Fish are held in brood stock raceways at LFH as described above. Fish are anesthetized using MS-222 to determine degree of ripeness. Fish may be treated with a suite of approved chemicals to control fungus, parasites and bacterial diseases, as prescribed by a WDFW fish health specialist.

7.7) Describe fish health maintenance and sanitation procedures applied.

Monthly fish health inspections occur at LFH. Because of very low numbers of adults held in broodstock raceways, raceway cleaning is unnecessary. Treatments for fungal infections are applied as chemical flushes through the raceways.

7.8) Disposition of carcasses.

In 2000, fish were live spawned and surviving males and females were retained in an attempt to rejuvenate them for subsequent re-spawning in 2001. Rejuvenation efforts failed however and all fish died. No further attempts at rejuvenation will be made until current research in the Columbia basin on Kelt rejuvenation has been completed. Carcasses will be sampled for DNA if a fish dies pre-spawning, and may be buried on station. In the future, fish surviving the

re-juvenation process after two spawns will be released into the Tucannon or Snake rivers to outmigrate.

Carcasses may be returned to the Tucannon River for nutrient enhancement after approval by a WDFW fish health specialist if such release of carcasses is determined not to pose a significant fish health risk for the natural population. Carcasses of endemic broodstock would be returned to the upper Tucannon River above RM 20.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

Broodstock will be collected from throughout the natural run period to provide for random selection of adults from the entire adult population, prevent run timing divergence of the hatchery reared population from the natural population, and provide for natural fish escapement into the habitat to spawn. Returning adults from natural brood smolt releases will be allowed to enter the spawning population without being used for the hatchery supplementation program. As the local brood program expands, trapping at the Tucannon Hatchery site will begin to remove returning LFH stock adults from the river to reduce their possible effect on the natural population.

Disease control efforts at LFH and TFH (in accordance with PNWFHC and IHOT standards) will effectively control expansion of species specific or general salmonid diseases.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.

All males and females, which have been collected for broodstock, will be examined weekly during the spawning season to determine ripeness, and all fish will be spawned when ripe.

8.2) Males.

Mating occurs in a 2x2 factorial cross to ensure the highest likelihood of fertilization. Jack or precocious steelhead (<20" TL) are generally not seen in the population. Likewise, repeat spawners are not known to exist in significant numbers in the population. WDFW is investigating the possibility of rejuvenating spawners at LFH and re-using them in the next brood year. However this proposed action is experimental at this time and was not successful at LFH in 2000.

8.3) Fertilization.

Maintaining an equal sex ratio in the spawning population is the program goal. A 2x2 factorial

spawning occurs (or a 1x2 when only one female is available) to increase the number of crosses. The small number of fish ripe on individual days usually limits spawning options. Males are normally limited to primary status on half the eggs from two females. Where insufficient males are available to meet this criterion, males can be used as primary more than twice. In those circumstances, males will be used no more than four times as primary spawners (egg equivalent = 2 females). After fertilization, eggs are rinsed in a buffered iodine solution (100 ppm) and allowed to water harden for one hour in the same solution.

8.4) Cryopreserved gametes.

Cryopreservation was not used during BY2000 matings, but may be used in future brood years to increase diversity. Currently, no semen from natural origin males has been preserved to use in the program.

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

Broodstock collection protocol will ensure that adults represent a proportional, temporal distribution of the natural population. A 2x2 factorial mating scheme has been and will be applied to reduce the risk of loss of within-population genetic diversity for the small steelhead population that is the subject of this conservation/mitigation program

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

Lyons Ferry Hatchery collects large numbers of LFH stock steelhead annually. Following is egg survival information at LFH for the six most recent brood years. One year of egg take information is available for endemic Tucannon steelhead (see also below). (**Note:** IHNV control measures at LFH require the disposal of eggs from females that test positive for the virus. Discarded eggs are included in % loss figures for the LFH stock, so figures may not represent true egg survival, but correctly depict survival under the existing hatchery management protocol.)

