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21 Spokane Subbasin Overview

21.1 Regional Context

The Spokane Subbasin shares a border with the Upper Columbia Subbasin to the north, the Pend Oreille Subbasin to the northeast, and the Coeur d' Alene Subbasin to the east (Figure 21.1). The outlet of Coeur d' Alene Lake forms the headwaters of the Spokane River, which flows westerly to its confluence with the Columbia River (Lake Roosevelt). The major river in the Subbasin is the Spokane River, which runs 111 miles from the outlet of Coeur d' Alene Lake to its confluence with the Columbia River. The major tributaries of the Spokane River listed from upstream to downstream include Hangman Creek (also known as Latah Creek), Little Spokane River, and Chamokane Creek (also known as Tshimikain Creek).

In eastern Washington and northern Idaho there are seven dams on the Spokane River. The city of Spokane Water Department owns, operates, and maintains Upriver Dam and is licensed for fifty years (FERC license 3074-WA, 1981-2031). Avista Corporation owns and operates the other six hydroelectric facilities. The six dams (from upstream to downstream) include Post Falls in Idaho, Upper Falls, Monroe Street, Nine Mile, Long Lake, and Little Falls located in Washington. Five of the six dams owned by Avista were constructed and were operating between 1906 and 1922. Monroe Street Dam was initially built in 1890 (Avista 2002; Scholz et al. 1985) and then reconstructed in 1973.

Five of the six dams (excluding Little Falls Dam, a run-of-the-river facility), owned and operated by Avista, are referred to collectively as the Spokane River Hydroelectric Project. The Spokane River Hydroelectric Project operates to maximize power generation to meet local and regional electricity demands with consideration given to flood management, natural resource protection, recreation, and other associated needs (T. Vore, Environmental Coordinator, Avista, personal communication, 2003). Post Falls Dam has the largest storage capacity of the five dams and operates to meet several interests including: 1) compliance with minimum flow requirements of the FERC license and regulating Spokane River flows, 2) maximizing the storage capacity available in Coeur d' Alene Lake during spring runoff, 3) generating electricity to meet Avista customer energy demands, and 4) considering other upstream and downstream recreational, residential, and commercial interests as well as downstream resource needs. Upper Falls and Monroe Street dams are operated as run-of-river facilities, meaning water flow into the facility is essentially equal to downstream outflow. It also means reservoir water levels change little unless under flood conditions, operation and maintenance activities, or some other unusual circumstance (T. Vore, Environmental Coordinator, Avista, personal communication, 2003). Nine Mile Dam has a limited storage capacity that may be utilized when following changes in load demand with associated pool level fluctuations rarely more than a few inches (T. Vore, Environmental Coordinator, Avista, personal communication, 2003). The most downstream facility, Long Lake Dam, has a greater storage capacity than Nine Mile Dam, but less than half of Post Falls Dam. Long Lake Dam is operated as a storage and release facility for power generation purposes (T. Vore, Environmental Coordinator, Avista, personal communication, 2003).

The lower 29 miles of the Spokane River (also referred to as the Spokane Arm of Lake Roosevelt or Spokane Arm) is inundated by Grand Coulee Dam and is considered part of Lake Roosevelt. For management purposes, however, the Spokane Arm is included in the Spokane Subbasin. Grand Coulee Dam, as well as the upriver hydro-operations, control the physical and chemical conditions of the Spokane Arm. Currently, no dam on the Spokane River has a fish passage facility and all dams create fish barriers for upstream migration.

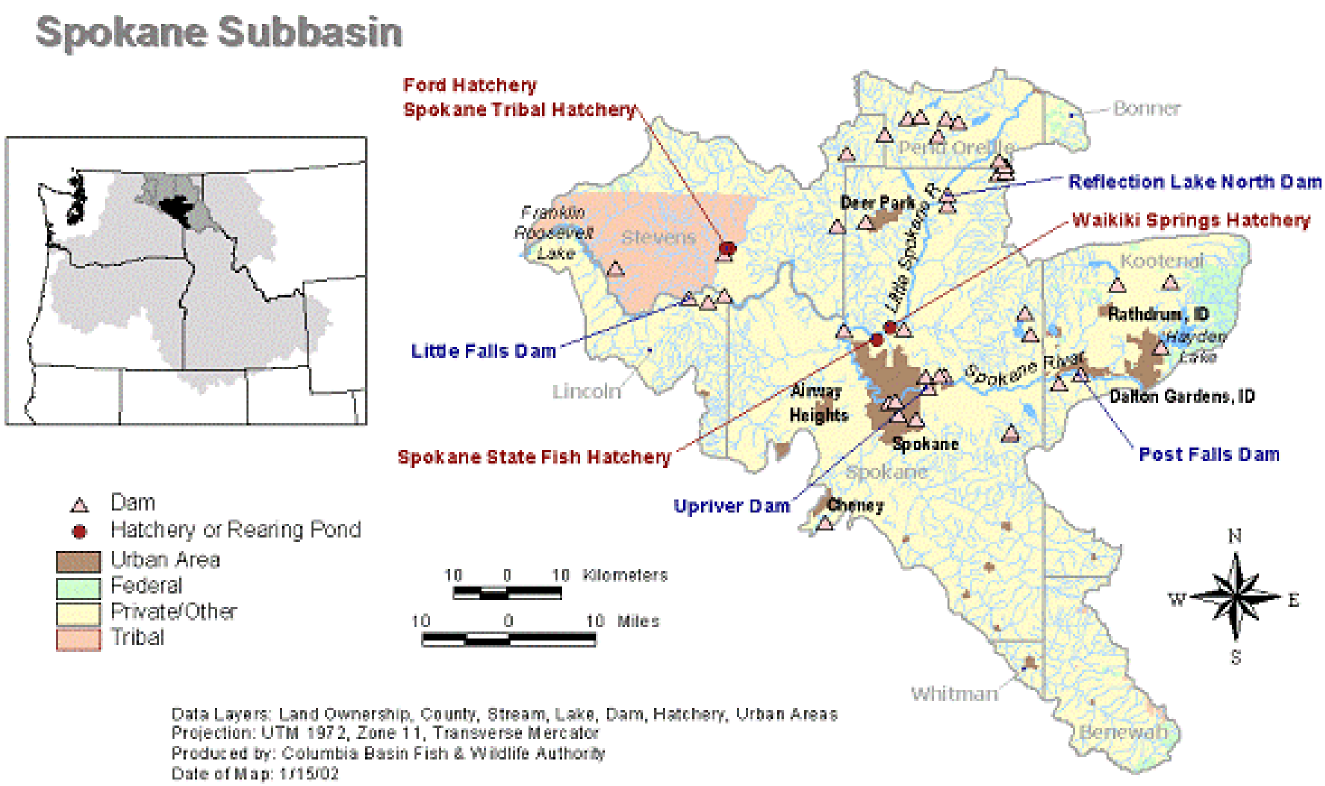


Figure 21.1. Map of Spokane Subbasin

21.2 Spokane Subbasin Description[1]

21.2.1 General Location

The Subbasin lies in five Washington counties, Pend Oreille, Stevens, Lincoln, Spokane, and Whitman and three Idaho counties, Benewah, Kootenai, and Bonner counties (Figure 21.1). The majority of the Subbasin (approximately 78 percent) lies within the state of Washington while the eastern, and generally higher elevations, portions lie within the state of Idaho. The Spokane Indian Reservation lies entirely within the Spokane Subbasin and borders the north shore of the Spokane River from Little Falls Dam west of the

[1] Large portions of Section 21.2 were contributed to by the Spokane River Subbasin Summary Report (2000) pp. 1-4.

confluence with the Columbia River. The western boundary of the Spokane Indian Reservation coincides with a portion of the western boundary of the Subbasin. The Subbasin covers approximately 43 percent of the Coeur d' Alene Indian Reservation, which is located in the southeastern portion of the Subbasin in the upper reaches of the Hangman Creek drainage. The southern boundary of the Coeur d' Alene Indian Reservation corresponds with the southern most boundary of the Subbasin. The western boundary or upstream boundary is in Idaho at Post Falls Dam.

The Spokane River flows west through the City of Spokane where it passes through three dams: Upriver Dam (RM 80.2, RM = River Mile refers to the distance from the confluence with Lake Roosevelt), Upper Falls Dam (RM 76), and the Monroe Street Dam (RM 74). Downstream of these dams, Hangman Creek is the first major tributary flowing into the Spokane River (RM 72). Continuing west, the Spokane River flows to Nine Mile Falls Dam (RM 58). As the river enters Lake Spokane (also known as Long Lake), a 24-mile long reservoir created by Long Lake Dam (RM 34), fluvial habitats change to lacustrine habitats. The Little Spokane River, the next major tributary, enters Lake Spokane (RM 56.5). From Long Lake Dam, the Spokane River continues to Little Falls Dam (RM 29), about 29 miles from the confluence with the Columbia River (Lake Roosevelt). The Spokane Indian Reservation borders the north shore of the Spokane River at the confluence of Chamokane Creek with the Spokane River (RM 32.5), 1.2 miles downstream of Long Lake Dam to the confluence with Lake Roosevelt.

21.2.2 Drainage Area

The water source for the Spokane River comes from the outlet of Coeur d' Alene Lake (RM 111) and its tributaries. The Spokane River and its tributaries are defined as waters downstream of Post Falls Dam. The Subbasin encompasses an area of approximately 2,400 square miles and incorporates the following four Water Resource Inventory Areas (WRIA) as designated by Washington Department of Ecology (WDOE):

1. WRIA 54, Lower Spokane (Figure 21.2)
2. WRIA 55, Little Spokane (Figure 21.3)
3. WRIA 56, Hangman (Latah), (Figure 21.4)
4. WRIA 57, Middle Spokane (Figure 21.5)