	Eggs taken	% loss to eye-up	Stock Origin
BY1994	1,352,296	33.5%	LFH

BY1995	1,772,477	47.6%	LFH
BY1996	1,614,636	28.7%	LFH
BY1997	1,090,638	11.7%	LFH
BY1998	1,460,967	36.1%	LFH
BY1999	1,140,813	17.7%	LFH
BY2000	80,850	11%	Tucannon

9.1.2) Cause for, and disposition of surplus egg takes.

Estimated egg take and fecundity is based on only one year of spawning data. Also, egg survival to eye-up is considerably higher than that for the existing stocks of steelhead used at LFH. Number of eggs collected from adults trapped and ultimately the number of fry could exceed program needs. Furthermore, the disease history of natural broodstock is not known. Eggs is excess of program may be retained to ensure the goal is met in case of unexpected loss from IHNV or other unexpected circumstances. Eggs from females determined to be IHNV positive would not necessarily be destroyed. The LFH Complex manager and a WDFW Fish Health specialist will make the decision. Excess fingerling will be released within the Tucannon River basin in areas of underseeded habitat.

9.1.3) Loading densities applied during incubation.

Brood Year 2000 Tucannon natural steelhead eggs averaged 272/oz. Eggs from individual females (14 -26 oz; 3,696 – 7,020) are incubated individually in 2 quart colanders through eye-up. Water flow through each colander is 2g/min. After eye-up, eggs are placed in hatching baskets with a capacity of 20,000 eggs each.

9.1.4) Incubation conditions.

Incubation, as with rearing, occurs with pathogen free, sediment free, 51-53 ^{0} F well water. The incubation building is fitted with back up pumps to maintain flow through the troughs, and with secondary packed columns to maintain water oxygenation above 10 ppm. Flow monitors will sound an alarm if flow through the incubation troughs is interrupted. Where possible, remedial actions identified in a 1996 IHOT compliance audit were implemented.

9.1.5) Ponding.

Fish hatch from baskets and drop into troughs where they remain for 4-8 weeks after feeding commences. Fish are fed after all are buttoned up (usually 1-3 days post swimup). Fish are then moved to intermediate inside tanks (usually at about 800 fish/lb). Fish rear in intermediate tanks until July or when fish reach 100/lb, at which time they are transferred to outside raceways.

9.1.6) Fish health maintenance and monitoring.

Eggs are examined daily by hatchery personnel. Prophylactic treatment of eggs for the control of fungus is prescribed by a WDFW fish health specialist, and may include treatment with formalin or other accepted fungicides. Non-viable eggs and sac-fry are removed by bulb-syringe.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

Eggs are incubated in pathogen free, silt free well water to ensure maximum egg survival and minimize potential loss from disease. The hatchery incubation room is protected by a separate low water alarm system and an automatic water reuse pumping system, and by the use of wells separate from the hatchery's main well field.

9.2) Rearing:

9.2.1) Provide survival rate data by hatchery life stage for the most recent twelve years (1988-99), or for years dependable data are available.

Survivals for LFH stock summer steelhead reared at LFH.

BY	Eggs taken	Eggs retained (%)		Fry produced (% egg-fry survival)		Smolts produced (% fry-smolt survival)	
1987	1,111,506	1,095,906	(98.6)	983,901	(89.8)	665,658	(67.6)[1]
1988	941,756	818,148	(86.9)	793,240	(96.9)	597,607	(75.3)
1989	1,263,237	957,074	(75.8)	941,000	(98.3)	0	(0.0)[2]
1990	2,570,676	1,483,485	(57.7)	1,002,320	(67.6)	635,635	(63.4)
1991	1,296,249	1,165,315	(89.9)	1,115,368	(95.7)	357,497	(32.1)[3]
1992	1,239,055	905,438	(73.1)	416,265	(46.0)	387,767	(93.2)[4]
1993	1,211,053	940,022	(77.6)	860,983	(91.6)	611,417	(71.0)
1994	1,352,296	899,350	(66.5)	845,316	(94.0)	558,130	(66.0)
1995	1,772,477	929,597	(52.4)	895,882	(96.4)	610,545	(68.2)
1996	1,614,636	1,151,363	(71.3)	1,148,114	(99.7)	807,253	(70.3)[5]
1997	1,090,638	962,705	(88.3)	809,845	(84.1)	569,264	(70.3)[6]
1998	1,460,967	934,247	(63.9)[7]	768,522	(82.3)		