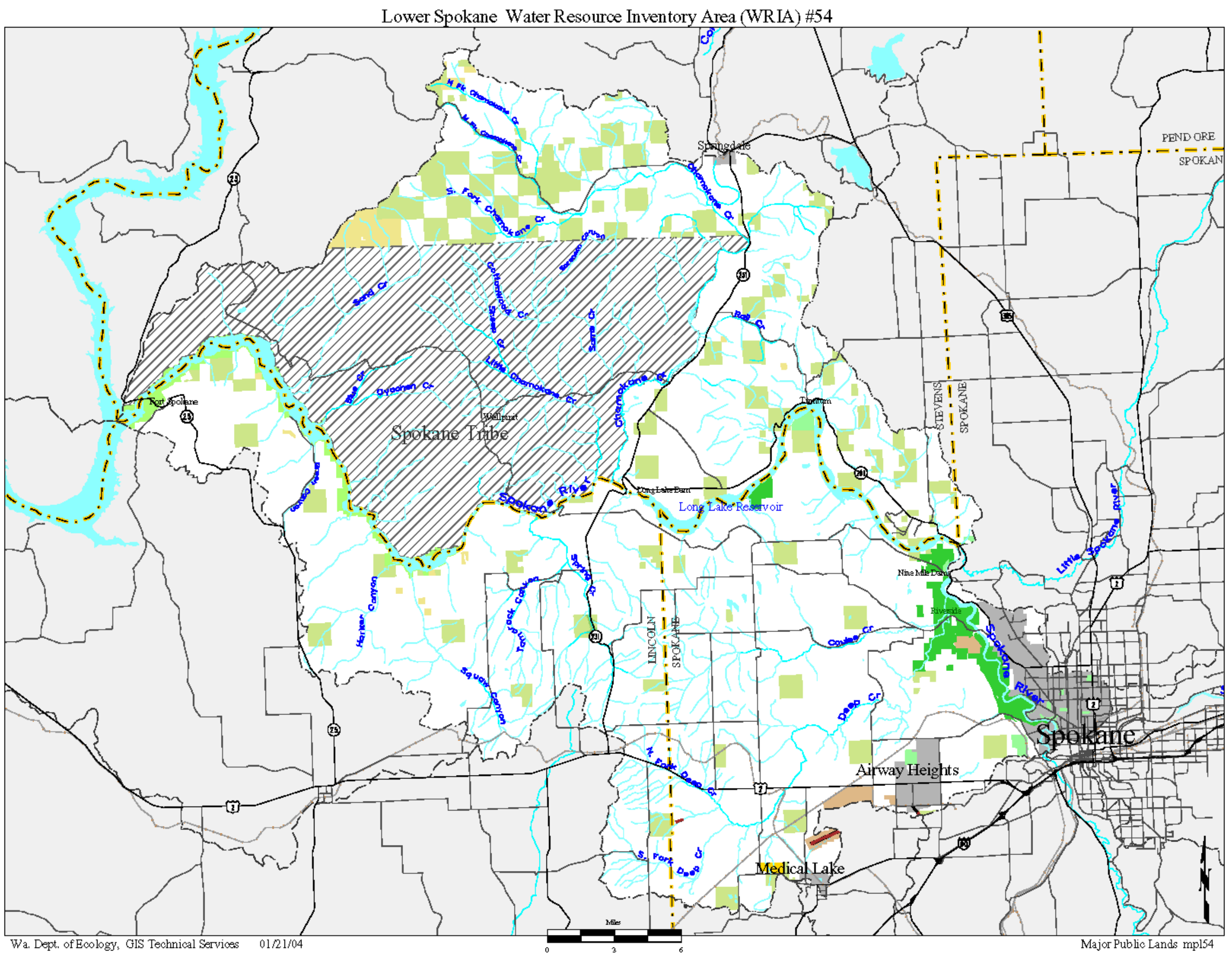


Figure 21.2. Map of WRIA 54

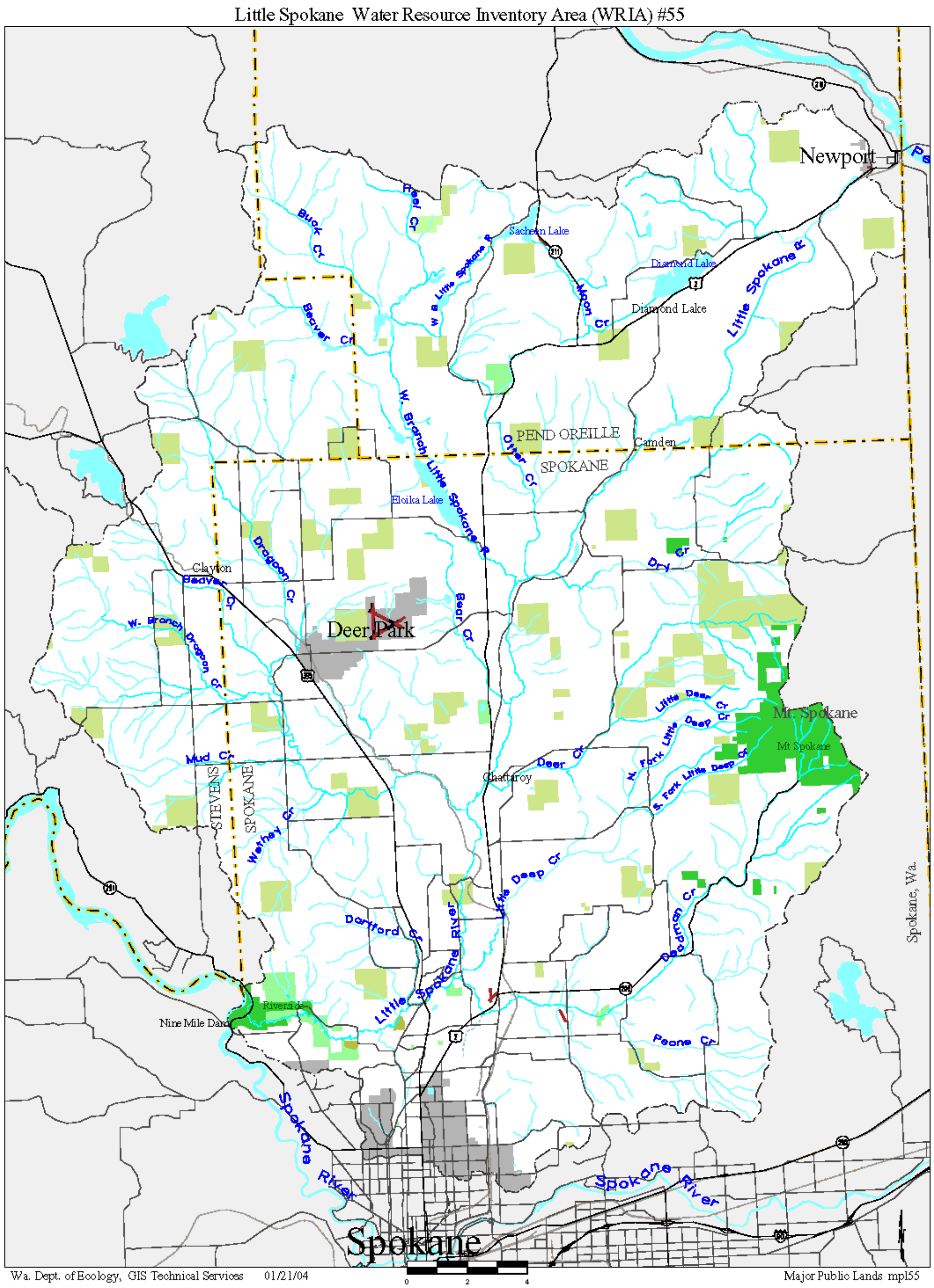


Figure 21.3. Map of WRIA 55

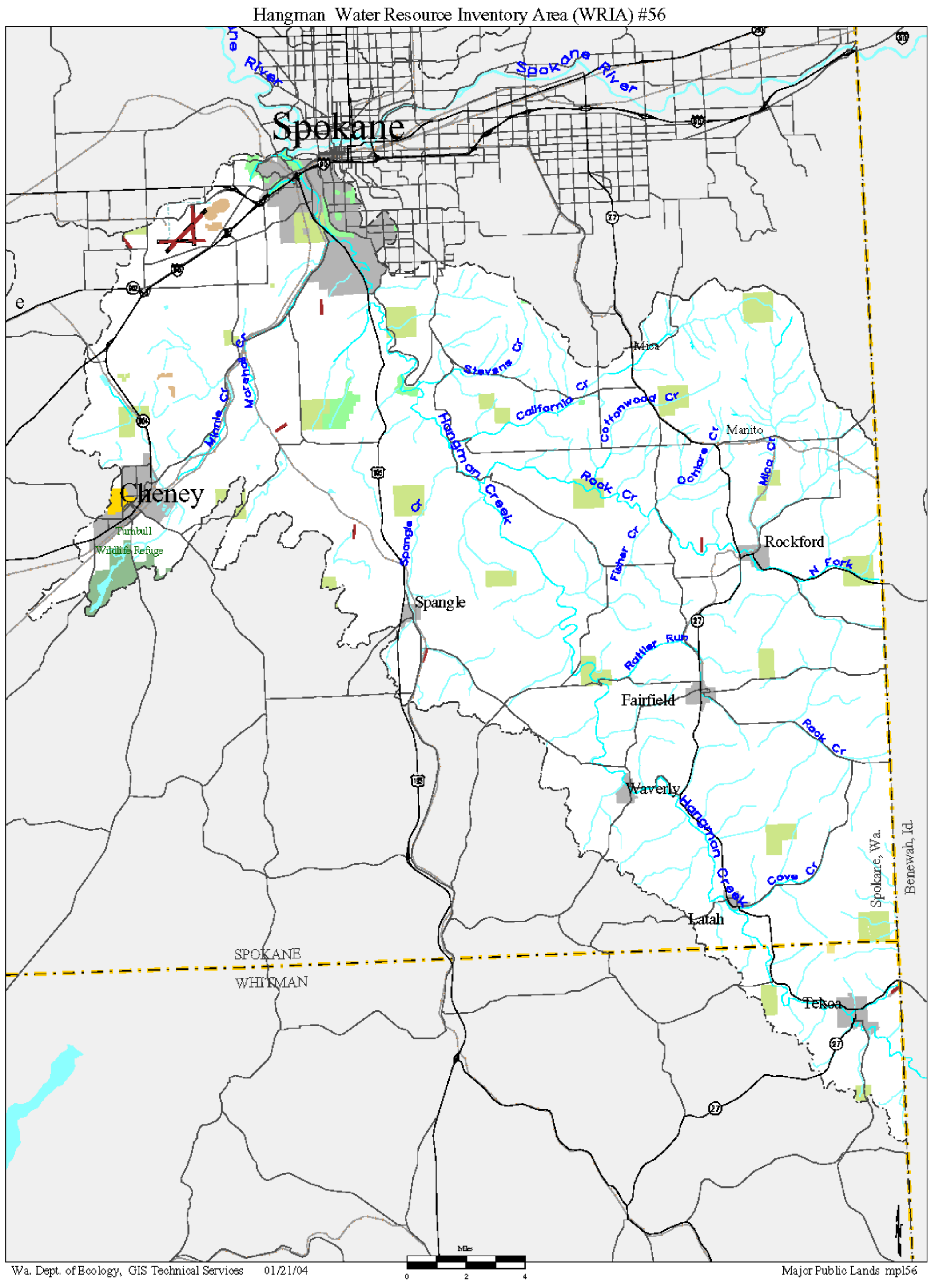
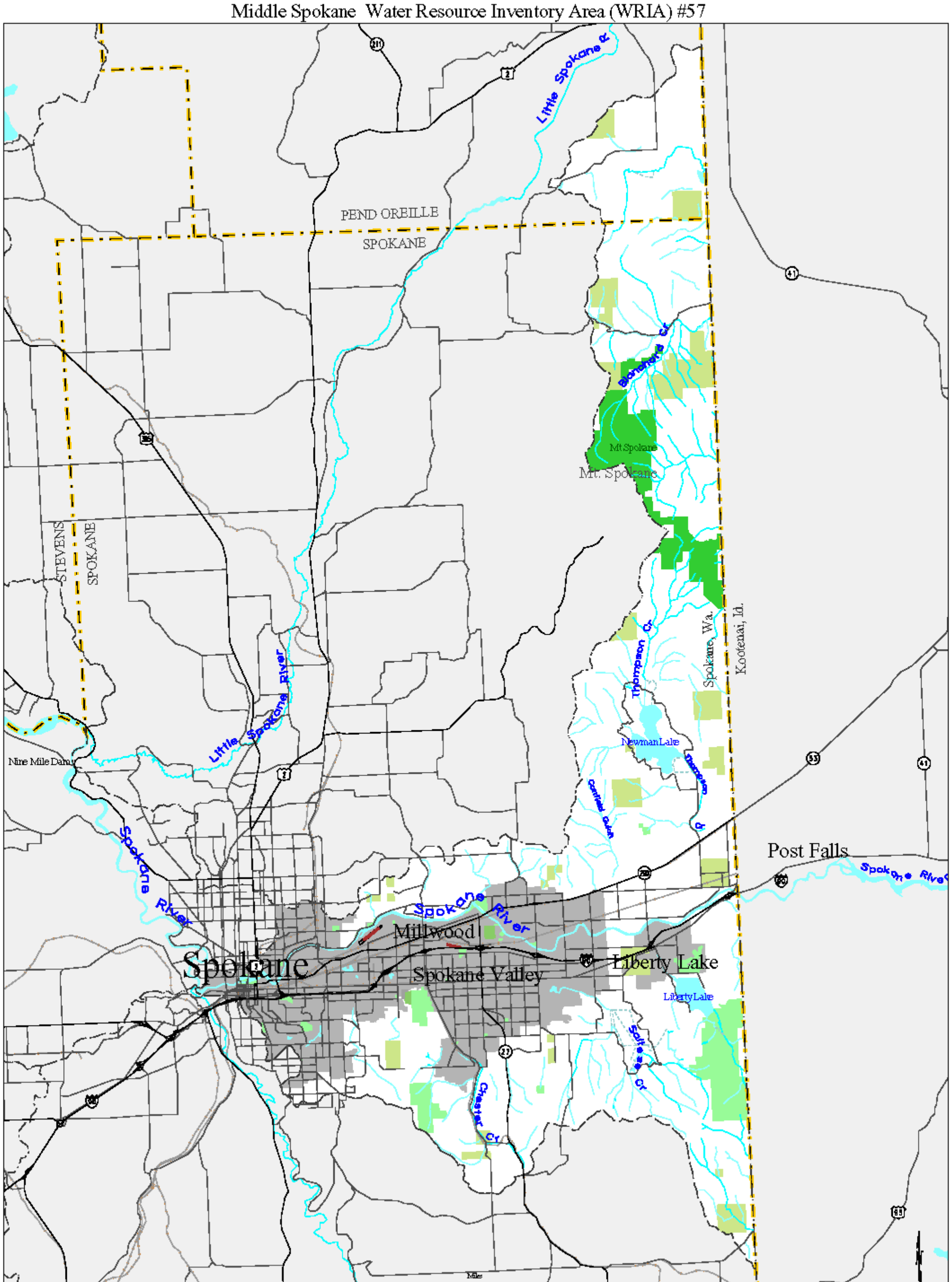


Figure 21.4. Map of WRIA 56

Middle Spokane Water Resource Inventory Area (WRIA) #57



Wa. Dept. of Ecology, GIS Technical Services 01/21/04

Major Public Lands mpl57

Figure 21.5. Map of WRIA 57

21.2.2.1 Spokane River

The Spokane River is a part of the Spokane Valley-Rathdrum Prairie Aquifer, which encompasses an area of about 320 square miles. The aquifer is bound by mountains to the north and south and extends from the east in Lake Pend Oreille and Coeur d' Alene Lake and to the west, the Little Spokane River. The aquifer flows east to west and is considered unconfined, meaning that the water table is not vertically confined and fluctuates with seasonal variation in recharge and discharge. The primary source of recharge comes from infiltration of precipitation and/or snowmelt, surface runoff (including any pollutants) from the watersheds, and inputs from the Spokane River between Post Falls Dam and Sullivan Road and from Coeur d' Alene Lake along with other lakes near the boundary of the Rathdrum Prairie. Below Spokane Falls, groundwater flows into the river from various seeps and springs, thus providing a direct connection between the river and aquifer. This is a sole source aquifer for many residents of the area in Idaho and Washington, including the city of Spokane (Available 2004: http://www.spokanecounty.org/utilities/wwfp/Nov01Rpt/BOPR%20Chapters/BOPR_Chapter_4.htm)

Flow conditions on the Spokane River fluctuate greatly between peak and base flows according to USGS records from 1891 to 2001 (USGS 12422500, Spokane River) (Figure 21.6). Historically, peak flows have occurred between December and June, with the majority occurring during May depending on the timing of rain and snow events (refer to section 21.2.3.1 for more on rain-on-snow events). Peak discharge has ranged from 7,610 to 49,000 cubic feet per second (cfs), while base flow during August and September averages approximately 1,750 cfs. The mean peak flow in May was on average 2,000 cfs lower from 1990-2001 compared to the mean discharge from 1891-2001 (Figure 21.7). Refer to Section 22.8.1 Environmental Conditions within the Subbasin, subheading Current Condition – Spokane River, for discussion comparing the Spokane River annual and seasonal hydrograph pre- and post-operation of Post Falls Dam (1906).

21.2.2.2 Little Spokane River

The Little Spokane River flows about 50 miles from the headwaters to the confluence with the Spokane River (Golder Associates 2003). The watershed is 710 square miles and drains the northeastern portion of the Spokane Subbasin. The major tributaries to the Little Spokane River include Dragoon, Deadman, Little Deep, and Deer creeks. The major lakes located in the northern half of the watershed include Eloika, Diamond, Sacheen, Horseshoe, and Chain lakes. Between 1930 and 2000 the average annual flow has been 303 cfs (USGS 12431000 Dartford). The monthly mean flow for the Little Spokane between 1929-2001 is shown in Figure 21.8. Refer to Section 22.8.1 Environmental Conditions within the Subbasin, subheading Current Condition – Little Spokane River, for discussion on the current Little Spokane River hydrograph and minimum flows.

21.2.2.3 Hangman Creek

Hangman Creek is in a low elevation watershed covering 689 square miles. The creek originates east of the Idaho-Washington border and passes through the Coeur d' Alene

Indian Reservation. Over 60 percent of the watershed is located in eastern Washington while the headwaters originate in the western foothills of the Rocky Mountains in Idaho. Approximately 20 miles of the lower creek flows through the northwest corner of the channeled scablands before joining the Spokane River (RM 72.4). The monthly mean flow in Hangman Creek at Spokane between 1948 and 2001 was 242 cfs (Figure 21.9) (USGS 12424000, Hangman Creek). The majority of the peak flow between 1948 and 2001 occurred between January and March with an occasional peak in late December or May (USGS, 2003). The average peak flow is about 7,585 cfs with the highest peak flow over 20,000 cfs in 1963 and 1997, and the lowest peak flow recorded at 395 cfs in 1994. From 1948 to 2001 summer (July-September) flows averaged 16.83 cfs but have been as low as 0.074 cfs (September 1992) (USGS, 2003). Current flow conditions are described as “flashy” and largely attributed to land use activities over the past century (agriculture, timber harvest, impervious surfaces, riparian/wetland removal, roads, stream channelization, etc.).

21.2.2.4 Chamokane Creek

Chamokane Creek drainage is 179 square miles and borders the Spokane Tribe of Indians Reservation. Data collected between 1971-2002 (USGS 12433200) below Tshimikain Falls indicate peak flows for Chamokane Creek occur in March (~175 cfs), but may vary between January and April, and base flows (~30 cfs) occur from August through November (Figure 21.10). Peak flow in Chamokane Creek (1971-2002) reached a high of 2,200 cfs in 1975 and has been greater than 1,000 cfs in 1971, 1974-75, 1995, 1997, and 1999 (USGS 2003). Between 1971 and 2002, the highest mean monthly flow for March was 626 cfs in 1997 and the lowest was 30 cfs in 1977. During the same time period (1971-2002), the highest mean base flow from August to November was 45 cfs, observed in 1997, and the lowest was approximately 19 cfs, observed between 1990 and 1992 (USGS 2003).

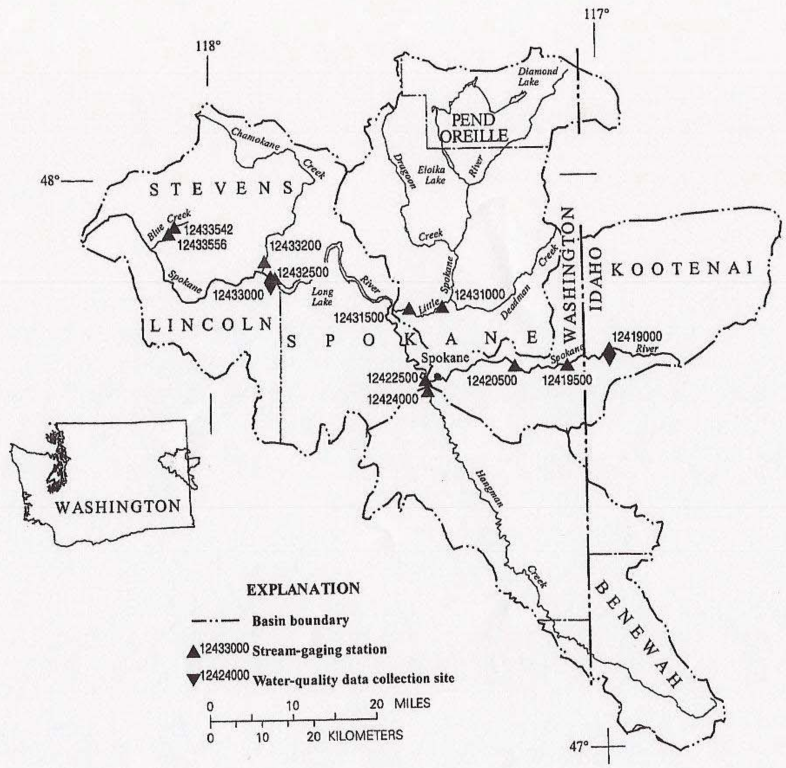


Figure 21.6. Map of the Spokane Subbasin and USGS surface water and water quality stream stations (*Source*: USGS)

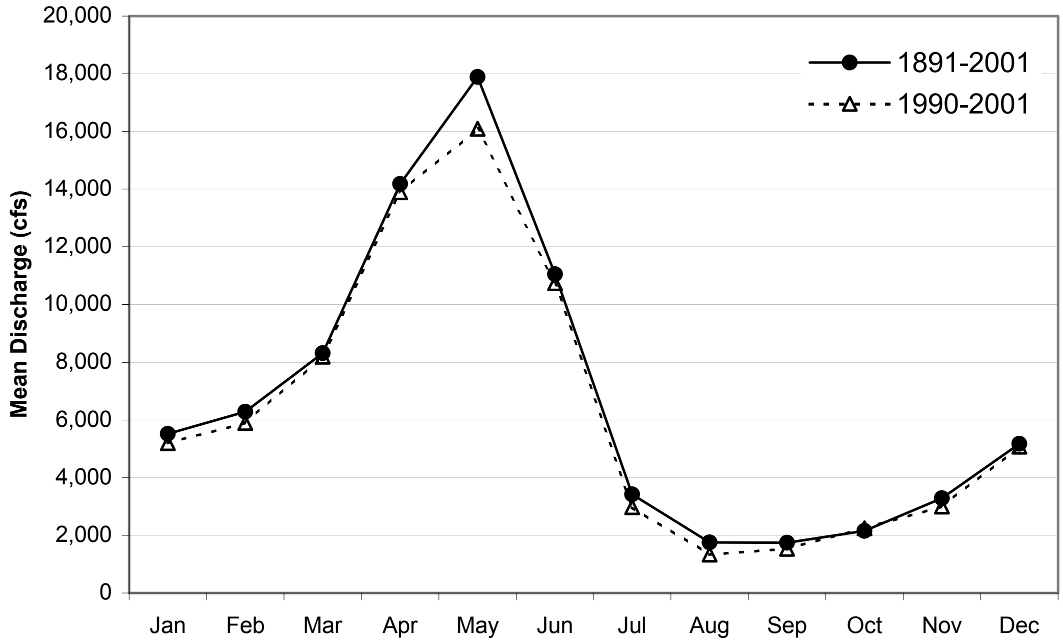


Figure 21.7. The hydrograph of the monthly mean flow between 1891-2001 and 1990-2001 for the Spokane River below the Monroe Street Dam (*Source*: USGS 12422500)

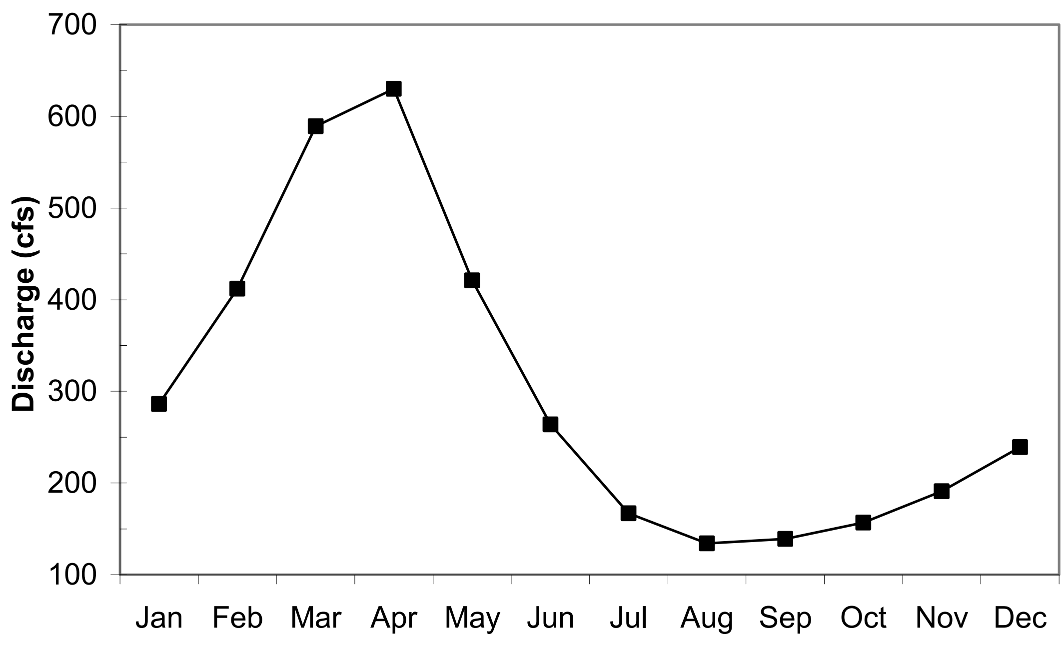


Figure 21.8. The hydrograph of the monthly mean flow between 1929-2001 for the Little Spokane River measured at Dartford, Washington (*Source*: USGS 12431000)