1 An additional 203,857 were outplanted as pre-smolts (fry-outplant survival = 88.4%)
2 Losses to IHNV = 100%
3 Includes 92,116 fish planted as sub-smolts: 172,000 fish lost to bird predation in lake.
4 Destroyed 378,257 fish infected with IHNV.
5 Includes 191,000 fry planted into Sprague Lake.
6 Includes 15,207 fry planted into Rock Lake
7 308,666 eggs discarded from IHNV positive females

9.2.2) Density and loading criteria (goals and actual levels).

LFH and TFH raceway rearing density for steelhead should not exceed 0.26 lbs fish/ft^3. Where steelhead are reared in rearing ponds, densities can be 10% of the raceway maximum, but may approach the maximum (100%) loading for volume of flow (FL index). Generally, endemic brood juveniles will rear in vessels at a density much less than 0.26 lbs fish per cubic foot or 100% of the FL index.

9.2.3) Fish rearing conditions

Raceways are supplied with oxygenated water from the hatchery's central degassing building. Approximately 1000-gpm water enters each raceway through secondary degassing cans. Oxygen levels range from 10-12 ppm coming in to 8-10 ppm leaving the raceway, depending on ambient air temperature and number of fish in the raceway. Raceways are cleaned three times weekly by brushing to remove accumulated uneaten feed and fecal material. Feeding is by pneumatic presentation from timed feeders, or by hand presentation.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

Growth rate information for the Lyons Ferry, Wallowa and Tucannon strain steelhead for last year (e.g. 1999-00), or for most recent year available:

Lyons Ferry Steelhead

Year	F/Kg L/CM	W/GRAMS		Growth-cm/Mo.	"K" Factor
March/99	24.39	0.41	3.49		3.48
April/99	776	1.29	5.10	1.61	3.51
May/99	441	2.27	6.16	1.06	3.51
June/99	225	4.45	7.71	1.55	3.50
July/99	109	9.16	9.82	2.11	3.49
August/99	80	12.43	10.87	1.05	3.49
September/99	38	26.22	13.94	3.07	3.49
October/99	27	37.10	15.65	1.71	3.49
November/99	22	46.27	16.84	1.19	3.50
December/99	16	64.41	18.80	1.96	3.50

Year	F/Kg L/CM	W/GRAMS		Growth-cm/Mo.	"K" Factor
January/00	12	82.55	20.43	1.63	3.49
February/00	10	100.70	21.82	1.39	3.50

Wallowa Steelhead

Year	F/KG L/CM	W/GRAMS		Growth-cm/Mo.	"K" Factor
May/99	2417	0.41	3.50		3.45
June/99	634	1.58	5.46	1.95	3.50
July/99	298	3.36	7.02	1.56	3.50
August/99	90	11.16	10.48	3.46	3.50
September/99	57	17.51	12.19	1.70	3.50
October/99	35	28.76	14.37	2.19	3.50
November/99	22	46.27	16.84	2.49	3.50
December/99	16	64.41	18.80	1.96	3.50
January/00	14	71.67	19.49	0.69	3.49
February/00	12	82.55	20.43	0.94	3.50
March//00	10	97.07	21.56	1.13	3.50
April/00	10	100.70	21.82	0.26	1.06

Tucannon Steelhead

Year	F/KG L/CM	W/GRAMS		Growth-cm/Mo.	"K" Factor
March					
April					
May	664	1.51	5.38		3.50
June	380	2.63	6.48	1.10	3.49
July	175	5.72	8.39	1.91	3.50
August	88	11.34	10.54	2.15	3.50
September					
October					
November					
December					

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

See above tables.

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing .

Fry/fingerling will be fed an appropriate commercial dry or semi-moist trout/salmon diet. Feeding occurs several times daily as necessary to provide the diet at a range of 0.7 – 1.1% B.W./day. Feed conversion is expected to fall in a range of 1.1 – 1.4 pounds fed to pounds produced. Due to the duration of spawning time for the natural steelhead, a variety of starter diets and feed schedules may be used to achieve a similar size among the fish before they are moved outside to the rearing raceways. This strategy will reduce length variation (CV) of juveniles within the supplemented population.

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

A WDFW fish health specialist monitors fish health as least monthly. More frequent care is provided as needed if disease is noted. Hatchery Specialists under the direction of the Fish Health Specialist provide treatment for disease. Sanitation consists of raceway cleaning three times each week by brushing, and disinfecting equipment between raceways and/or between species on the hatchery site.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

Program goal for the endemic program will be to release fish between April 1-30 at 4.0-5.0 fish/lb. Pre-liberation samples note smolt development visually based on degree of silvering, presence/absence of parr marks, and fin clarity and banding of the caudal fin. No gill ATPase activity or blood chemistry samples to determine degree of smoltification, or guide fish release timing is anticipated.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

Camouflage covers over the outside raceways are planned at this time to help maintain a fright response. Demand feeders may also be used where possible to limit human disturbance or habituation to humans. Raceways are old enough that the walls and bottoms are of nearly natural coloration and texture.

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

Lyons Ferry Complex facilities are manned by professional personnel trained in fish cultural procedures. Facilities are state-of-the-art to provide a safe and secure rearing environment through the use of alarm systems, backup generators, and water re-use- pumping systems to prevent catastrophic fish losses.

Fish will be reared under camouflage covers to maintain fright response to humans and other potential predators. Final rearing/acclimation at Tucannon Hatchery will occur on river water to provide acclimation/imprinting time and begin the conversion to natural feed sources present in river water.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1) Proposed fish release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Unfed Fry				
Fry				
Fingerling	25,000	50	1 October	Tucannon River
Yearling	150,000	5	1-30 April	Tucannon River

10.2) Specific location(s) of proposed release(s).

Stream, river, or watercourse: Tucannon River (WRIA 35)
Release point: RM 40-60
Major watershed: Tucannon River
Basin or Region: Snake River

10.3) Actual numbers and sizes of fish released by age class through the program.
For existing programs, provide fish release number and size data for the past three fish generations, or approximately the past 12 years, if available. Use standardized life stage definitions by species presented in ***Attachment 2****. Cite the data source for this information.*

N/A (no fish have yet been released from this program)

10.4) Actual dates of release and description of release protocols.

N/A (no fish have yet been released from this program)

Fish will be transferred from LFH to TFH in February of the release year and placed in round ponds supplied with river water (see 10.6 below). Fish will be fed while at TFH. During April of the release year, when fish appear to be visibly smolted, they will be loaded into trucks and hauled to the upper river (≥ RM 41) and released.

10.5) Fish transportation procedures, if applicable.

Fish will be transported from LFH to TFH and from TFH to release sites above the hatchery by tank truck. Transportation time from LFH will usually be less than one hour and from TFH to release sites will usually be less than 30 minutes.

10.6) Acclimation procedures.

Fish will be reared at TFH from 15 February through release in April (5-9 weeks). Rearing will occur on Tucannon River water, which will provide acclimation to the chemistry and temperature regime of the Tucannon basin.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

All natural brood origin smolts will receive a coded wire tag in the snout and a VI tag in the adipose eye tissue for external identification upon return as adults. Should fry need to be released in October, they would similarly marked, but a different VI tag color would be used to evaluate the success of fry/parr releases into the basin

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

Monitoring of fish numbers, growth and mortality at the hatcheries will provide reasonably accurate estimates of live fish throughout their rearing life. No fish surplus to program goal are expected in 2000/2001, and are not likely before 2004/2005.