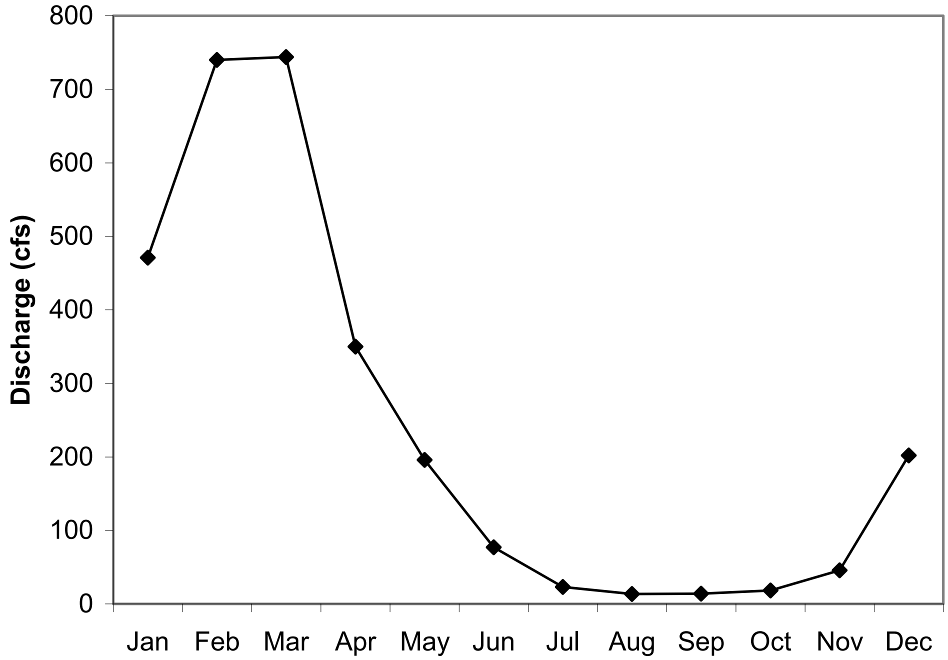


Figure 21.9. The hydrograph of the monthly mean flow between 1948-2001 at Hangman Creek at Spokane, Washington (*Source:* USGS 12424000)

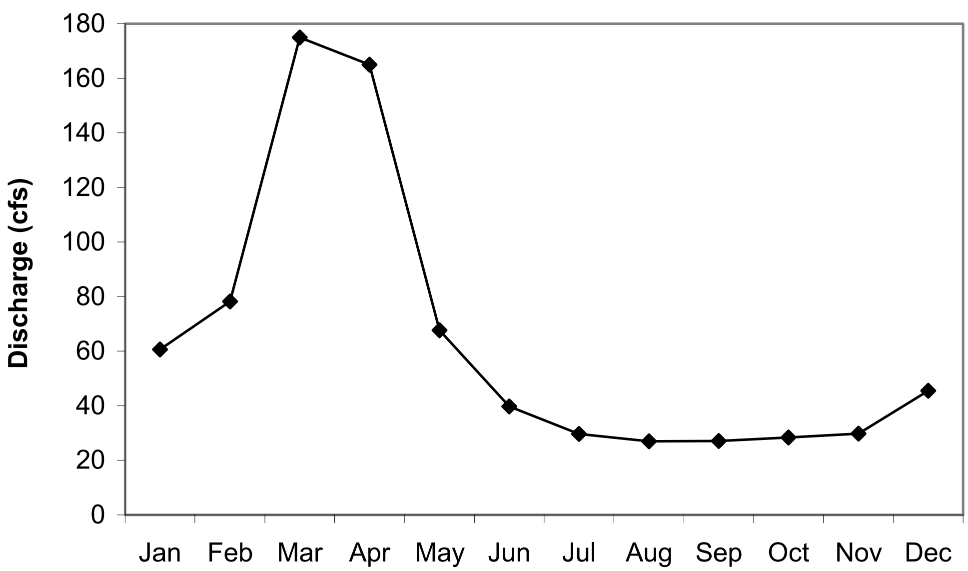


Figure 21.10. The hydrograph of the monthly mean flow between 1971-2002 for the Chamokane River measured below the falls near Long Lake (*Source*: USGS 12433200)

21.2.2.5 Lake Spokane

Lake Spokane is a 39-km (24-mile) long reservoir created when Long Lake Dam impounded the Spokane River in 1915. The reservoir has a maximum depth of 54 m, a mean depth of 15 m, and useable storage capacity of 105,000 acre-feet (Osborne et al. 2003). Lake Spokane is currently operated in the summer within one foot of full pool elevation. Under the Avista Corporation's existing FERC license, the maximum drawdown level is 7.3 m with attempts to limit fluctuations of the reservoir levels to a maximum of 4.3 m. An assessment of current habitat conditions (physical and chemical characteristics) in the reservoir is addressed in Section 22.8.1.8.

21.2.3 Climate

The Spokane Subbasin has a continental climate that is influenced by maritime air masses from the Pacific Coast. The average annual temperature between 1953 and 1983 was 9.4 °C, with July being the warmest (average 21.6 °C) and January being the coldest (average -1.5 °C). Annual precipitation from rain for the area is about 45 centimeters (cm) and for snowfall is about 27 cm (Western Regional Climate Center, http://www.wrcc.dri.edu).

21.2.3.1 Rain-on-Snow Events

Rain-on-snow (ROS) events are described as runoff from rain falling on snow. This type of weather event has been associated with mass-wasting of hill slopes, damage to river banks, downstream flooding, and associated damage and loss of life. Some of the management issues associated with ROS events include identifying the effects of land use activities that have eliminated riparian buffers and/or reduced vegetative cover in the watershed, which can result in significant flooding and increased sediment loading during a ROS event. Physical processes involving topography and ROS events indicate rain falling on snow in open areas with reduced vegetative or canopy cover that attenuates and intercepts rainfall produces more water available for surface runoff compared to rain falling in, for example, forested areas (http://wa.water.usgs.gov/projects/rosevents/summary.htm).

In 1989, the duration of ROS events within the Spokane Subbasin extended between zero to nine days with the average lasting between two and three days (Figure 21.11). The occurrence of ROS events was based on an average year of precipitation. The greatest number of days of ROS events occurred in the eastern portion of the Subbasin, east of the Idaho-Washington state line. Data estimating the increase in water availability for surface runoff during the ROS events was not available and is not reflected in Figure 21.11.

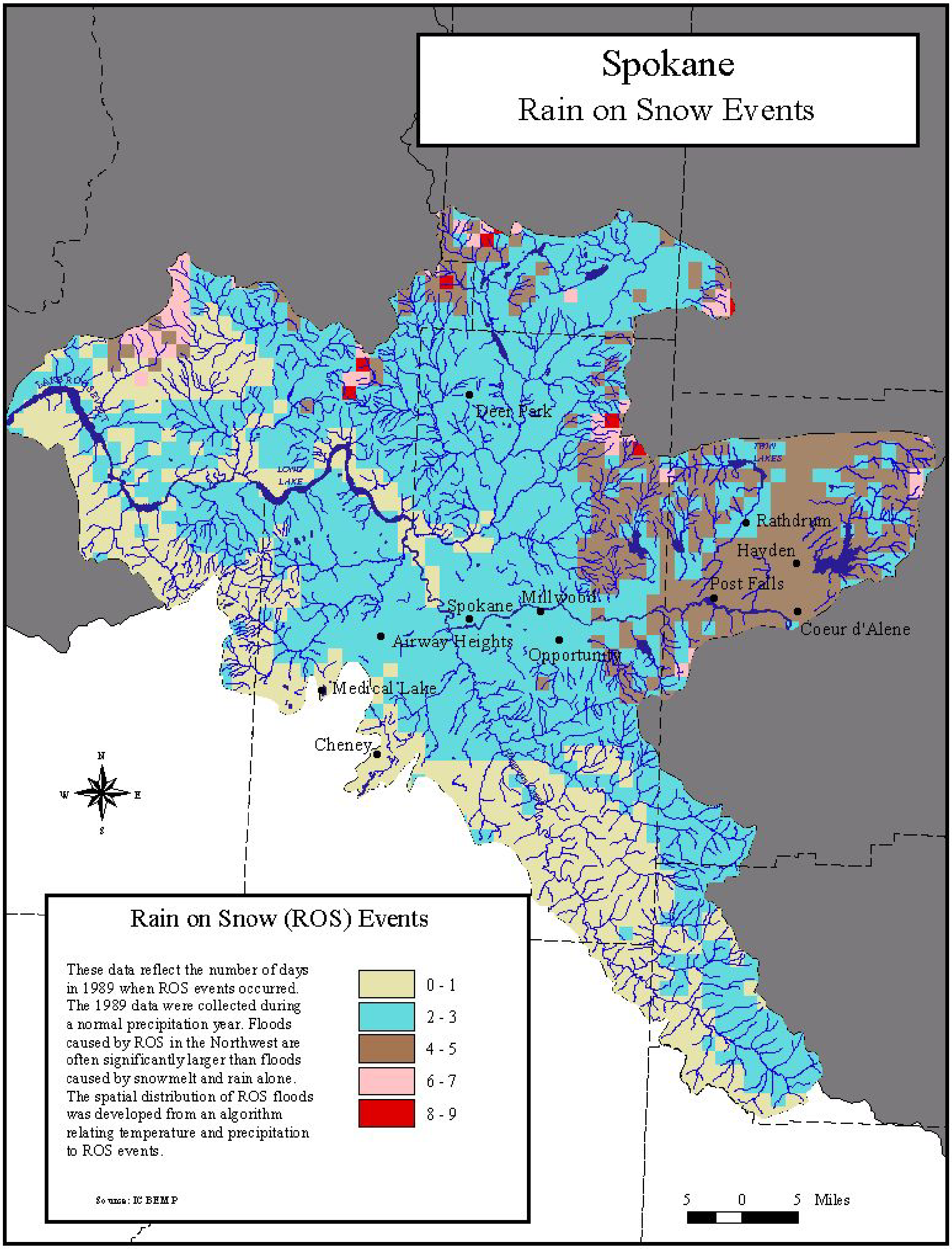


Figure 21.11. Rain-on-Snow (ROS) events during 1989 (a normal precipitation year) shown as the number of days of occurrence within the Spokane Subbasin (*Source*: Interior Columbia Basin Ecosystem Management Project, ICBEMP)

21.2.4 Geology and Soils

21.2.4.1 Geology

The Spokane Subbasin is represented by the Okanogan Highlands to the north and Columbia Basin, also known as the Columbia Plateau, to the south. Basalt flows during the Miocene period and glacial activity during the Pleistocene define the land formation and geological characteristics of the Columbia Plateau. Land formation and sculpting in the Okanogan Highlands was largely associated with glacial covering and activity during the Pleistocene.

Two geologic provinces, the old North American Continent and the Columbia Plateau characterized the Spokane Subbasin. The old North American Continent is represented by a small part of the Rocky Mountains in northeastern Washington. The ancient rock from the continental crust is more than two billion years old and consists of a combination of metamorphic rocks such as granite and gneiss (Alt and Hyndman 1984). Geologically, the Columbia Plateau comprises the Columbia Basalt Group that is differentiated into four formations that consisted of 61 different basalt flows that covered a total of 4,120 square miles (Mueller and Mueller 1987). In the Spokane Subbasin, the Columbia Plateau was formed by a series of black basalt lava flows from the Wanapum (Priest Rapids Member) and Grand Ronde formations 14-16 million years ago (Miocene period), which are visible in the current landscape (Alt 2001; Mueller and Mueller 1997; Alt and Hyndman 1984). In between these eruptive flow events, erosional and depositional processes occurred leaving material such as sands, gravels, glaciolacustrine clays, and Palouse loess either within the basalt layers or overlying some basalt flows (Derkey and Hamilton 2003). One of the sedimentary horizons, referred to as the Latah Formation, is visible in the Hangman Creek watershed.

Most recent glacial activity occurred during the Pleistocene period. Glacial Lake Columbia and Glacial Lake Missoula had the most significant impacts on the formation and shaping of the scablands characteristic of the Spokane Subbasin. Glacial Lake Columbia was a large lake impounded by an ice dam and filled the Rathdrum Prairie, Spokane Valley, and the Spokane River valley extending from the east above today's Coeur d' Alene Lake to the west of Grand Coulee (Alt 2001). Although Glacial Lake Missoula was located outside of the Spokane Subbasin, massive flood events from the lake scoured the floor of the Spokane Valley (Alt 2001). Glacial Lake Missoula was impounded by an ice dam and covered an area of 7,770 square kilometers (3,000 square miles) (Alt 2001). The lake was 300 km (186 miles) long and 105 km (65 miles) wide (Alt 2001), with a lake volume comparable to Lake Erie or Lake Ontario today. Flood deposits in the Spokane Subbasin (also in Idaho, Oregon, and other regions of Washington) indicate that between 40-70 massive flooding events originating from Glacial Lake Missoula occurred over a 10,000-year period or more (Alt 2001). The flooding transported and deposited large amounts of glacial out-wash onto the floor of the Spokane Valley, filling old river channels, and impounding some of today's lakes (Alt 2001). The intense floods also removed Palouse loess soil from top of the basalt, cut into the basalt forming the channeled scablands, and left fine-grained sediment deposits in slackwater areas (Alt and Hyndman 1984), such as today's Hangman Valley (Alt 2001). Some flood deposits in Hangman Valley range in thickness from 3 to 17 feet (Alt 2001).

21.2.4.2 Soils

Soils in the Spokane Subbasin are closely tied with elevation. Areas of high elevation have soils derived from a granite parent material. The texture is usually gravelly sandy loam or silt loam and has a depth of one meter or less. A substantial amount of these high elevation soils have a considerable amount of volcanic ash. Surface layers of these soils usually have a silt loam texture while subsoils are generally gravelly loam. At lower elevations in the margins of river valleys, the most abundant parent material is glacial till. Textures of these soils are usually sandy loam to loam, and are moderately dark. At the lowest elevations, along major rivers, soils are coarse in texture and well drained to excessively well drained. Glacial out-wash sands and gravels are the most abundant parent materials. Palouse loess deposits, yellowish brown sand and silt, are also found within the Spokane Subbasin and are more characteristic of the Hangman watershed. Some of the loess deposits in the Columbia Basin can be 150 ft (46 m) or more thick.

21.2.4.3 Spokane Arm, Lake Roosevelt Shoreline Erosion

The Lake Roosevelt shoreline extends approximately 530 miles, and about 70 percent of the shoreline consists of easily eroded unconsolidated sediments (USBR 2000). The sediments are alternately exposed, during winter reservoir (Grand Coulee Dam) drawdowns, and inundated during full pool operation. The combination of wave action and water fluctuations has contributed to slope failures of these inherently unstable soils at many locations around the reservoir. Figure 21.12 shows the portion of Lake Roosevelt located within the Spokane Subbasin, referred to as the Spokane Arm, and highlights the areas of high erosion potential along the shoreline. Analysis of a 300-foot wide band, extending upslope from the full pool reservoir elevation of 1,290 feet, shows that 23 percent of the area within the band is classified as high erosion potential, while 7 percent of the area is bedrock.

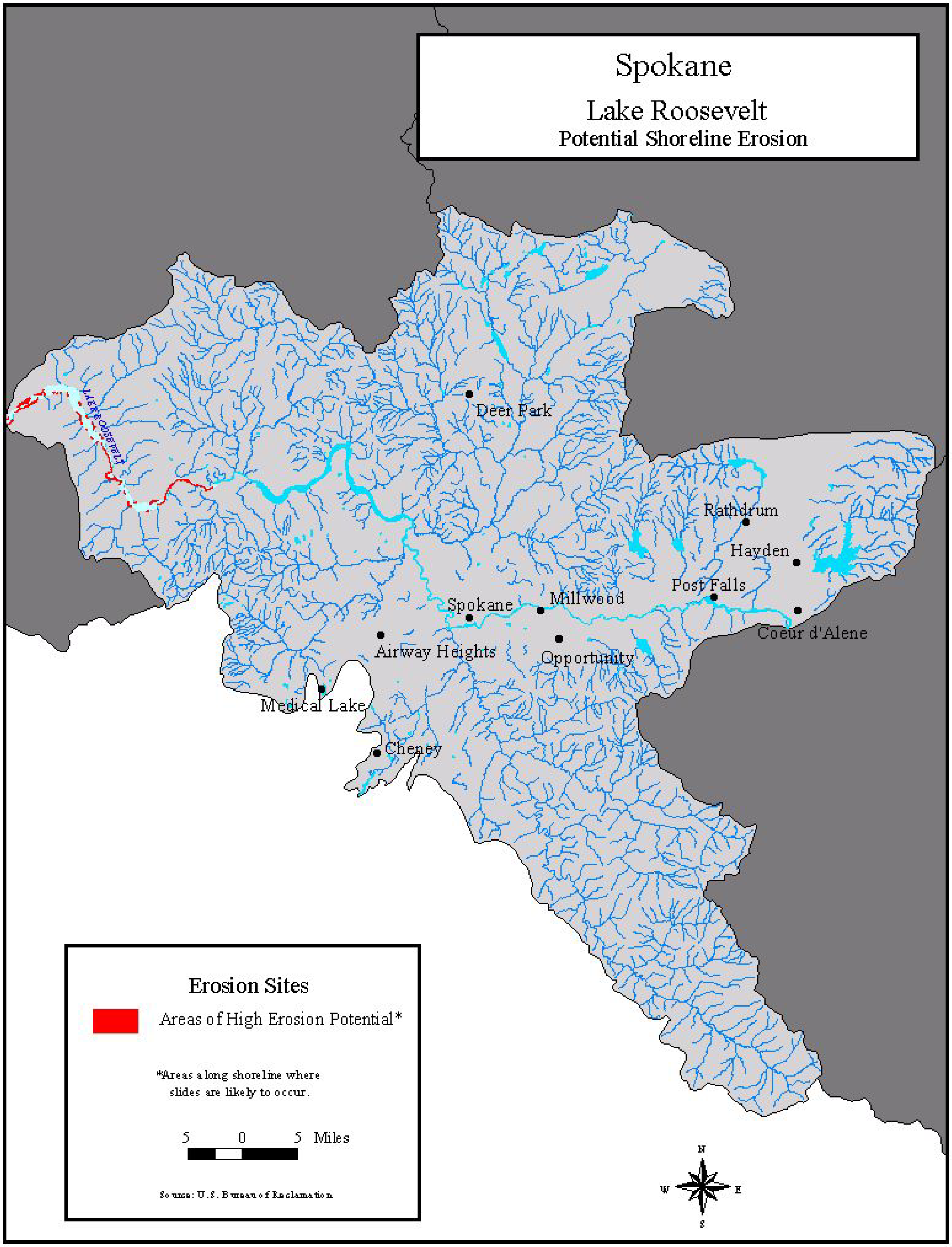


Figure 21.12. Areas of high erosion potential in the Spokane Arm, emphasized for display purposes, not to scale

21.2.5 Topography/Geomorphology

The upper Spokane River, between Post Falls and Upper Falls dams is a relatively low gradient river characterized by a wide valley and marginal channel entrenchment. Channel characteristics consist of unembedded boulder substrate, stable banks, and direct connections with the Spokane Valley-Rathdrum Prairie Aquifer. Spokane Falls marks a "nick point" (a point where the stream gradient changes) and is comprised of Miocene basalt flows. The channel is highly entrenched and bedrock is the dominant substrate. Below Spokane Falls the channel is deeply entrenched with a relatively narrow valley floor dominated by unembedded cobble to boulder substrate in areas not affected by reservoir conditions.