Because fish are of Tucannon River origin, all fish will be released into the Tucannon River either as smolts or fingerlings. As the program develops to the stage where the potential surpluses of juveniles for hatchery rearing may occur, those surpluses will be identified in early fall (1 October). Fingerlings would be outplanted into the basin at that time, targeting river reaches that had population densities below carrying capacity. Any surplus production of fingerlings is expected to be small.

10.9) Fish health certification procedures applied pre-release.

Fish will be examined by a WDFW fish health specialist and certified for release as required under the PNWFHPC (1989) guidelines.

10.10) Emergency release procedures in response to flooding or water system failure.

Under conditions requiring release of fish at either hatchery in response to a water system failure, all fish would be hauled by truck to the upper Tucannon River and released.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

All fish will be released into the upper river basin, which is currently underseeded by steelhead. Since the standard release strategy will consist of releasing smolts, most will orient to the river for a short time (1-10 days) and then emigrate. Some smaller fish may not be developmentally ready to emigrate and could assume residence in the river for up to another year. This number would be much greater in the case of fall fingerling plants. However, because the river is presently underseeded, WDFW does not expect these fish to represent a problem for juvenile salmon, steelhead or bull trout in the system. Fish rearing for an additional year within the Tucannon will contribute to the conservation/ recovery goal for the program as a life history variant of those emigrating as yearlings.

Predation by hatchery fish on natural-origin smolts is less likely to occur than predation on fry (NMFS 1995). Salmonid predators are generally thought to prey on fish 1/3 or less their length (CBFWA 1996). Witty et al. (1995) concluded that predation by hatchery production on wild salmonids does not significantly impact naturally produced fish survival in the Columbia River migration corridor.

The Species Interaction Work Group (SIWG 1984) reported that potential impacts from competition between hatchery and wild fish is assumed to be greatest in the spawning and

nursery areas and at release locations where fish densities are highest (NMFS 1995). These impacts likely diminish as hatchery smolts disperse, but resource competition may continue at some unknown, but lower level as smolts move downstream through the migration corridor. Steward and Bjornn (1990), however, concluded that hatchery fish kept in the hatchery for extended periods before release as smolts (e.g. yearling salmonids) may have different food and habitat preferences than wild fish, and that hatchery fish will be unlikely to out-compete wild fish. Hatchery-produced smolts emigrate seaward soon after liberation, minimizing the potential for competition with wild fish (Steward and Bjornn 1990). Competition between hatchery-origin salmonids with wild salmonids, including steelhead, in the mainstem corridor was judged not to be a significant factor (Witty et al. 1995).

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

Estimate the contribution of conservation / mitigation program-origin summer steelhead to the basin and compare performance to the natural population.

Indicators: *1.1, 2.1, 2.3, 3.1, 3.2, 3.3, 3.4, 4.2, 5.1, 5.3, 5.4*

1. Differentially mark all hatchery-reared summer steelhead fingerling to allow for distinction from natural-origin fish upon return as adults on the spawning grounds. Coded wire and visible implant elastomer tagging or another permanent, effective method will be used to accomplish this task. Adipose fin clipping may be used after 2004/ 2005 if the program is successful.

Indicators: *3.1, 3.2, 3.3, 3.4, 4.1, 5.1, 6.6, 6.7*

2. Conduct trapping at permanent and temporary trap locations throughout the summer steelhead return to collect broodstock for the hatchery conservation/mitigation program, enumerate overall returns, and to collect information regarding fish origin for the spawning escapement, and age class composition.

Indicators: *3.2, 3.3, 4.2, 5.2, 6.6*

3. Conduct spawning ground surveys to estimate spawners, and use in conjunction with trapping data to estimate the proportions of natural, endemic brood hatchery, and other hatchery origin steelhead in the spawning population.

Indicators: *3.2, 3.3, 4.2, 5.2, 6*

4. Estimate the number of natural and naturally spawning hatchery-origin summer steelhead contributing to the Tucannon River annual escapement.

Indicators: *3.4, 4.2, 4.3, 4.4*

5. Conduct summer electrofishing and snorkel surveys to estimate densities and populations of Age 0 and Age 1+ summer steelhead throughout the Tucannon River basin to compare to historical records. Electrofishing and snorkel surveys will also be able to determine the degree of residual steelhead left in the river from hatchery supplementation releases.

Indicators: *3.4, 3.6, 4.2, 4.3, 4.4*

6. Operate a smolt trap on the Tucannon River to: 1) Estimate the number, timing, and age composition of natural origin steelhead smolts from the river, 2) estimate the migration success to the smolt trap from releases of hatchery supplementation steelhead in the upper basin, and 3) allow downriver migration comparison between natural and hatchery propagated by PIT tagging at the smolt trap.

Indicators: *2.3, 3.1, 3.3, 3.4, 4.2, 5.3, 5.4, 5.5*

7. Calculate SARs by brood year to determine if fish are surviving. Estimate escapement to hatchery, spawning grounds and harvest.

Monitor and evaluate any changes in the genetic, phenotypic, or ecological characteristics of the populations potentially affected by the program.

Indicators: *5.1*

1. Collect GSI data (allozyme or DNA-based) from regional summer steelhead adult populations to determine the degree to which discrete populations persist in the individual watersheds. Allozyme collections will be used for comparison with past collections to monitor changes in allelic characteristics, and with the intent to assess whether the supplementation program negatively affects the genetic diversity of the natural population in the Tucannon River.

Indicators: *3.4, 4.2, 5.3, 5.4*

2. Collect length and scale samples from all adults (natural and hatchery) returning to traps on the Tucannon River. Assess age structure of returning hatchery origin fish and compare with natural fish. Compare length at age of natural and hatchery reared returning adults.

Indicators: *4.2, 4.3*

3. Conduct summer electrofishing and snorkel surveys to estimate densities and populations of Age 0 and Age 1+ summer steelhead throughout the Tucannon River basin to compare to historical records. Electrofishing and snorkel surveys will also be able to determine the degree of residual steelhead left in the river from hatchery supplementation releases.

Indicators: *5.5, 5.6*

4. Operate a smolt trap on the Tucannon River to: 1) Estimate the number, timing, and age composition of natural origin steelhead smolts from the river, 2) estimate the migration success to the smolt trap from releases of hatchery supplementation steelhead in the upper basin, and 3) allow downriver migration comparison between natural and hatchery supplementation by PIT tagging at the smolt trap.

Assess the need and methods for improvement of conservation / mitigation activities in order to meet program objectives, or the need to discontinue the program because of failure to meet objectives.

Indicators: *3.6, 4.4, 5.5, 6.1*

1. Determine the pre-spawning and green-egg to released smolt survivals for the program.

a. Monitor growth and feed conversion for fingerling.
b. Determine green-egg to eyed-egg, eyed-egg to fry, and fry to released-smolt survival rates.
c. Maintain and compile records of cultural techniques used for each life stage, such as: collection and handling procedures, and trap holding durations for broodstock; fish and egg condition at time of spawning; fertilization procedures, incubation methods/densities, temperature unit records by developmental stage, shocking methods, and fungus treatment methods for eggs; ponding methods, rearing/pond loading densities, feeding schedules and rates for juveniles; and release methods.
d. Summarize results of tasks for presentation in annual reports.
e. Identify where the propagation program is falling short of objectives, and make recommendations for improved production as needed.

Indicators: *4.1, 4.2, 4.3, 5.2, 5.4, 6.4, 6.6, 6.7*

2. Determine if broodstock procurement methods are collecting the required number of adults that represent the demographics of the donor population with minimal injuries and stress to the fish.

a. Monitor operation of adult trapping operations to ensure compliance with established broodstock collection protocols.
b. Monitor timing, duration, composition, and magnitude of run at each adult collection site.
c. Maintain daily records of trap operation and maintenance (e.g. time of collection), number and condition of fish trapped, and environmental conditions (e.g. river level, water temperature).
d. Collect biological information on collection-related mortalities. Determine causes of mortality, and use carcasses for stock profile sampling, if possible.

e. Summarize results for presentation in annual reports. Provide recommendations on means to improve broodstock collection, and refine protocols if needed for application in subsequent seasons.