The Little Spokane River drainage is located in the northern portion of the Subbasin where the headwaters originate in Pend Oreille County. The majority of the drainage consists of forests (~68 percent, Golder Associates 2003) and mountainous terrain. The geology within the watershed is largely comprised of granitic formations, thus the presence of fines in the channel is increased as a result of disintegrated granite (grus) from chemical processes such as hydrolysis. Elevations in the drainage range from the highest areas in the north and east sides at 5,300 feet to 1,540 feet amsl at the confluence with the Spokane River. The drainage is represented by both the Columbia Plateau Province and North Rocky Mountain Province (Golder Associates 2003). The Columbia Plateau Province has relatively broad and flat topographic features with incised stream channels and is descriptive of the southern portion of the drainage. In contrast, the Rocky Mountain Province where the stream channels have a lower degree of sinuosity and the channels are confined by steep-sided canyons characterizes the northern portion of the drainage.

The Hangman Creek watershed represents the southern portion of the Spokane Subbasin. The headwaters of Hangman Creek lie above 3,600 feet above mean sea level in the western foothills of the Clearwater Mountains. These foothills are part of the Rocky Mountains of the old North American Continent. Slopes are steep, largely forested, and stream courses are set in deep mountainous drainages. Water flowing northwesterly in Hangman Creek from the Mountain foothills passes through the rolling Palouse Hills, were valley bottoms are broad with low gradients. The streams in the upper portions of the rolling Palouse Hills within the Coeur d'Alene Indian Reservation are perched well above the water table due to the thick layers of basalt under the deep Palouse loess soils (Ko et al., 1974). The water table and the stream elevations converge near the current border between the states of Washington and Idaho (Buchanan and Brown, 2003). The stream enters deep and narrow basalt canyons as it leaves the rolling Palouse Hills and ultimately flows into a broad alleviated valley as it joins the Spokane River (SCCD, 1994).

Matt and Buchanan (1993) and Howard et al. (1989) describe the topography and geomorphology in the Chamokane Creek (see Section 53 References). Refer to Section 22.8.1 regarding the current environmental conditions of Chamokane Creek.

21.2.6 Vegetation

Historically vegetation in the Subbasin ranges from shrub-steppe in the far west to open grass prairies in the rolling Palouse Hills. The grasslands transition with increased elevation into mountainous Douglas fir/ponderosa pine/larch/grand fir coniferous communities (refer to Figure 4.1 in Section 4.2 Historic Focal Habitat Conditions). Limited high elevation areas with moist soil conditions exhibit cedar/hemlock communities. Dryland crops such as wheat, turfgrass, alfalfa, and legumes dominate the Palouse soils of the southern portion of the Subbasin. Land use activities such as agriculture and logging, as well as the urban setting of much of the Subbasin has resulted in displacement of native vegetation with landscaping and ornamental vegetation. Figure 21.13 shows the current distribution of wildlife-habitat types in the Spokane Subbasin based on IBIS (2003).

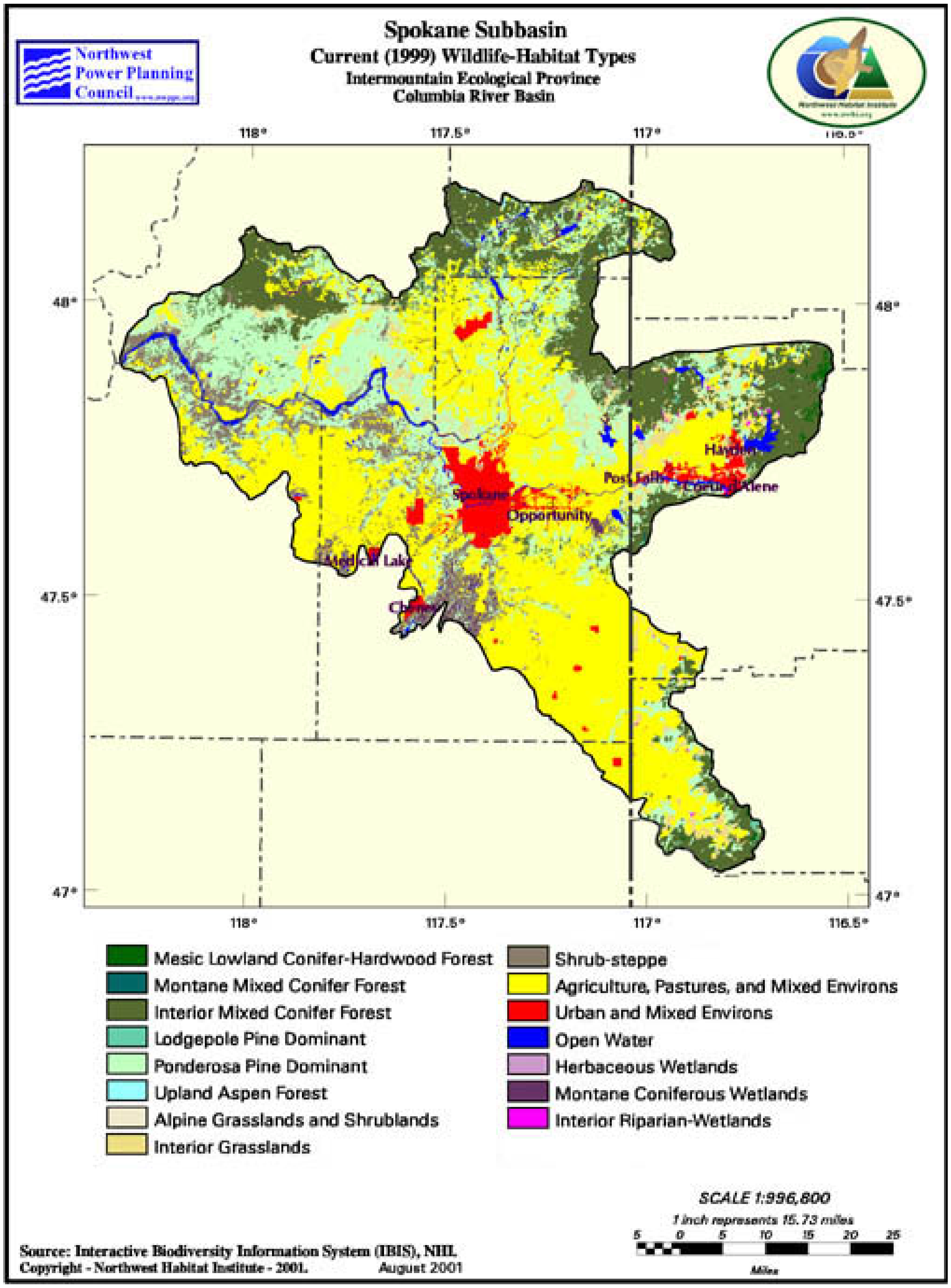


Figure 21.13. Current vegetation cover and major land use within the Spokane Subbasin

21.2.7 Major Land Uses

A map of land ownership is presented in Figure 21.1, and provides an indication of broad categories of land use in the Spokane Subbasin. Land use is heavily impacted from anthropogenic activities such as agriculture (fruit crops, cultivated crops, livestock rearing) and increasing development throughout the Spokane Subbasin. The Subbasin is broadly affected by both concentrated and diffused residential growth, which is intensifying stress on natural resources. A large part of the Subbasin is affected by urbanization from the City of Spokane and surrounding suburbs. Agricultural land uses are also widespread. Cattle graze extensively throughout the Subbasin, while dryland crops generally dominate the southern portion of the Subbasin. Livestock trample riparian areas and stream banks and contribute to fecal coliform, temperature, and dissolved oxygen water quality issues. Poor riparian condition reduces natural filtration processes and allows for increased sedimentation into streams negatively impacting channel morphology and aquatic habitat. Timber harvest is also an important land use in the Little Spokane River drainage and the headwaters of Hangman Creek.

Current watershed conditions and limiting factors with respect to the smaller drainages (Little Spokane River, Hangman Creek, etc.) are presented in Section 22.8 Environmental Conditions and Section 22.9 Limiting Factors and Conditions.

21.2.7.1 Road Density

Road densities in the Spokane Subbasin vary from low to very high, with the majority of the basin ranked as moderate. Figure 21.14 displays road density by density class in sixth order watersheds of the Spokane Subbasin. Very high road densities (4.7-16.4 miles per square mile) are present in the urban center consisting of Spokane and Spokane Valley, as well as on the Spokane Indian Reservation.

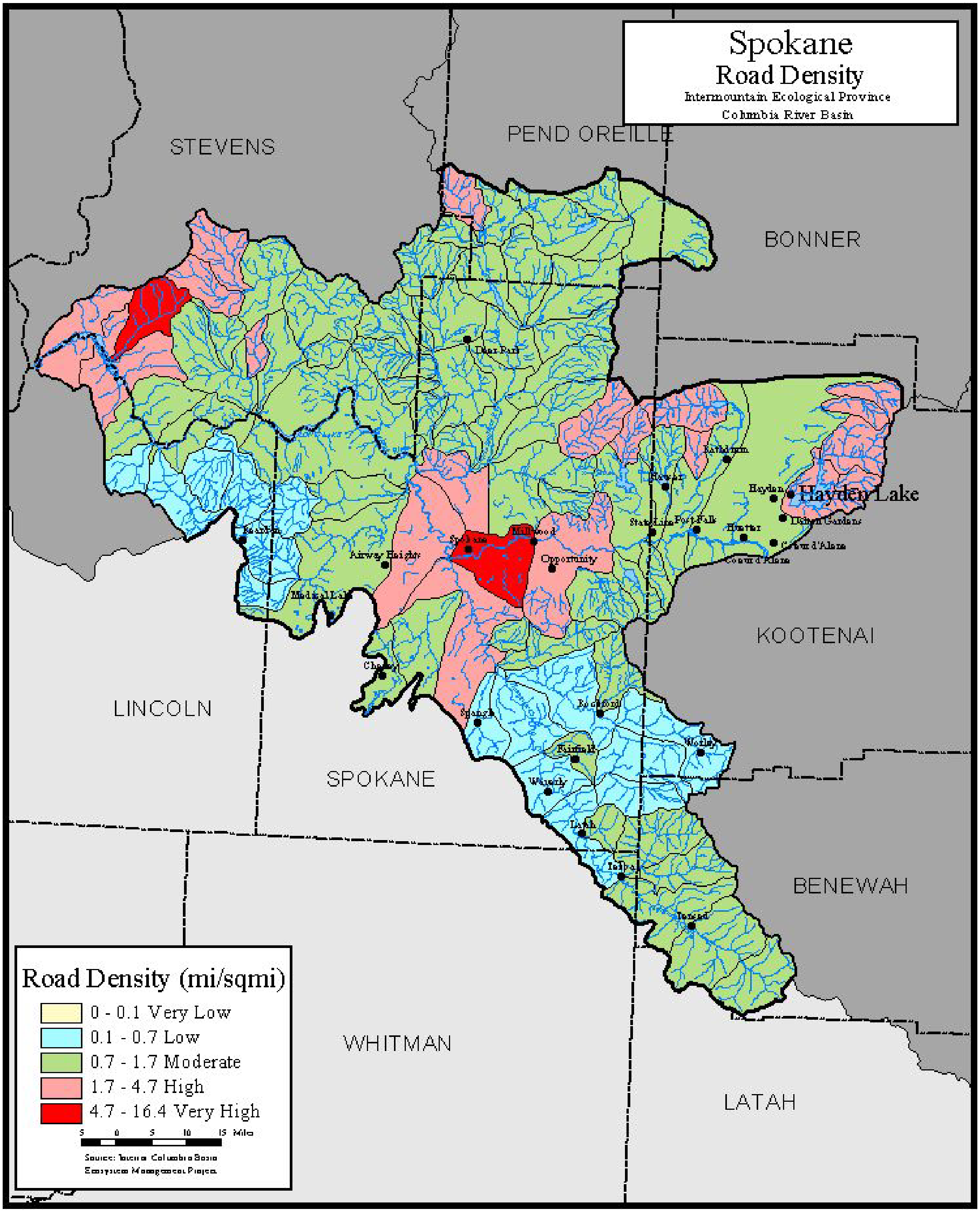


Figure 21.14. Road density within the Spokane Subbasin ranges between low (0.1-0.7 miles/square mile) to very high (4.7 to 16.4 miles/square mile)

21.3 Logic Path

The logic path starts with an overall physical description of the Subbasin, followed by an assessment of aquatic and terrestrial resources from which a management plan was created with specific strategies and objectives to address limiting factors and management goals. In the next section, Section 22: Aquatic Assessment Spokane Subbasin, aquatic resources regarding the historic and current status of selected focal species are described in detail. An analysis based on the QHA technique (described in Section 3) identifies specific habitat attributes that have been altered the most over time relative to the entire Subbasin and which areas in the Subbasin are categorized as having poor or good habitat for the respective focal species. Based on the current status of the focal species, limiting habitat attributes, and management goals recognized in the Subbasin, strategies and objectives were identified and are presented in Section 26: Spokane Subbasin Management Plan. The terrestrial assessment, presented in Section 24, provides a description of the historic and current status of wildlife species and condition of terrestrial habitat types within the Subbasin. Based on the terrestrial assessment and key findings, strategies and objectives were developed and are defined in Section 26: Spokane Subbasin Management Plan.

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22 Spokane Subbasin Assessment – Aquatic

22.1 Species Characterization and Status[1]

Over 35 species of fish, including 20 native species, are found in the Spokane Subbasin (Table 22.1).

Table 22.1. Fish species currently present in the Spokane Subbasin

Species	Origin	Location	Status
White Sturgeon (*Acipenser transmontanus*)	N	L	D
Chiselmouth (*Acrocheilus alutaceus*)	N	L,R,T	C,S
Largescale sucker (*Catostomus catastomus*)	N	L,R,T	C,S
Bridgelip Sucker (*C. columbianus*)	N	L,R,T	C,S
Longnose sucker (*C. macrocheilus*)	N	L,R,T	C,S
Piute sculpin (*Cottus beldingi*)	N	L,R,T	U
Slimy sculpin (*C. cognatus*)	N	L,R,T	U
Torrent sculpin (*C. rhotheus*)	N	L,R,T	U
Burbot (*Lota lota*)	N	L	U
Peamouth (*Mylocheilus caurinus*)	N	L,R	C,S
Westslope cutthroat trout (*Oncorhynchus clarki lewisi*)	N	L,R,T	O,D
“Coastal” Rainbow trout (*O. mykiss*)	N	L,R,T	C
Redband trout (*O. mykiss gairdneri*)	N	R,T	O,D
Mountain whitefish (*P. williamsoni*)	N	L,R,T	U
Northern pike minnow (*Ptychocheilus oregoninsis*)	N	L,R	C,S
Longnose dace (*Rhinichthys cataractae*)	N	L,R,T	C,O,D
Speckled dace (*R. osculus*)	N	T	C
Redside shiner (*Richardsonius balteatus*)	N	L,R,T	C,S
Bull trout (*Salvelinus confluentus*)	N	L,R,T	O,D
Kokanee salmon (*Oncorhynchus nerka*)	N,E	L,R,T	C
Yellow bullhead (*Ameiurus natalis*)	E	L,R	U
Brown bullhead (*A. nebulosis*)	E	L,R	U
Lake whitefish (*Coregonus clupeaformis*)	E	L,R	C
Carp (*Cyprinus Carpio*)	E	L	U
Grass pickerel (*Esox americanus vermiculatus*)	E	R,T	O
Northern pike (*E. lucius*)	E	L	U
Tiger Musky (*E.lucius X E. masquinongy*)	E	L	C
Channel catfish (*Ictalurus punctatus*)	E	L,R	C
Green sunfish (*Lepomis cyanellus*)	E	L	A
Pumpkinseed (L. gibbosus)	E	L,T	O
Smallmouth bass (*Micropterus dolomieui*)	E	L,R	C,S
Largemouth bass (*M. salmoides*)	E	L,R	C
Yellow perch (*Perca flavescens*)	E	L,R	C
Crappie, black and white (*Pomoxis spp.*)	E	L,R	C,S
Brook trout (*Salvelinus fontinalis*)	E	R,T	C
Brown trout (*Salmo trutta*)	E	L,R,T	C
Tiger trout (*Salmo trutta X Salvelinus fontinalis*)	E	L	C
Walleye (*Sander vitreus*)	E	L	C
Tench (*Tinca tinca*)	E	L,R,T	O
E=Exotic, N=Native, L=Lake, R=River, T=Tributary, A=Abundant, C=Common, O=Occasional, U=Unknown, S=Stable, I=Increasing, D=Declining			

[1] Large portions of Section 22.1 were contributed to by the Spokane River Subbasin Summary Report (2000) pp. 4-9.

Many of the fish species hold important economic, aesthetic, cultural, recreational, and ecological value to the region. Based on these values, five species (redband trout, mountain whitefish, kokanee salmon, Chinook salmon, largemouth bass) were selected as focal species and are discussed in more detail in sections 22.2 to 22.7.

22.1.1 Anadromous Fishes

Historically, the Spokane River was famous as a recreational and subsistence fishery for both anadromous and resident salmonids (Stone 1883; Gilbert and Evermann 1895; Scholz et al. 1985). The STOI harvested various anadromous species such as Chinook salmon, sockeye salmon, coho salmon, and steelhead on the Columbia River (now part of Lake Roosevelt) up to Kettle Falls (Scholz et al. 1985). Along the Spokane River from the mouth up to Spokane Falls, Chinook salmon, sockeye salmon, and steelhead were the primary anadromous species the STOI harvested (Scholz et al. 1985). Salmon and steelhead were also harvested in Little Spokane River and its tributaries, Chamokane Creek below Tshimikain Falls and Hangman Creek at a fishing site about 10 miles upstream of the confluence with the Spokane River (Scholz et al. 1985). Sockeye salmon historically migrated up the east branch of the Little Spokane River to Chain Lakes, which consists of three small lakes with a total area of 100-surface acres (unpublished WDFW 1956). Additionally, the Coeur d' Alene Tribe historically operated fish traps along the Spokane River from Spokane Falls upstream to the outlet at Coeur d' Alene Lake suggesting anadromous fish were capable of migrating past Spokane Falls (Coeur d' Alene Tribal Elder, personal communication).

Prior to the construction of dams, the natural barriers preventing upstream migration of anadromous salmonids in the Spokane Subbasin were Spokane Falls (RM 74) on the mainstem and Tshimikain Falls on Chamokane Creek, a tributary to the mainstem. However, evidence suggests salmon or steelhead may have passed Spokane Falls in high flow years (Scholz, EWU, personal communication). In 1908, Nine Mile Dam (RM 58.1) was built blocking anadromous species upstream migration to Hangman Creek and middle reaches of the Spokane River. After the construction of Little Falls Dam (RM 29) in 1911, migratory fishes (anadromous and resident salmonids) were blocked from the upper reaches of the Spokane River and its tributaries including Chamokane Creek (RM 32.5), Little Spokane River (RM 56.3), and Hangman Creek (RM 72.4) (Scholz et al. 1985). Additionally, after the construction of Grand Coulee Dam (1939) on the Columbia River, anadromous stocks were blocked and extirpated from the remainder of the lower Spokane River system.