Indicators: *6.1, 6.5*

3. Monitor fish health, specifically as related to cultural practices that can be adapted to prevent fish health problems. Professional fish health specialists supplied by WDFW will monitor fish health.

a. A fish health specialist will conduct fish health monitoring. Significant fish mortality to unknown causes will be sampled for histopathological study.

b. The incidence of viral pathogens in broodstock will be determined by sampling fish at spawning in accordance with procedures set forth in PNWFHPC. Recommendations on fish cultural practices will be provided on a monthly basis based upon the fish health condition of juveniles.

a. Fish health monitoring results will be summarized as part of an annual report.

Collect and evaluate information on adult returns.

This element will be addressed through consideration of the results of previous elements, and through the collection of information required under adaptive criteria. All will be used as the basis for determining the success of progress toward program goals and whether the program should continue.

Indicators: *1.1, 2.3 3.1, 3.2, 3.3, 5.1*

1. Monitor the incidental harvest of artificially produced endemic stock Tucannon and hatchery stock steelhead in recreational and treaty fisheries. Document trends in abundance.
2. Collect age, sex, length, average egg size, and fecundity data from a representative sample of broodstock used in the supplementation program for use as baseline data to document any phenotypic changes in the populations.
3. Compare newly acquired electrophoretic analysis data reporting allele frequency variation of returning hatchery and natural fish with baseline genetic data. Determine if there is evidence of a loss in genetic variation (not expected from random drift) that may have resulted from the supplementation program.
4. Commencing with the first year of returns of progeny from naturally-spawned, hatchery-origin summer steelhead, evaluate results of spawning ground surveys and age class data collections to:
    a. Estimate the abundance and trends in abundance of spawners;
    b. Estimate the proportion of the escapement comprised by steelhead of hatchery lineage, and of natural lineage;
    c. Through mark sampling, estimate brood year contribution for hatchery lineage and natural-origin fish.

Use the above information to determine whether the population has declined, remained stable, or has been recovered to sustainable levels. The ability to estimate hatchery and natural proportions will be determined by implementation plans, budgets, and assessment priorities. Once natural populations have attained the ability to replace themselves, the focus of the program will shift form conservation and recovery of the population, to achieving mitigation goals defined under LSRCP.

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

The LSRCP program as part of the ongoing mitigation program will provide funding for Monitoring and Evaluation.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

1. Juvenile sampling at hatchery facilities will be conducted with accepted procedures to minimize stress and mortality from sampling. Sample sizes will be the minimum necessary to achieve statistically valid results for growth, tag retention and fish health.
2. Smolt trapping operations will ensure that holding time, stress and potential for injury of captured migrants is minimized. Marked groups for assessing trap efficiency will be the minimum necessary to achieve statistically valid results.
3. Adult trapping facilities will be monitored daily, or more often as necessary to prevent injury and unnecessary delay.
4. Spawning ground surveys will be conducted in such a manner to avoid scaring spawning fish off redds. Also, staff will carefully walk in areas with redds so eggs won't be accidentally crushed.
5. Snorkel surveys will be conducted only at a minimum number of sites necessary to achieve statistically valid results for population estimates. Displacement of fish will be kept to a minimum by snorkeling on days when water clarity and visibility are at maximum.
6. Electrofishing surveys will be conducted only at a minimum number of sites necessary to achieve statistically valid results for population estimates. If possible surveys will be conducted when water temperatures are below stressful levels to fish. WDFW will follow NMFS and WDFW electrofishing guidelines by: not shocking near redds or spawning adults, use of approved electroshockers, having experienced crew members during all shocking surveys, using DC current, recording temperature, conductivity and electroshocker settings, and providing a good environment for fish holding/sampling after capture.