22.1.2 Spokane River

Historically, the fish assemblage below Spokane Falls in the Spokane River comprised of anadromous salmonids (Chinook salmon, steelhead, sockeye salmon) and resident fishes (largescale sucker, northern pikeminow, redside shiner, resident trout, mountain whitefish). Resident fishes were also prevalent above Spokane Falls (Gilbert and Evermann 1895). The native salmonid assemblage included bull trout, mountain whitefish, redband trout, and westslope cutthroat trout (Scholz et al. 1985). Behnke (1992) suggests areas historically accessible to steelhead, at least to Spokane Falls, likely had resident redband trout populations associated with them.

As previously mentioned, Nine Mile Dam (1908) and Little Falls Dam (1911) prevented anadromous and resident salmonid migration to the upper reaches of the Spokane River while Grand Coulee Dam prevented migration of anadromous stocks to the entire Subbasin. In addition to these man-made fish barriers, six other dams upstream of Little Falls Dam were constructed on the Spokane River with no fish passage facilities, creating a highly fragmented river with both free-flowing and reservoir habitat types. These dams are discussed in Section 21 Spokane Subbasin Overview.

As a result of species introductions and physical alterations to the environment over time, the overall fish assemblage in the Spokane River has shifted. Currently, nonnative species well adapted or more tolerant to warm water conditions such as largemouth bass, yellow perch, tench, brown trout, and others listed as exotic species in Table 22.1 are more abundant than native species in reservoir type habitats within the Spokane River. Data also suggest white sturgeon are present in the Spokane River based on one captured individual (Scholz, EWU and Peck, WDFW, personal communication).

Historical analysis suggests bull trout were present at low densities and current data suggests that they are undetectable in the Subbasin (Scholz, EWU, personal communication). Recent observations of bull trout below Little Falls Dam have been of individual fish most likely entrained down the Spokane River, most likely originating upstream from Coeur d' Alene Lake and its tributaries (Scholz, EWU, personal communication). Bull trout occur in the upstream Subbasin (Coeur d' Alene), but are at depressed levels (Scholz et al. 1985). Bull trout are also incidentally noted downstream in Lake Roosevelt, but are likely dropouts from tributaries.

Compared to the extremely low numbers of westslope cutthroat trout in the Spokane River below Post Falls Dam, westslope cutthroat trout are relatively abundant upstream of the dam in Idaho. Poor habitat quality due to unfavorable thermal conditions and flow regimes coupled with species competition has most likely limited the persistence of westlsope cutthroat trout in the mainstem Spokane River (C. Donley, Fisheries Biologist WDFW, personal communication, 2004).

Based on cutthroat trout supplementation history, the existing westslope cutthroat trout populations within the Spokane River between Post Falls and Spokane Falls are likely the remnant population of the native stock. There are no supplementation projects currently in operation for cutthroat trout in the upper Spokane River (C. Donley, Fisheries Biologist WDFW, personal communication, 2003). At this time there is no genetic data available for these cutthroat trout populations, however, genetic inventories are presently underway as a component of the Joint Stock Assessment Program (JSAP) (C. Donley, Fisheries Biologist WDFW, personal communication, 2003).

Information on other native and nonnative species present in the mainstem of the Spokane River (> 170 km in length) is limited. The most recent resident fish surveys available were conducted by WDFW in 2002 (Connor et al. 2003b) and 2003 (memo from McLellan, WDFW, 2004) and focused on the middle Spokane River, a 25.6 km (16 mi) reach between Nine Mile and Monroe Street dams (Connor et al. 2003b). The surveyed reach included both free-flowing and reservoir habitats. In the free-flowing section seven species were captured, which was less than half the number of species (15) captured in Nine Mile Reservoir (Table 22.2, Connor et al. 2003b). In the free-flowing section, all species identified were native, while almost half of the species in the reservoir were nonnative. All species present in the free-flowing section with the exception of longnose dace were present in the reservoir (Connor et al. 2003b).

Table 22.2. Fish species captured in free-flowing and reservoir habitat within the middle Spokane River during the 2002 WDFW survey

Species	Free-flowing	Reservoir
Longnose dace	X	
Rainbow Trout	X	X
Mountain Whitefish	X	X
Northern Pikeminnow	X	X
Redside Shiner	X	X
Bridgelip sucker	X	X
Largescale sucker	X	X
Brown Trout		X
Chinook Salmon		X
Chiselmouth		X
Black Crappie		X
Pumpkinseed		X
Largemouth bass		X
Brown bullhead		X
Yellow perch		X
Sculpin spp.		X

(***Source:*** Connor et al. 2003b)

In 2003 (April to July) WDFW surveyed one free-flowing section in the upper Spokane River above Spokane Falls between RM 92.7 to RM 96.1 and a second section in the middle Spokane River above Nine Mile Reservoir between RM 65.7 and RM 74 (memo from McLellan 2004). In the upper Spokane River, four salmonid species (brown trout, Chinook salmon, cutthroat trout, rainbow trout) were sampled along with northern pikeminow and largescale sucker. Largescale sucker (71.2 percent) and northern pikeminnow (17.6 percent) were the most common fish caught between April and May 2003 in the upper Spokane River. In the middle Spokane River, four salmonid species (brown trout, cutthroat trout, rainbow trout, mountain whitefish) were identified along with four cyprinidae (minnows), two catostomidae (suckers), and sculpin. In contrast to the upper Spokane River, bridgelip sucker (44.8 percent), mountain whitefish (29.7 percent), and rainbow trout (13.3 percent) were the most common species caught in the middle Spokane River between May and July 2003.

Current information on the fish assemblage in the Spokane Arm and for other lakes and reservoirs are discussed in sections 22.1.5 and 22.1.6, respectively.

22.1.3 Little Spokane River

Downstream dams on the Spokane and Columbia rivers have altered the historic fish community and dynamics in the Little Spokane River drainage. Information about historic distribution, abundance, and stock composition of native resident salmonids is limited (Council 2000). Native salmonids known and suspected to have inhabited the Little Spokane River drainage historically included Chinook salmon, steelhead, sockeye salmon, kokanee salmon, redband trout, westslope cutthroat trout, and mountain whitefish. The current fish assemblage (Table 22.3) in the Little Spokane River drainage consists of 33 species (Connor et al. 2003a, 2003b), both native and nonnative. Of the species listed in Table 22.3, kokanee, redband/rainbow trout, mountain whitefish, and largemouth bass are focal species and discussed within sections 22.2 to 22.7.

Table 22.3. Fish species identified in 2001 and 2002 WDFW resident fish surveys in the Little Spokane River drainage. Fish species are indicated as present in Little Spokane River, its tributaries, and/or lakes with an X.

Species	Little Spokane River	Tributaries	Lakes
Brown trout	X	X	X
Eastern brook trout	X	X	X
Kokanee Salmon	X	X	X
Rainbow Trout	X	X	X
Redband Trout		X	
Mountain Whitefish	X	X	X
Pygmy Whitefish	X		X
Grass pickerel	X	X	X
Carp	X		
Chiselmouth	X		X
Longnose dace	X	X	
Northern pikeminnow	X	X	X
Redside Shiner	X	X	X
Speckled dace	X	X	
Tench	X		X
Sucker spp. (3 spp.)	X	X	X
Black crappie	X		X
Bluegill	X		X
Green Sunfish		X	X
Largemouth Bass	X		X
Smallmouth Bass			X
Pumpkinseed	X		X
Yellow perch	X		X
Bullhead spp. (3 spp.)	X		X
Sculpin spp. (4 spp.)	X	X	

(*Source*: Connor et al. 2003a, 2003b)

22.1.4 Hangman Creek Watershed

In general, there is little documentation describing the historical distribution of salmonids or habitat conditions within the Hangman Creek watershed (Peters et al. 2003). Few fish surveys have been conducted over the last 105 years (Edelen and Allen 1998). Although Hangman Creek is not thought to have been a major producer of salmon such as the Little Spokane River and Spokane River (Scholz et al. 1985), historical records indicate

Chinook salmon migrated up Hangman Creek as far as Tekoa, Washington (Scholz et al. 1985).

Currently available information regarding the fish assemblage in the Hangman Creek drainage is isolated to the area within the boundaries of Idaho. In 2002, the Coeur d' Alene Tribe and Idaho Department of Environmental Quality (IDEQ) conducted fish surveys and water quality assessments (Peters et al. 2003). There were seven fish species observed in the 2002 survey including rainbow trout, cutthroat trout, rainbow/cutthroat hybrid, speckled dace, redside shiner, longnose sucker, and sculpin (Peters et al. 2003).

Presence of rainbow trout, cutthroat trout, and non-salmonids in the 2002 stream surveys (Peters et al. 2003) are indicated in Table 22.4. There were a total of 89 salmonids sampled, 52 rainbow, 36 cutthroat trout, and one hybrid (in lower Nehchen Creek). Cutthroat trout were most abundant (n=35) in Nehchen Creek and rainbow trout were most abundant in South Fork Hangman (n=19) (Peters et al. 2003).

Table 22.4. Creeks surveyed in 2002 and presence (indicated by X) of rainbow, cutthroat, and non-salmonids

Creek Name	Rainbow Trout	Cutthroat Trout	Non-Salmonids
North Fork Rock			X
Tensed			
Lolo			
Moctilime			X
Smith			X
Mineral			X
Rose			X
Hangman	X		X
Mission	X	X	
Sheep	X		X
Nehchen*	X	X	X
Indian	X		
Bunnel	X		
South Fork Hangman	X		X
*Formerly called Squaw Creek, one rainbow/cutthroat hybrid observed.			

(*Source*: Peters et al. 2003)

Distribution of salmonids appears to be in decline in the last ten years (Peters et al. 2003). In 2002, salmonids were detected in Mission, Sheep, Nehchen, Indian, Bunnel, Hangman, and South Fork Hangman creeks and densities of rainbow trout were low whereas ten years ago salmonids were also observed in Tensed, Smith, and Mineral creeks (Peters et al. 2003).

The 2002 survey conducted by Peters et al (2003) shows fish species composition in the upper Hangman Creek drainage varies depending on the surrounding land use practices (refer to Section 21, Figure 21.13 for map illustrating vegetation type and land use in the Spokane Subbasin). Salmonids tended to be present in conifer dominated areas or less impacted habitat areas in the upper reaches. No salmonids were found in stream reaches surrounded by agricultural land such as Lolo, Tensed, and Moctileme creeks. Distribution and abundance of trout are most likely limited in the upper Hangman Creek drainage as a result of degraded habitat conditions negatively impacting water quality conditions such as total suspended solids, low dissolved oxygen, and high temperatures (Peters et al. 2003). Water quality conditions are discussed in more detail in Section 22.8 Environmental Conditions and Section 22.9 Limiting Factors and Conditions.

22.1.5 Spokane Arm of Lake Roosevelt

The Spokane River contributes the second largest amount of discharge to Lake Roosevelt. The other major tributaries to Lake Roosevelt include Colville River, Kettle River, and San Poil River. The Spokane Arm, the lower reach of the Spokane River below Little Falls Dam, can be described as a low gradient channel where fine sediments accumulate and where numerous backwater habitats exist (Munn and Short 1997).

Historic fish assemblage in the Spokane Arm would most likely have been similar to the Upper Columbia River and Spokane River upstream to Spokane Falls. The current fish assemblage has been significantly altered as a consequence of Grand Coulee Dam. Grand Coulee Dam has resulted in the inundation of the Spokane Arm and eradication of anadromous salmonids and Pacific lamprey (since no fish passage facility exists). .

In general there are eight families of fish known to be present in the Spokane including Cyprinidae, Catostomidae, Ictaluridae, Salmonidae, Gadidae, Cottidae, Centrarchidae, and Percidae (Thatcher et al. 1992; STOI unpublished data). Acipenseridae are also known to be present in Lake Roosevelt, and are most likely present in the Spokane Arm as well (Lee et al. 2003). Fisheries surveys have been conducted on Lake Roosevelt from 1990 to the present via electrofishing and gill nets (Deanne Pavlik, personal communication). In 2000, 1,685 fish were captured throughout Lake Roosevelt. The majority of the fish assemblage collected was comprised of walleye (28 percent), largescale sucker (15 percent), rainbow trout (14 percent), lake whitefish (10 percent), smallmouth bass (8 percent), and longnose sucker (5 percent) (Lee et al. 2003).

As expected fish assemblage in the Spokane Arm is similar to Lake Roosevelt. Largescale sucker, lake whitefish, rainbow trout, kokanee, brown trout, smallmouth bass, yellow perch, and walleye have been collected every year from 1993-2001, and on average, represent the most abundant species found in the Spokane Arm (STOI unpublished data). The relative abundance of walleye captured between 1993 and 2001 peaked in 1998, then decreased (STOI unpublished data). Increases in walleye relative abundance in the Spokane Arm are expected due to the large number of walleye known to spawn there (Baldwin et al. 2003). Smallmouth bass have shown a general decrease in abundance between 1993 and 2001, with only a slight increase in relative abundance in recent years (STOI unpublished data). Rainbow trout relative abundance has increased slightly in recent years. The population is likely rebuilding following the 1997 high water year where large numbers of tagged rainbow trout were found to have entrained through Grand Coulee Dam (Lee et al. 2003; STOI unpublished data). Alternately, relative abundance of kokanee salmon, largescale sucker and brown trout did not show pronounced trends towards increasing or decreasing abundance between 1993-2001, but rather fluctuated between 3.4-20.3 percent, 1.0-15.8 percent, and 0.9-7.4 percent respectively (STOI unpublished data). Burbot are also present in the Spokane Arm. They have been consistently collected during fish surveys since 1994 with relative abundance ranging from 1.4 percent in 1996 and 2001 to 4.7 percent in 1998. The principal sport fish present in the Spokane Arm include walleye, rainbow trout, kokanee salmon, yellow perch, and smallmouth bass (McDowell and Griffith 1993, as cited in Munn and Short 1997). Black crappie, brown trout, mountain whitefish, and brook trout are present in lower numbers (STOI unpublished data).

In the early 1980s elevated levels of trace elements were found in fish in the lower region of Lake Roosevelt. Studies have confirmed elevated concentrations of arsenic, cadmium, copper, lead, zinc, and mercury in the sediments of Lake Roosevelt and elevated mercury levels in walleye, smallmouth bass, and rainbow trout (Munn and Short 1997). However mercury concentrations in fish tissue do not appear to correspond to spatial differences of mercury concentrations in surficial sediments (Munn and Short 1997). Consumption advisories have been issued for all fish in Lake Roosevelt, including the Spokane Arm.

Refer to Thatcher et al. (1992), Lee et al. (2003), Scofield et al. (2004), and the Upper Columbia Section 30 for further discussion regarding fish species in Lake Roosevelt, of which the Spokane Arm is part. Physical and chemical characteristics of the Spokane Arm are discussed in Section 22.8 Environmental Conditions under the subheading Spokane Arm.

22.1.6 Lakes and Reservoirs

Many of the lakes within the Subbasin are hydrologically isolated from the Spokane River and tributaries. Limited information exists about the historical fish assemblages of these natural lakes, it could be speculated that most of these bodies of water contained native cyprinid (minnows) and catostomid (sucker) populations (C. Donley, Fisheries Biologist WDFW, personal communication, 2003). Lakes hydrologically connected to the Spokane River drainage had species assemblages similar to the isolated lakes with the exception that native salmonids were also present given the fact a multitude of migratory native salmonid stocks were present historically in the Subbasin (Scholz et al. 1985). Lake habitats could have been critical rearing areas for migratory salmonid populations. WDFW historical records indicate that there was a run of sockeye salmon in the Little Spokane River that spawned and reared within Chain lakes (unpublished WFDW 1956). The remainder of lakes within the Little Spokane River drainage would have been available habitat to migratory fish, but there is no information indicating their presence.

Most of the lakes within the Subbasin have been hydrologically altered; water has been routed for hydropower production, irrigation or other uses, completely altering the hydrologic regime. The manipulation of these lake basins and the connection of isolated waters, in conjunction with historical fish stocking activities, have lead to the introduction of multiple nonnative fish species (Table 22.1). Most of the lakes within the Subbasin contain warmwater fish species. The most popular of which are largemouth bass, smallmouth bass, and bluegill sunfish.

There is one major reservoir on the Spokane River, Lake Spokane. Lake Spokane is impounded by Long Lake Dam and is managed by WDFW as a warmwater and coldwater fishery. WDFW has stocked the lake with nonnative salmonids such as rainbow trout, brown trout, and eastern brook trout since 1974 (Connor et al. 2003b). Sampling data from the past 20 years show yellow perch as the most abundant game fish (Osborne et al. 2003). Non-game native species such as northern pikeminnow, largescale sucker, and chiselmouth chub are also in high abundance (Osborne et al. 2003).

There are numerous small privately owned reservoirs, lakes and ponds established within the Spokane Subbasin. Some of these small bodies of water act as fish barriers and support multiple non-game fish species. WDFW does not actively manage these bodies of water, but does inherit fish species through entrainment into waters of the state of Washington. WDFW requires permitting in private waters to allow for fish stocking and is restricting the stocking of sexually viable trout and warmwater fish in hydrologically connected waters. As a result, these bodies of water could be a major impediment to native species enhancement, restoration and ultimately recovery.

There are three major inland lakes within the Spokane Indian Reservation that support fisheries. These are natural, eutrophic lakes that are not directly connected to larger streams or rivers. These lakes support salmonid fisheries that co-exist with warmwater species such as largemouth bass and pumpkinseed. Preference of Spokane Tribal members is to catch and consume salmonid species. Although the lakes suffer from high temperature and low dissolved oxygen, they are stocked with salmonids with the goal to provide an adequate consumptive fishery for tribal members.

The natural lakes and reservoirs in the Spokane Subbasin are important resources for sport fishing. Annual fish stocking within the Spokane Subbasin accounts for an average of 652,500 rainbow, cutthroat, brown, and brook trout (Peck, WDFW, personal communication). Sport fishing and the current management tactics within the Subbasin are critical parts of the local economy. The stocking creates popular sport fisheries with annual economic value estimated between 4 and 5 million dollars. Fish stocking efforts that create genetic problems or competition issues have been suspended, or are under review for modification.

Within the Spokane Subbasin there are eleven lakes that are actively managed by the WDFW (Table 22.5). Four management strategies are applied to these lakes: (1) Trout only opening day lowland lake, (2) Mixed species opening day lowland lakes, (3) Mixed species year-round lowland lakes, and (4) Warmwater Fisheries year-round lowland lakes. Additionally, there are lakes with special rules intended for resource protection. The rules for all WDFW lakes within the Spokane Subbasin are available in the annually published WDFW " Fishing Rules" pamphlet (Available 1/2004: http://wdfw.wa.gov/fish/regs/fishregs.htm).

Trout only opening day lowland lake lakes are managed as put-and-take fisheries. These lakes are stocked with high density trout populations, and are managed as harvest driven fisheries. Stocking densities are adjusted based on lake size and productivity, fish species, and size of fish available for stocking. Stocking densities range from 200 to 600 fish per surface acre. Rotenone is used to maintain the trout only single species management strategy; lakes in the program are treated every 7 to 10 years with rotenone.

Opening day mixed species lakes are waters stocked with trout to provide for moderate catch rate trout fisheries. Stocking densities vary from 75 to 200 fish per surface acre based on lake size and productivity, species composition of the lake and the size of fish available for stocking. These lakes are also managed to provide for moderate harvest of self-sustaining warmwater fish populations. Because of the presence of warmwater fish populations, these lakes provide a protracted fishery opportunity as opposed to the aforementioned trout only lakes.

Mixed species year-round lowland lakes are stocked with a limited amount of trout, 10 to 100 fish per surface acre. The objective is to provide for a trout fishery having modest catch rates of larger trout. Some of these lakes can produce trout of trophy proportions. These lakes are also managed to provide for harvest of self-sustaining warmwater fish populations. The warmwater fisheries in these lakes are targeted on panfish or large predator fish harvest depending on the lake type, productivity and the species that are most productive in the available habitat.

Warmwater only lakes are managed for harvest of self-sustaining warmwater fish species. There may be limited trout stocking to provide fishery potential during periods of time when warmwater fish are not available to the fishery. Stocking densities are on the order of less than 10 fish per surface acre.

Lakes managed using the above strategies are extremely popular with sport fisherman and are economically important to WDFW, the State of Washington and surrounding communities. Lowland lake fishing as a whole generates millions of angler days annually for the State of Washington, and opening day fisheries are billed as the largest single fishing season opener in the State of Washington. There are an estimated 300,000 anglers statewide that participate in just the opening day lowland lake fisheries.

Table 22.5. List of lakes in the Spokane Subbasin and associated management strategy

Lake Name	Management Strategy
Fish Lake*	Trout only opening day lowland lake
Liberty Lake*	Mixed species opening day lowland lakes
Newman Lake*	Warmwater Fisheries year-round lowland lakes
Horseshoe Lake (Spokane County)*	Mixed species year-round lowland lakes
Horseshoe Lake (Pend Oreille County)*	Mixed species opening day lowland lakes
Bear Lake*	Mixed species opening day lowland lakes
Eloika Lake*	Warmwater Fisheries year-round lowland lakes
Fan Lake*	Mixed species opening day lowland lakes
Diamond Lake*	Mixed species opening day lowland lakes
Chain Lake*	Mixed species opening day lowland lakes
Sacheen Lake*	Mixed species opening day lowland lakes

*Special rules apply for management of individual species. (Washington regulations available: https://fortress.wa.gov/dfw/erules/efishrules/index.jsp)

22.1.6.1 Little Falls Pool

The body of water between Little Falls Dam and Long Lake Dam is considered the Little Falls Pool. There are two major tributaries entering into the Spokane River within this reach: Chamokane Creek and Little Chamokane Creek. There are two large irrigation pump stations located within this reach to irrigate the Huteritarian lands to the south and the Little Falls Flats on the Spokane Indian Reservation.

The STOI does not actively manage the fisheries due to a combination of poor water quality and access. There are no general public or tribal boat ramps for this section of the river. The Avista Corporation conducted the first known fish sampling event using gill nets in the 1980s. The gill net results were similar to the fish assemblage collected in 2003 (Scholz, EWU, personal communication). Little Falls Pool has been electrofished twice by Eastern Washington University (EWU) in cooperation with the STOI although no reports were produced from the data collected. Scholz reported sampling northern pikeminnow, largemouth bass, kokanee, rainbow, and brown trout in 1992 (EWU data unpublished). In 2003, EWU and Tribal personnel conducted the latest fishery sampling effort of the littoral habitats. Several families of fish were identified including Catostomidae (suckers), Cyprinidae (minnows), Percidae (perch), and Centrarchidae (bass). There are no Tribal limits or regulations although the State of Washington combines it into its general regulations of the Spokane River. As the capabilities of the Spokane Tribal Department of Natural Resources grow, they are seeking to actively manage Little Falls Pool as a salmonid fishery.

22.2 Focal Species Selection

The focal species selected in the Spokane Subbasin are ecologically significant based on their utilization of the multitude of diverse habitats present in the Subbasin. Additionally, the focal species have cultural and recreational value. The selection criteria for the focal species are specifically discussed in Section 3. The focal species selected for the Spokane Subbasin include redband/rainbow trout, mountain whitefish, kokanee, largemouth bass, and Chinook salmon.

22.3 Focal Species – Redband/Rainbow Trout

22.3.1 Historic Status

Redband trout are a subspecies of rainbow trout with populations historically present in areas of the Columbia River basin, east of the Cascades. The genetic profile of native redband trout populations in the Spokane Subbasin has not been described entirely, and the historical distribution and abundance of native redband trout in the Spokane Subbasin is somewhat mysterious due to the complex distribution of both coastal and inland forms (Behnke 1992). Behnke (1992) suggests areas historically accessible to steelhead, at least to Spokane Falls, likely had resident redband trout populations associated with them.

22.3.2 Current Status

Currently, redband/rainbow trout are present, or suspected to exist throughout the Spokane Subbasin (Spokane Arm, Spokane River, Little Spokane River drainage, Hangman Creek drainage). However historical references are not available for comparison with current redband/rainbow trout distribution and abundance. The degree of introgression of coastal rainbow and resident redband trout is currently unknown for the entire Subbasin. In general, introgression is likely to be extensive throughout the Subbasin given the stocking practices in the twentieth century. WDFW stocked rainbow trout in the Spokane River and Little Spokane River for multiple years from 1933 to 2002 (tables 22.6 and 22.7) (Connor et al. 2003b). Stocking also occurs in the Spokane Arm with net pens and hatcheries.

Genetic testing to differentiate coastal rainbow trout from native redband trout has been conducted in the Little Spokane River drainage (WDFW) and is in the planning stages by fisheries managers for other drainages. WDFW has found four native redband populations in the Little Spokane Drainage (Table 22.7, Figure 22.1) (Connor et al. 2003b). The Coeur d'Alene Tribe has captured fish expressing phenotypic characteristics of redband trout in several streams in the upper reaches of the Hangman Creek watershed and intends to conduct DNA analysis to determine whether these fish originated from pure redband stock or are of a mixed origin (Figure 22.1) (Peters et al. 2003). Additionally, native rainbow trout, presumably redband trout, are also present in the Blue and Chamokane creeks (Figure 22.1, Scholz et al. 1988; Crossley, Fisheries Biologist, STOI, personal communication, 2004). In early May 2004, a collaborative effort among the Coeur d' Alene Tribe, WDFW, and Spokane County Conservation District (SCCD) will conduct a genetics study to determine the genetic profile of the rainbow trout population in Hangman Creek and its tributaries (Marshall Creek, California Creek, and Rock Creek) (BPA Project # 2001-032-00).

Many information gaps exist regarding redband/rainbow trout within the Spokane Subbasin. At this time, the carrying capacity and potential productivity for redband/rainbow trout populations are not known. Low flow, habitat degradation, and pollutants may be limiting the rainbow trout populations in the Spokane Subbasin (for more information on low flows in the Spokane and Little Spokane rivers refer to Section 22.8). A better understanding of where current populations are and their status, as well as where genetically distinct populations originated is needed to manage, conserve, and protect native redband trout.

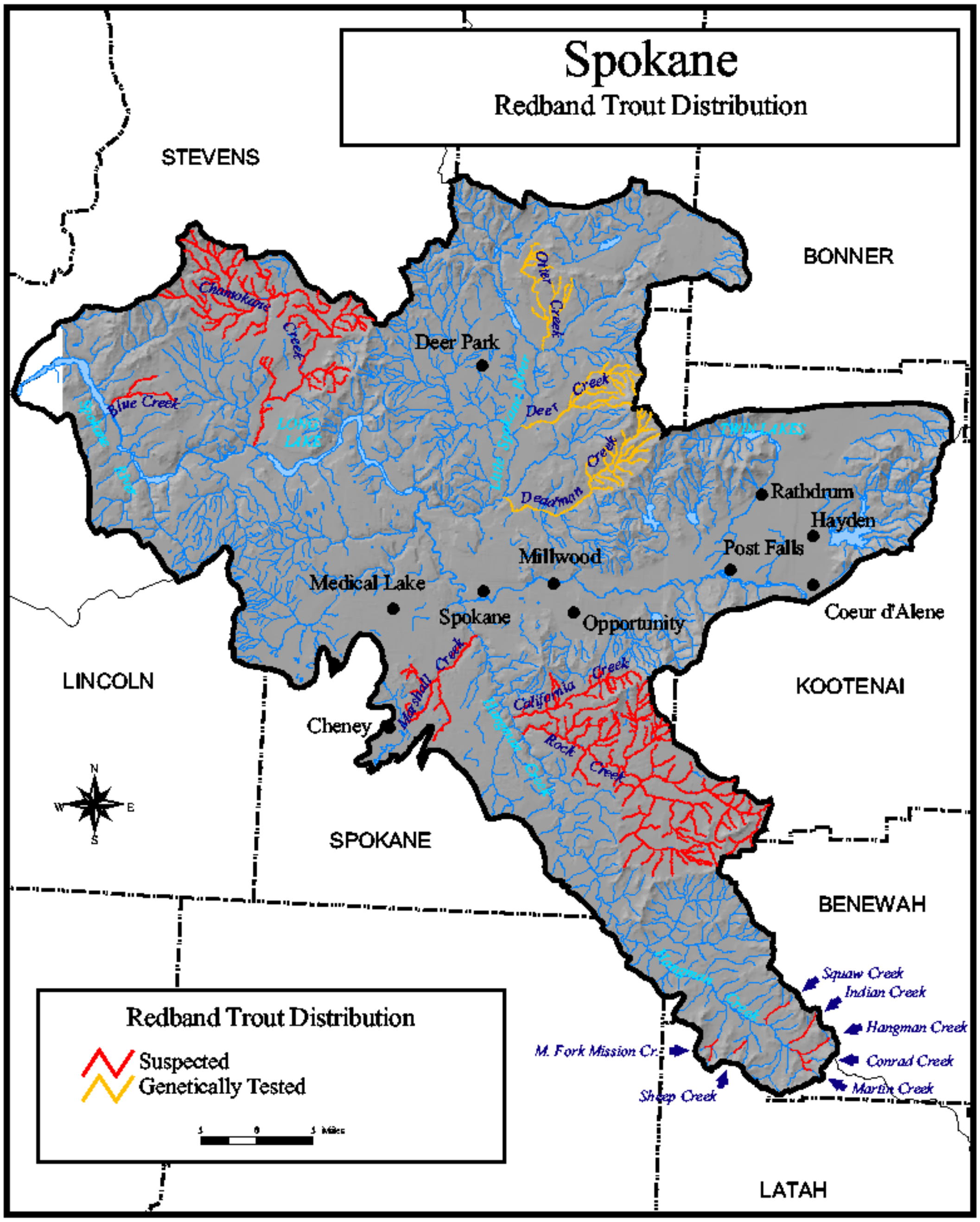


Figure 22.1. Genetically tested redband trout in Little Spokane River drainage and suspected redband trout in the Hangman Creek drainage, Chamokane Creek, and Blue Creek within the Spokane Subbasin. Other streams have not been genetically tested and/or are not suspected to have "pure" redband trout due to extensive stocking of "coastal" rainbow trout.

Table 22.6. Distribution of rainbow trout in the Spokane River indicating the genetic structure as redband, coastal, introgressed, or unknown

			Genetic Structure				
Water	**Dates Stocked**	**Genetics Tested**	**Redband**	**Coastal**	**Introgression (redband X coastal)**	**Mixed Stocks (Spokane-McCloud R. CA, Phalon Lake)**	**Unknown**
Spokane River							
Lower Spokane River (below Nine Mile Dam)	No data available						X
Middle Spokane River (Nine Mile Dam to Spokane Falls)	1934-2002	Y				X	
Upper Spokane River (above Spokane Falls)	No data available						X

(*Source*: Connor et al. 2003b)

Table 22.7. Distribution of rainbow trout in the Little Spokane River drainage indicating the genetic structure as redband, coastal, introgressed, or unknown

			Genetic Structure			
Water	**Dates Stocked**	**Genetics Tested**	**Redband**	**Coastal**	**Introgression (redband X coastal)**	**Unknown**
Little Spokane River	1933-2001					X
Tributaries of the Little Spokane River						
Bear Creek	1936-1939					X
Beaver Creek	1944-1947					X
Buck Creek	1941-1947	Y		X		
Dartford Creek						X
Deadman Creek	1934-1955	Y	X			
Deer Creek	1936	Y	X			
Dragoon Creek drainage	1934-1985	Y			X	
Dry Creek	1936					X
Little Deep Creek						X
Little Deer Creek		Y	X			
East Branch Little Spokane River	1938, 1939					
Mud Creek	1974, 1977, 1978					
Otter Creek	1936	Y	X			
Spring Creek	1951-1956					X
Spring Heel Creek	1940, 1947, 1948					
West Branch Little Spokane River	1939					X
Wethey Creek	1939-1944					X

			Genetic Structure			
Water	Dates Stocked	Genetics Tested	Redband	Coastal	Introgression (redband X coastal)	Unknown
Lakes in the Little Spokane River Drainage						
Chain Lakes	1940-1944					X
Diamond Lake	1933-2001					X
Trout Lake	1941-1972					X
Sacheen Lake	1939-2001					
Horseshoe Lake	1989-2001					X
Eloika Lake						X
Fan Lake	1941-2001					X

(*Source*: Connor et al. 2003a, Connor et al. 2003b, WDFW 2003 memo)

The remaining discussion on the current status of redband/rainbow trout is separated by three geographic locations: (1) Spokane River, (2) Little Spokane River, and (3) Hangman Creek. No data was available describing redband/rainbow trout populations specifically in the Spokane Arm. For information most relevant to this region, refer to Upper Columbia Subbasin Section 30.4 on rainbow/redband trout in Lake Roosevelt of which the Spokane Arm is part.

22.3.2.1 Spokane River

Between 1948 and 1987, the State of Washington stocked the Spokane River with more than one million rainbow trout (of presumably coastal genetic origin) to develop and maintain a resident salmonid fishery (Avista 2002). The State of Washington continued to stock 65,000-75,000 two- to three-inch rainbow trout into the lower Spokane River between 1995 and 1997 (Avista 2002). Since 1995, the Avista Corporation has also stocked eight- to ten-inch rainbow trout upstream and downstream of Monroe Street Dam with an estimated 2,000 and 5,000 fish, respectively (Avista 2002). As of 2002, all stocking of trout in the Spokane River has been reduced, by agreement between Avista and WDFW, to 2500 triploid fish annually. These fish are stocked in the impounded portions of the river (for example, Riverfront Park/Monroe Street Dam, Nine Mile Reservoir), and are mitigation for Avista hydropower operations. Current stocking strategies are intended to eliminate genetic introgression between hatchery rainbow and native redband trout. Additionally, the Spokane Arm is stocked with rainbow trout and kokanee through direct releases and via the Lake Roosevelt net pen program (Lee et al. 2003).

The following describes rainbow trout populations in the lower (Spokane Arm), middle (above Nine Mile Dam), upper (above Spokane Falls) reaches of the Spokane River.

STOI has collected several years of data on rainbow trout in Lake Roosevelt including the Spokane Arm. Between 1993 and 2001, a total of 924 rainbow trout were collected via electrofishing and gill netting in the Spokane Arm (STOI unpublished data). Relative abundance of rainbow trout was highest in 1994 (17.4 percent, n = 393), and lowest in 1997 (0.9 percent, n = 3; STOI unpublished data). Low numbers of rainbow trout collected in 1997 have been attributed to the very high flows observed in 1997 that contributed to large numbers of rainbow trout being entrained through Grand Coulee Dam (Cichosz et al. 1999). Between 1997 and 2000, the condition factor (K_{TL}) for hatchery and wild rainbow trout collected from Lake Roosevelt were similar to the condition factor of rainbow trout in other hatchery supplemented northwest lakes (Table 22.8) (McLellan 2000; Taylor 2000; Scholz et al. 1988).

Table 22.8. Comparison of rainbow trout condition factor (K) of fish collected in Lake Roosevelt (FDR) since 1997, and from other lakes and reservoirs in eastern Washington

	Hatchery		Wild	
Species and Location	**n**	**K_{TL}**	**n**	**K_{TL}**
FDR 1997	50	1.30 ± 0.24	31	1.16 ± 0.24
FDR 1998	154	1.39 ± 0.25	50	1.25 ± 0.30
FDR 1999	59	1.13 ± 0.27	20	1.00 ± 0.25
FDR 2000	132	1.13 ± 0.29	26	0.98 ± 0.24
Rock Lake, WA[1]	266	0.98 ± 0.2		
Sprague Lake, WA[2]	86	1.14 ± 0.16		
Deer Lake, WA[3]	--	1.07 ± ----		

(*Sources*: [1] McLellan 2000, [2] Taylor 2000, [3] Scholz et al. 1988a)

In 2002, WDFW conducted a fish survey on the middle Spokane River from Spokane Falls downstream to Nine Mile Dam (Connor et al. 2003b). Rainbow trout were the most abundant fish species in Nine Mile reservoir and in the free-flowing section of the middle Spokane River along with mountain whitefish. In the free-flowing section, rainbow trout represented about 12 percent of the total fish captured and about 89 percent of the rainbow trout were identified as wild (Connor et al. 2003b). In the reservoir, rainbow trout represented about 8 percent of the total fish captured and about 23 percent of the rainbow trout were identified as wild (Connor et al. 2003b). The age of wild rainbow trout in the free-flowing section ranged between 1 and 3 years, and in the reservoir ranged between 0 and 4 years (Connor et al. 2003b). In both habitat types growth based on relative weight (W_r) of rainbow trout was considered good although below the national standard of 100 (free-flowing $W_r = 88 \pm 11$, reservoir $W_r = 87 \pm 9$) (Connor et al. 2003b). The condition factor (free-flowing $K_{TL} = 0.96 \pm 0.11$, reservoir $K_{TL} = 0.95 \pm 0.09$) was comparable to other northwest rivers and reservoirs ($K_{TL} = 0.93 – 1.22$) (Connor et al. 2003b). No population estimates were provided in this study. Genetics data were also collected in the middle reach of the Spokane River. Results found rainbow trout represented multiple stocks of fish and could not be grouped solely within any of the previously tested rainbow stocks present in the Subbasin (Table 22.6) (Connor et al. 2003b). Additional genetic investigation will be conducted to determine the genetic contribution of each stock within the Subbasin to the middle Spokane River metapopulation.