SECTION 13. ATTACHMENTS AND CITATIONS

CBFWA (Columbia Basin Fish and Wildlife Authority). 1996. Draft programmatic environmental impact statement - impacts of artificial salmon and steelhead production strategies in the Columbia River basin. USFWS, NMFS, and Bonneville Power Administration. Portland, OR. December 10, 1996 draft.

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Steward, C.R. and T.C. Bjornn. 1990. Supplementation of salmon and steelhead stocks with hatchery fish: a synthesis of published literature. Tech. Rpt. 90-1. Idaho Cooperative Fish and Wildlife Research Unit. University of Idaho, Moscow, ID.

Washington Department of Fisheries (WDF), Washington Department of Wildlife (WDW), and Western Washington Treaty Indian Tribes (WWTIT). 1993. 1992 Washington State salmon and

steelhead stock inventory (SASSI). Wash. Dept. Fish Wildlife, Olympia, 212 p. and 5 regional volumes. Washington Dept. Fish and Wildlife, 600 Capitol Way N, Olympia, WA. 98501-1091.

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Washington Department of Fish and Wildlife. 1999. Unpublished data from the files of the Snake River Lab.

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the foregoing information is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

Appendix Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: _Summer Steelhead__ ESU/Population:__Snake / Tucannon_____ Activity:__Broodstock Collection, spawning, rearing and releases_____			
Location of hatchery activity:__Lyons Ferry Complex__ Dates of activity:_Year Round_ Hatchery program operator:_Butch Harty__			
	Annual Take of Listed Fish By Life Stage *(Number of Fish)*		
Type of Take	Egg/Fry	Juvenile/Smolt	Adult
Observe or harass a)	0	0	200
Collect for transport b)	0	0	0
Capture, handle, and release c)	0	0	0
Capture, handle, tag/mark/tissue sample, and release d)	0	0	1000
Removal (e.g. broodstock) e)	0	0	88
Intentional lethal take f)	0	0	80
Unintentional lethal take g)	0	0	20
Other Take (specify) h)	0	0	0

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

1. *An entry for a fish to be taken should be in the take category that describes the greatest impact.*
2. *Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).*
3. *If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.*

Appendix Table 2. Estimated listed salmonid take levels of by Research/Monitoring/Evaluation activity.

Listed species affected: _Summer Steelhead_ ESU/Population:__Snake / Tucannon__ Activity:_Spawning, Snorkel, Electrofish surveys and smolt trapping_		
Location of hatchery activity: Tucannon River _(Various locations) Dates of activity:__Year Round___ Research/Monditoring/Evaluation program operator:_Mark Schuck and Joe Bumgarner___		
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***	
	Egg/Fry	Juvenile/Smolt
Observe or harass a)	2500	2500
Collect for transport b)	0	3000
Capture, handle, and release c)	4000	3500
Capture, handle, tag/mark/tissue sample, and release d)	0	2500
Removal (e.g. broodstock) e)	0	0
Intentional lethal take f)	0	0
Unintentional lethal take g)	200	200
Other Take (specify) h)	0	0

a. Contact with listed fish through snorkeling.
b. Take (non-lethal) of juveniles/smolts captured and marked (caudal clip) for smolt trap efficiency tests.
c. Take associated with smolt trapping operations and electrofishing where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to PIT tagging and/or bio-sampling (length/weight and scales) of fish collected through smolt trapping operations or electrofishing surveys prior to release.
e. Listed fish removed from the wild and collected for use as broodstock.f. Intentional mortality of listed fish during smolt trapping or electrofishing.
g. Unintentional mortality of listed fish, including loss of fish during transport during smolt trapping or holding after electrofishing.
h. Other takes not identified above as a category.
i. Rainbow trout mature

Instructions:

1. An entry for a fish to be taken should be in the take category that describes the greatest impact.
2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).
3. If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.