Results from a 2003 WDFW fish survey conducted in the free-flowing middle and upper reaches in the Spokane River found rainbow comprised an aggregate total of 9 percent and 13 percent of the relative abundance, respectively during the sample period. Mean lengths in the middle reach were 333 mm ranging from 135 to 413 mm, and 400 mm in the upper reach ranging from 268 to 463 mm (WDFW, unpublished data).

In the Spokane River, water quality issues including but not limited to temperature, total dissolved gases (TDGs), turbidity, total suspended solids, and pollutants such as polychlorinated byphenyls (PCBs) or lead continue to impact fish species and habitat quality. In 1999, three fish species including rainbow trout contained higher than normal concentrations of lead between Upper Falls Dam and the Washington-Idaho state line. In 2001, a fish advisory was expanded to include PCBs of which elevated levels were found in rainbow trout, mountain whitefish, and largescale suckers between Nine Mile Dam and the Washington-Idaho state line (Washington Department of Health 2001). Although rainbow trout remain present in reaches with marginal conditions (temperature, pollutants, etc.), it is uncertain what impacts poor water quality conditions have had on the rainbow trout population. Research is still needed to unveil the current condition of rainbow trout and the potential limiting factors present in the Spokane Subbasin.

22.3.2.2 Little Spokane River

Currently redband/rainbow trout are present in the mainstem, several tributaries, and lakes within the Little Spokane River drainage (see Table 22.7) (Connor et al. 2003a, 2003b). Genetics were tested in 11 redband/rainbow trout populations representing 6 tributaries in the Little Spokane drainage suspected to be genetically "pure" redband trout. Results concluded 4 tributaries (Deadman, Deer, Little Deer, Otter) had native redband trout present (see Table 22.7, Figure 22.1). At least once between 1934 and 1955, three of the four tributaries (Deadman Creek, Deer Creek, and Otter Creek) having native redband trout were stocked with rainbow trout (see Table 22.7). Although not specifically stocked with rainbow trout, Little Deer Creek is connected to and a tributary of Deer Creek.

In 2001 and 2002, WDFW conducted fish surveys in a total of 12 creeks; Beaver Creek was surveyed in both years (Table 22.9). The relative abundance of rainbow trout ranged from less than 1 percent (Bear Creek) to 92 percent (Little Deer Creek). No rainbow trout were found in Heel or Spring Heel Creek. Mean total lengths ranged between 76 and 141 mm. When the relative abundance of rainbow trout exceeded 80 percent (Buck and Little Deer creeks), riffle habitat was most common (≥ 75 percent) and run habitat was least common (≤ 6 percent) (Table 22.9).

The Little Spokane River drainage, as in the rest of the Spokane Subbasin, has been impacted by anthropogenic activities such as timber harvest, agriculture, and urban development. It is assumed that these activities coupled with the introduction of nonnative fish species have negatively impacted the water quality and rainbow trout (Connor et al. 2003b), however data to quantify the degree of impact is limited.

Table 22.9. Tributaries to the Little Spokane River surveyed by WDFW in 2001 and 2002. Data on rainbow trout (total number, relative abundance to total sample, mean length) and habitat types (riffle, pool, run) are from Connor et al. (2003a, 2003b).

2001	# Reaches Surveyed	Total # RBT	% Relative Abundance	Mean Total Length (mm)	% Riffle	% Pool	% Run
Bear	11	17	<1	141	34	3	63
Beaver	3	21	4	93	27	10	63
Buck	15	743	84	107	75	21	4
Deer	14	2311	54	92	52	18	30
Dry	6	507	36	76	54	6	40
Otter Creek	14	452	17	89	31	12	57
West Branch Little Spokane***	8	25	3	119	34	18	48
Heel**	5	-	-	-	-	-	-
Spring Heel Creek***	1	-	-	-	-	-	-

* rainbow only collected below barrier falls

** no fish stocking records in creek (WDFW unpublished), but brook trout are present

*** rainbow have been planted by WDFW, but rainbow were not detected

2002	# Reaches Surveyed	Total # RBT	% Relative Abundance	Mean Total Length (mm)	% Riffle	% Pool	% Run
Beaver	11	7	<1	54	5	2	93
Dragoon	27	189	4	179	24	19	57
Little Deer	9	707	92	63	79	15	6
Spring	2	4	1.5	147	0	0	100
West Branch Dragoon	13	154	7	99	15	9	76

(*Source*: Connor et al. 2003a, 2003b)

22.3.2.3 Hangman Creek

In 2002, Peters et al. (2003) conducted a fish survey in upper Hangman Creek and its tributaries within the boundaries of Idaho (for additional information refer to Section 22.1.4). Rainbow trout, in low density, were found in Hangman, South Fork Hangman, Mission, Sheep, Nehchen, Indian, and Bunnel creeks. Many of the trout sampled in the upper Hangman watershed, particularly those sampled in the Indian Creek, expressed phenotypic characteristics consistent with those of native redband trout. In addition, one of this fish caught in Nehchen Creek expressed traits suggesting it was a rainbow/cutthroat hybrid (Peters et al. 2003). In general it appears salmonid (rainbow and cutthroat trout) distribution and abundance compared to ten years ago is in decline in the upper Hangman Creek drainage (Peters et al. 2003). No rainbow trout or cutthroat trout were found in heavily disturbed drainages surrounded by agriculture; rather all salmonids were in relatively intact, forested drainages. Water quality as a result of land use practices is most likely the principal limiting factor (refer to sections 21.2.5, 21.2.7, 22.1.4, 22.8, and 22.9 for information regarding water quality, land use practices, and limiting factors).

No information regarding redband/rainbow trout was available for the section of Hangman Creek within the boundaries of Washington state.

22.3.3 Limiting Factors Redband/Rainbow Trout

Historically rainbow trout were present in 49 of 63 delineated reaches and watersheds in the Subbasin. Five of these 49 areas no longer host rainbow trout (Table 22.10). However, rainbow trout have expanded their distribution to three new reaches (Table 22.11) and are currently distributed in 48 reaches.

Table 22.10. List of 5 reaches no longer hosting rainbow trout and respective rank for the amount of deviation present habitat conditions are from reference conditions, Rank 1 = most altered

Reach Name	Rank
State line to Mission Hangman Tributaries	2
Little Hangman	4
Moctileme	9
Rose	11
North Fork Rock	12

Table 22.11. Reaches where rainbow trout are currently present, but were not found historically along with the respective rank for protection. The ranking measures the degree of similarity present habitat conditions have to reference conditions, Rank 1 = most similar

Reach Name	Rank
Hauser/Post Falls	42
Rathdrum Ck	40
Hayden	3

To assess the degree of habitat alteration from reference conditions, all 49 historic areas were evaluated (Table 22.12). As shown in Table 22.9, some areas where rainbow trout were historically received rankings for large amounts of habitat alteration and degradation and no longer support rainbow trout. In general, the habitat attributes having changed the most included fine sediment, habitat diversity, and low flow regimes (Table 22.26). Within the Subbasin, Hangman watershed appears to have experienced the greatest degree of change to the habitat (for example, low flow, fine sediments, habitat diversity) relative to reference conditions (Table 22.12). The areas ranked the highest for protection are spread throughout the central region of the Subbasin (Table 22.123).

Table 22.12. Ranking of reaches with the largest deviation from the reference habitat conditions for rainbow trout in the Spokane Subbasin. A reach rank equal to 1 has the greatest deviation from reference condition in comparison to other reaches. Reach scores range from 0 to 1, with 1 having the greatest deviation from reference. Values associated with each habitat attribute range from 1 to 11, a value of 1 indicates a habitat attribute having the greatest deviation from reference compared to the other attributes within that reach. In some cases multiple habitat attributes have a value of 1 indicating all attributes equally deviate the most from the reference.

Sequence	Reach Name	Reach Rank	Reach Score	Riparian Condition	Channel stability	Habitat Diversity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions
61	Mainstem Hangman - Upper	1	0.7	8	2	2	2	2	1	6	10	8	6	10
46	State line to Mission Hangman Tribs	2	0.6	7	2	2	2	5	1	5	11	9	7	10
49	Western Tributaries of Hangman Ck	2	0.6	7	2	2	2	5	1	5	11	9	7	10
44	Little Hangman	4	0.6	8	4	2	4	2	1	4	10	8	4	10
62	Mainstem Hangman - Middle	4	0.6	8	4	2	4	2	1	4	10	8	4	10
63	Mainstem Hangman - Lower	4	0.6	7	2	6	1	2	7	2	11	9	2	10
12	Rail Ck/Walkers Prairie	7	0.5	6	3	3	3	9	1	2	9	6	8	9
47	Mission to Indian Creek Hangman Tribs	8	0.5	7	3	3	1	3	1	6	11	8	8	10
8	Camas	9	0.5	6	1	1	1	9	1	1	9	6	6	9
45	Moctileme	9	0.5	4	2	3	1	4	4	4	11	9	4	10
43	Rose	11	0.5	4	2	3	1	4	4	4	10	9	4	10
42	North Fork Rock	12	0.5	5	2	2	1	5	2	5	10	9	5	10
41	Rock	13	0.4	4	2	2	1	4	4	9	10	8	4	10
7	Little Chamokane	14	0.4	5	2	2	1	9	2	5	9	7	8	9
3	Blue/Oyachen/Orzada	15	0.4	5	2	6	3	10	3	7	10	8	1	8
48	Hangman Headwaters	16	0.4	9	5	3	2	3	1	7	11	6	7	9

Sequence	Reach Name	Reach Rank	Reach Score	Riparian Condition	Channel stability	Habitat Diversity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions
54	Mainstem Spokane R - Seven Mile to Nine Mile Falls Hydro	16	0.4	6	7	2	1	9	5	9	9	8	4	3
14	Frog/W.Dragoon	18	0.3	4	3	1	1	6	5	10	10	6	6	9
55	Mainstem Spokane R - Nine Mile Falls to Long Lake Dam	19	0.3	4	5	1	1	10	5	5	10	9	5	3
21	Peone/Deadman	20	0.3	2	2	2	1	7	2	9	9	7	2	9
6	Upper Chamokane	21	0.3	6	2	2	1	9	2	7	9	7	2	9
1	McCoy /Ente'	22	0.3	5	1	2	2	6	2	6	11	9	6	9
11	Lower Chamokane	22	0.3	6	3	2	1	9	5	7	10	8	3	10
25	Upper Little Spokane Tribs	24	0.3	5	3	2	1	7	3	9	9	8	9	6
52	Mainstem Spokane R- Upriver Dam to Monroe St Hydro	24	0.3	6	3	1	3	9	9	7	9	8	3	2
57	Spokane Arm of Lake Roosevelt, Little Falls Dam to confluence with Colombia	24	0.3	3	8	2	3	9	5	9	9	6	1	6
15	Dragoon	27	0.3	5	2	3	1	6	4	10	10	6	6	9
18	North Spokane	28	0.3	5	5	2	1	5	3	10	10	9	3	8
60	West Branch Little Spokane	29	0.3	4	5	1	1	8	6	8	8	3	7	8
59	Mainstem Little Spokane River - Lower	30	0.3	5	6	1	1	8	4	9	9	6	3	9
56	Mainstem Spokane R - Long Lake Dam to Little Falls Dam	31	0.3	4	6	1	3	9	6	9	9	8	5	2
24	West Branch Little Spokane Tribs	32	0.3	5	3	2	1	6	4	9	9	7	9	7
2	Sand Creek	33	0.3	5	2	2	1	9	2	6	9	8	6	9
58	Mainstem Little Spokane River - Upper	34	0.3	4	6	1	2	8	3	10	10	4	8	7
32	Upper Spring Creek	35	0.3	6	4	1	2	7	4	9	9	8	2	9
34	Middle Coulee	35	0.3	5	3	1	3	7	1	9	9	8	6	9

Sequence	Reach Name	Reach Rank	Reach Score	Riparian Condition	Channel stability	Habitat Diversity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions
35	Upper Coulee	35	0.3	5	3	1	3	7	1	9	9	8	6	9
37	Middle Deep	35	0.3	5	3	1	3	7	1	9	9	8	6	9
38	Upper Deep	35	0.3	5	3	1	3	7	1	9	9	8	6	9
51	Mainstem Spokane R- Post Falls Dam to Upriver Dam	40	0.3	4	7	2	2	7	6	7	7	4	1	7
39	Marshall Creek	41	0.3	5	7	1	4	7	3	10	10	9	6	2
17	Mud/Wethey/Huston	42	0.2	4	1	3	1	4	4	9	9	4	4	9
30	Lower Spring Creek	42	0.2	5	6	1	2	6	4	9	9	8	2	9
31	Middle Spring Creek	42	0.2	5	6	1	2	6	4	9	9	8	2	9
40	California	45	0.2	4	5	1	1	8	1	9	9	7	5	9
53	Mainstem Spokane R - Monroe St to Seven Mi Bridge	46	0.2	4	7	3	1	8	5	8	8	6	2	8
22	Upper Deadman	47	0.2	4	5	1	1	5	3	8	8	7	8	8
23	Bear/Cottonwood/Pell	48	0.2	4	5	3	1	8	1	8	8	7	8	6
33	Lower Coulee	49	0.0	5	5	5	5	2	2	5	5	4	1	5
36	Lower Deep	49	0.0	5	5	5	5	2	2	5	5	4	1	5

Table 22.13. Ranking of streams whose habitat is most similar to the reference condition for rainbow trout in the Spokane Subbasin in comparison to other reaches. A reach rank equal to 1 reveals the reach with current conditions most similar to reference conditions in comparison to other reaches. Reach score ranges from 0 to -1, with -1 having the least deviation from reference. Values associated with each habitat attribute range from 1 to 11, a value of 1 indicates a habitat attribute being most similar to the reference compared to the other attributes within that reach. In some cases multiple habitat attributes have a value of 1 indicating all attributes are equally the most similar to the reference.

Sequence	Reach Name	Reach Rank	Reach Score	Riparian Condition	Channel stability	Habitat Diversity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions
22	Upper Deadman	1	-0.66	11	3	8	8	3	7	1	5	8	1	5
53	Mainstem Spokane R - Monroe St to Seven Mi Bridge	1	-0.66	11	3	7	10	1	4	1	5	8	8	5
29	Hayden	3	-0.66	11	9	5	3	5	3	1	7	7	2	9
23	Bear/Cottonwood/Pell	4	-0.65	10	4	6	8	1	8	1	5	7	1	11
17	Mud/Wethey/Huston	5	-0.64	10	8	7	8	2	2	1	5	10	2	5
31	Middle Spring Creek	6	-0.64	8	2	11	8	2	6	1	4	7	8	4
40	California	6	-0.64	11	3	7	7	2	7	1	5	7	3	5
30	Lower Spring Creek	8	-0.61	7	2	11	7	2	5	1	4	6	7	10
39	Marshall Creek	8	-0.61	10	2	9	6	2	8	1	5	6	4	11
32	Upper Spring Creek	10	-0.60	10	5	11	8	2	5	1	3	7	8	3
34	Middle Coulee	10	-0.60	11	7	9	7	2	9	1	4	6	3	4
35	Upper Coulee	10	-0.60	11	7	9	7	2	9	1	4	6	3	4
37	Middle Deep	10	-0.60	11	7	9	7	2	9	1	4	6	3	4
38	Upper Deep	10	-0.60	11	7	9	7	2	9	1	4	6	3	4
56	Mainstem Spokane R - Long Lake Dam to Little Falls Dam	15	-0.58	9	3	9	8	1	3	1	5	7	6	11
59	Mainstem Little Spokane River - Lower	16	-0.58	9	3	10	10	2	6	1	4	8	7	4
18	North Spokane	17	-0.57	9	2	10	11	2	6	1	4	5	6	6
2	Sand Creek	18	-0.56	10	5	5	9	1	5	2	4	5	2	10
15	Dragoon	19	-0.56	10	9	6	11	2	5	1	4	8	2	6
25	Upper Little Spokane Tribs	20	-0.56	10	5	8	10	3	5	1	4	5	1	9

Sequence	Reach Name	Reach Rank	Reach Score	Riparian Condition	Channel stability	Habitat Diversity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions
57	Spokane Arm of Lake Roosevelt, Little Falls Dam to confluence with Colombia	20	-0.56	9	6	9	6	1	1	3	4	5	6	11
58	Mainstem Little Spokane River - Upper	22	-0.55	8	4	10	7	2	6	1	5	8	2	11
1	McCoy /Ente'	23	-0.55	11	10	5	5	1	5	1	4	5	1	5
51	Mainstem Spokane R- Post Falls Dam to Upriver Dam	23	-0.55	8	1	6	6	1	5	1	4	8	8	11
24	West Branch Little Spokane Tribs	25	-0.55	9	6	8	10	3	5	1	4	6	1	11
21	Peone/Deadman	26	-0.54	11	5	5	10	2	5	1	3	9	5	3
11	Lower Chamokane	27	-0.53	10	5	9	11	1	4	2	3	5	5	5
6	Upper Chamokane	28	-0.53	10	4	4	10	1	4	2	3	9	4	4
14	Frog/W.Dragoon	28	-0.53	9	8	9	9	2	5	1	4	7	2	6
55	Mainstem Spokane R - Nine Mile Falls to Long Lake Dam	30	-0.53	10	2	8	8	1	2	2	6	7	2	11
52	Mainstem Spokane R- Upriver Dam to Monroe St Hydro	31	-0.53	10	3	7	6	1	5	1	4	8	9	11
48	Hangman Headwaters	32	-0.52	5	4	5	9	5	11	1	3	10	1	5
54	Mainstem Spokane R - Seven Mile to Nine Mile Falls Hydro	32	-0.52	8	3	9	10	1	5	1	4	6	6	11
3	Blue/Oyachen/Orzada	34	-0.52	10	9	4	5	1	5	2	3	5	11	5
60	West Branch Little Spokane	34	-0.52	9	6	7	7	1	4	1	5	10	3	11
7	Little Chamokane	36	-0.48	11	6	6	10	1	6	4	3	9	2	4
41	Rock	37	-0.46	11	7	7	10	4	4	1	2	9	4	2
47	Mission to Indian Creek Hangman Tribs	38	-0.39	6	7	7	10	7	10	3	2	5	1	4
8	Camas	39	-0.39	10	5	5	5	1	5	5	2	10	3	3
28	Rathdrum Creek	40	-0.37	5	3	5	7	8	9	1	2	9	3	11
12	Rail Ck/Walkers Prairie	41	-0.36	8	5	5	5	1	11	10	2	8	3	4
27	Hauser/Post Falls	42	-0.30	8	4	8	5	5	8	1	2	5	3	11
33	Lower Coulee	43	-0.28	8	8	8	8	3	7	1	5	6	4	1
36	Lower Deep	43	-0.28	8	8	8	8	3	7	1	5	6	4	1

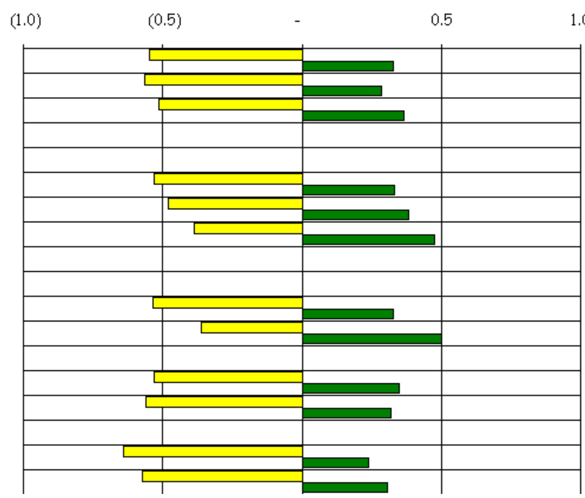
Sequence	Reach Name	Reach Rank	Reach Score	Riparian Condition	Channel stability	Habitat Diversity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions
49	Western Tributaries of Hangman Ck	**45**	-0.28	7	8	8	8	5	11	5	1	4	2	2
63	Mainstem Hangman - Lower	**46**	-0.23	6	3	7	10	7	11	3	1	7	3	1
61	Mainstem Hangman - Upper	**47**	-0.19	5	5	5	10	5	10	3	1	5	3	1
62	Mainstem Hangman - Middle	**48**	-0.15	7	7	7	7	5	7	3	2	6	3	1

The tornado diagram (Table 22.14) and maps (Map SK-1, Map SK-2, located at the end of Section 22) present the reach scores for both current habitat condition (ranging from zero to positive one, Map SK-1) and protection (ranging from zero to negative one, Map SK-2). The reach score ranges from negative one to zero with negative one indicative of a watershed having experienced the least amount of change. Scores closest to negative one depict reaches that are most representative of reference habitat conditions. Scores closest to positive one depict reaches with habitat conditions least similar to reference conditions. Confidence scores range from zero to one and are associated with the ratings assigned by local biologists based on documentation or their expert opinion regarding reference and current habitat attributes for each reach.

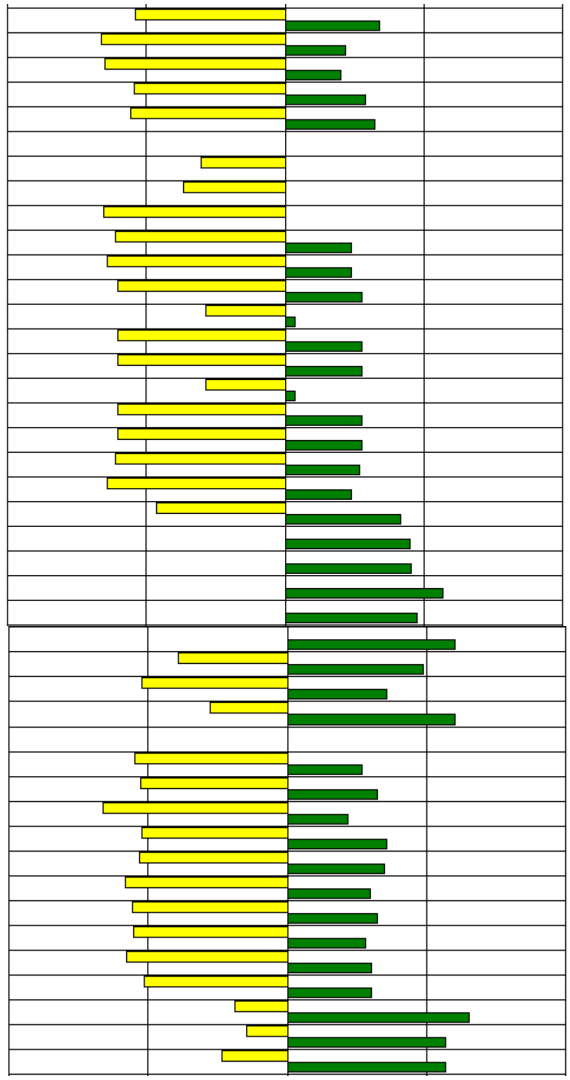
Table 22.14. Tornado diagram for rainbow trout in the Spokane Subbasin. Degree of confidence for protection and current habitat conditions range from 0.0 to 1.0 with the greatest confidence equal to 1.0. Protection reach scores are presented on the left side and current habitat reach scores are presented on the right. Negative scores are in parentheses.

NP = Not present

Sequence	Reach Name	Protection Confidence	Current Habitat Condition Confidence
1	McCoy /Ente'	0.88	0.78
2	Sand Ck	0.88	0.78
3	Blue/Oyachen/Orzada	0.88	0.78
4	South Slopes/Harker Canyon	NP	
5	South Slopes/Mill Canyon	NP	
6	Upper Chamokane	0.71	0.70
7	Little Chamokane	0.71	0.70
8	Camas	0.71	0.70
9	Included in #7	NP	
10	Included in #7	NP	
11	Lower Chamokane	0.88	0.78
12	Rail Ck/Walkers Prairie	0.71	0.70
13	TumTum/ North 1/2 only	NP	
14	Frog/W.Dragoon	0.88	0.78
15	Dragoon	0.88	0.78
16	Little Sandy Canyon	NP	
17	Mud/Wethey/Huston	0.71	0.70
18	North Spokane	0.88	0.78



21	Peone/Deadman	0.71	0.70
22	Upper Deadman	0.71	0.70
23	Bear/Cottonwood/Pell	0.88	0.78
24	West Branch Little Spokane Tribs	0.88	0.78
25	Upper Little Spokane Tribs	0.88	0.78
26	Thompson Creek	NP	
27	Hauser/Post Falls	NP	
28	Rathdrum Ck	NP	
29	Hayden	NP	
30	Lower Spring Creek	0.71	0.70
31	Middle Spring Creek	0.71	0.70
32	Upper Spring Creek	0.71	0.70
33	Lower Coulee	0.71	0.70
34	Middle Coulee	0.71	0.70
35	Upper Coulee	0.71	0.70
36	Lower Deep	0.71	0.70
37	Middle Deep	0.71	0.70
38	Upper Deep	0.71	0.70
39	Marshall Ck	0.71	0.70
40	California	0.71	0.70
41	Rock	0.71	0.70
42	N Fk Rock	0.71	0.70
43	Rose	0.71	0.70
44	Little Hangman	0.71	0.70
45	Moctileme	0.71	0.70
46	Stateline to Mission Hangman Tribs	0.88	0.78
47	Mission to Indian Creek Hangman Tribs	0.88	0.78
48	Hangman Headwaters	0.88	0.78
49	Western Tributaries of Hangman Ck	0.55	0.61
50	nstem Spokane R- C d'A Lake to Post Falls Dam	NP	
51	tem Spokane R- Post Falls Dam to Upriver Dam	0.71	0.70
52	n Spokane R- Upriver Dam to Monroe St Hydro	0.71	0.70
53	em Spokane R - Monroe St to Seven Mi Bridge	0.71	0.70
54	pokane R - Seven Mile to Ninemile Falls Hydro	0.71	0.70
55	n Spokane R - Ninemile Falls to Long Lake Dam	0.71	0.70
56	Spokane R - Long Lake Dam to Little Falls Dam	0.71	0.70
57	lt, Little Falls Dam to confluence with Colombia	0.71	0.70
58	Mainstem Little Spokane River - Upper	0.71	0.70
59	Mainstem Little Spokane River - Lower	0.71	0.70
60	West Branch Little Spokane	0.88	0.78
61	Mainstem Hangman - Upper	0.88	0.78
62	Mainstem Hangman - Middle	0.71	0.70
63	Mainstem Hangman - Lower	0.71	0.70



22.3.4 Current Management

Rainbow trout spawning and emergence was studied in the upper Spokane River between Upper Falls Dam and Post Falls Dam between 1995 and 1999 (Avista Corp 2000). The results of this study are being used to manipulate flows from Post Falls Dam to maintain flows at desirable levels during the rainbow trout incubation period (Avista Corp 2000). Rainbow trout year-class strengths vary annually and are associated with flows between spawning and post emergence (Bennett and Underwood 1988). A substantial proportion of spawning substrate is dewatered when mainstem flows drop below 6,000 cfs, resulting in decreased spawning success (Avista Corp 2000). Mean monthly flows from 1891 to 2001 indicate mainstem flows are below 6,000 cfs July through January (Figure 22.2). However, the key period for rainbow trout incubation is from late March until mid-June (Avista Corp 2000). There have been three primary spawning areas identified: Harvard Road, Starr Road Bar, and the Island Complex. Most redds were constructed at elevations that would be dewatered as flows drop between 4,000-6,000 cfs.

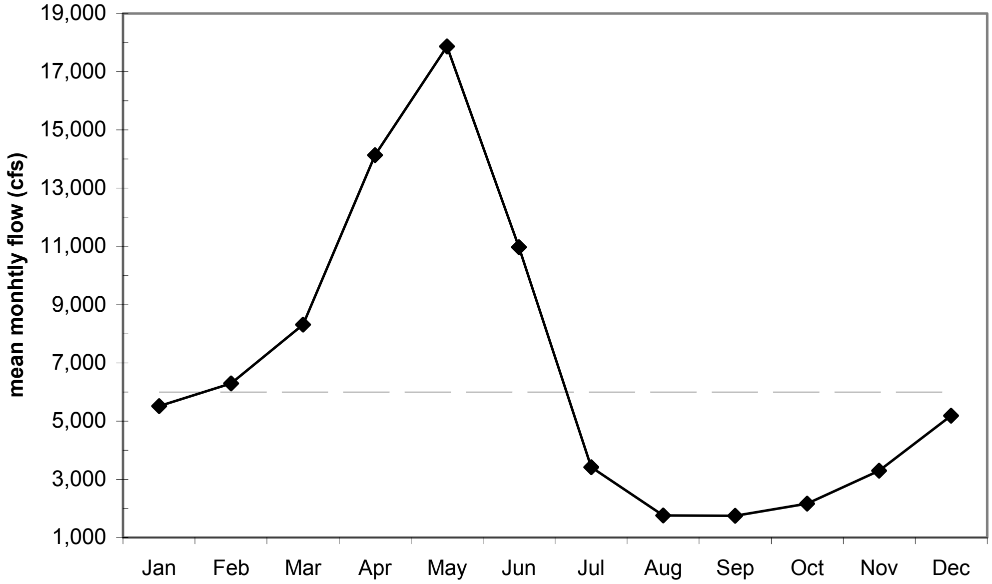


Figure 22.2 Mean monthly flow in the Spokane River 1891-2001.
(*Source:* USGS 12422500)

Current harvest regulations are intended to protect native rainbow trout in the Spokane River mainstem. Only catch and release is permitted in the Spokane River above Upper Falls Dam upstream to the Washington-Idaho state line. There is a restricted harvest in the Spokane River from Upper Falls Dam downstream to Riverfront Park, and from Monroe Street to Nine Mile Falls Dam allowing harvest of only hatchery origin fish (adipose clipped). In addition, WDFW enforces harvest regulations designated for tributaries and reservoirs to the Spokane River to protect wild salmonids from overharvest. In the river and tributaries, the minimum catch is 8 inches and daily limit is two trout. In lakes, ponds, and reservoirs there is no minimum size and the daily limit is 5 trout (refer to website for regulations:
https://fortress.wa.gov/dfw/erules/efishrules/index.jsp).

22.4 Focal Species – Mountain Whitefish

22.4.1 Historic Status

Mountain whitefish are native to the Spokane Subbasin, and are broadly distributed in the Columbia River basin but absent from coastal drainages with the exception of the Puget Sound and the westside river drainages of the Olympic Mountains (McPhail and Troffe 2001). Mountain whitefish are present in both lotic and lentic environments. Some populations of whitefish complete their life cycle within or between a single lake or river system. Mountain whitefish life history traits and habitat requirements vary between lake and river environments. The variability in environmental conditions may affect behavior such as spawning time and locality. General knowledge and specific information regarding mountain whitefish migration patterns, straying, and gene flow among populations within the Spokane Subbasin is sparse.

22.4.2 Current Status

Current and past documentation and data on the abundance, distribution, life history strategy, genetic integrity, carrying capacity, and productivity of mountain whitefish in the Spokane Subbasin is limited. From 1938 to 1978, WDFW conducted creel surveys and found mountain whitefish present in Chain Lakes, Horseshoe Lake, and the Little Spokane River (Connor et al. 2003a). The most recent resident fish survey data available were conducted by the WDFW in 2001 and 2002 in the Little Spokane drainage and the middle Spokane River (Connor et al. 2003a, 2003b). Mountain whitefish were also sampled in Little Falls Pool in 1992 (Scholz, EWU, personal communication, unpublished data), in Chamokane Creek (Scholz et al .1988; Connor et al. 2004), in Lake Spokane (Johnson 2001), and in the Spokane Arm (STOI unpublished data). The following text describes mountain whitefish population abundance/structure for the Little Spokane River drainage, Spokane River, and Chamokane Creek.

Based on the WDFW 2001 and 2002 surveys, mountain whitefish are currently present in the Little Spokane River drainage encompassing Bear Creek, Dry Creek, Little Spokane River, Otter Creek, West Branch Little Spokane River, Wethey Creek, Horseshoe Lake, and Chain Lakes (Connor et al. 2003a, 2003b). No mountain whitefish were observed in Eloika, Fan, Sacheen, Diamond, or Trout lakes (Connor et al. 2003a). The relative abundance of mountain whitefish in the creeks and lakes in the Little Spokane River drainage were often less than three percent of the total fish captured in all reaches surveyed at one site (Connor et al. 2003a, 2003b). Temperature was suggested to be the limiting factor for mountain whitefish distribution since this species prefers conditions between 9 and 11 °C (Northcote and Ennis 1994). In the West Branch Little Spokane River, the mean annual temperature in 2001 was 17 °C, the mean temperature between May and September remained at 18.8 °C, and the maximum reached 28.65 °C (Connor et al. 2003a). These less favorable thermal conditions were likely the result of surface inflow from surrounding lakes (Connor et al. 2003a).

In 2002, WDFW also surveyed the middle Spokane River, which extends from Nine Mile Dam upstream to Spokane Falls including free-flowing and reservoir habitats (Connor et al. 2003b). In the free-flowing habitat, mountain whitefish represented about 12 percent of the fish surveyed with ages ranging between 2 and 4 years. In Nine Mile Reservoir mountain whitefish represented less than one percent of the relative abundance with ages ranging between 0 and 5 years. In 2002, the relative weight (W_r) of mountain whitefish in the reservoir was greater ($W_r = 92$) than in the free-flowing water ($W_r = 80$), but both habitat types were lower than the national standard ($W_r = 100$). Similarly, the condition factor (K_{TL}) of mountain whitefish in the reservoir was also greater ($K_{TL} = 0.93$) than in the free-flowing water ($K_{TL} = 0.80$), but overall comparable to condition factors of mountain whitefish in the Pend Oreille River reservoirs Box Canyon ($K_{TL} = 0.76$) and Boundary ($K_{TL} = 0.83$) (Connor et al. 2003b).

In 1987 an estimation of the mountain whitefish population was determined in Chamokane Creek (Scholz et al.1988) to be 719 individuals with a density of 55 per kilometer. In 2003, the density of mountain whitefish in the lower reach of Chamokane Creek was 3.08 fish/100m² (Connor et. al. 2004).

Mountain whitefish have been collected in the Spokane Arm every year since 1993, excluding 1996 and 1997 (STOI unpublished data). The highest relative abundance occurred in 2000. In the fall of 2000, a mature male and female mountain whitefish were collected below Little Falls Dam spillway by Eastern Washington University. These fish were spawned in the laboratory and progeny were archived for future morphological and larval development characterization (EWU unpublished data).

In general, population studies on mountain whitefish in the Subbasin remain limited. Based on the results from WDFW (Connor et al. 2003a, 2003b), the condition factor and relative weights of mountain whitefish are similar to other northwest streams and the national standard, respectively. Biologists do not have the data to know how water quality issues including but not limited to temperature, TDGs, turbidity, total suspended solids, and pollutants such as PCBs or lead in the Spokane River impact mountain whitefish. Water quality could prove to be a principal limiting factor and is a concern within the Spokane Subbasin. In 1999, three fish species including mountain whitefish contained higher than normal concentrations of lead between Upper Falls Dam and the Washington-Idaho state line. In 2001, a fish advisory was expanded to include PCBs of which elevated levels were found in rainbow trout, mountain whitefish, and largescale suckers between Nine Mile Dam and the Washington-Idaho state line (Washington Department of Health 2001). Studies on TDGs in river systems have concluded mountain whitefish are highly intolerant resulting in death of fish after 48 hours with TDGs at 128 percent saturation (Northcote and Ennis 1994). Concentrations of TDGs below dams between Post Falls and Little Falls are known to exceed state standards of 110 percent TDG saturation (Avista 2002), which could potentially limit mountain whitefish abundance or distribution. Research is still needed to unveil the current condition of mountain whitefish and the potential limiting factors present in the Spokane Subbasin.

22.4.4 Limiting Factors Mountain Whitefish

Historically, mountain whitefish were distributed in 39 of 63 delineated reaches and watersheds in the Spokane Subbasin. Habitat conditions from the past (reference) to present were compared for all 39 reaches and the results are presented in Section 22.9, Table 22.26. This table identifies the habitat attributes altered the most from reference conditions within a particular reach.

Currently, mountain whitefish are only present in 19 of 63 reaches and watersheds. Table 22.15 shows the areas where mountain whitefish are no longer present and the rank each reach received when comparing reference to current habitat conditions. The results show clearly the areas where the physical habitat is least similar to the reference and mountain whitefish are no longer present (Tables 22.15 and 22.16).

Table 22.15. List of the 20 reaches in the Spokane River where mountain whitefish are no longer present and the respective reach rank assessing the degree of habitat deviation from reference conditions, 1 = greatest habitat alteration

Reach Name	Reach Rank
Mainstem Hangman - Upper	1
State line to Mission Hangman Tributaries	2
Western Tributaries of Hangman Ck	2
Little Hangman	4
Mainstem Hangman - Middle	5
Mainstem Hangman - Lower	5
Mission to Indian Creek Hangman Tributaries	7
Moctileme	8
Rose	9
North Fork Rock	10
Rock	11
Blue/Oyachen/Orzada	12
Little Chamokane	13
Hangman Headwaters	13
Hauser/Post Falls	15
Frog/W.Dragoon	18
Sand Ck	29
Mainstem Spokane R- C d'A Lake to Post Falls Dam	32
California	36
Hayden	37

The Hangman watershed (southern tip of the Subbasin) received the top rankings for habitat conditions least representative to reference conditions. The key habitat attributes having undergone the most change appear to be fine sediment loading and high flow (Table 22.16).

Reaches ranked for protection (Table 22.17) signify the areas most representative of reference conditions. These areas were scattered around the Subbasin.

The tornado diagram (Table 22.18) and maps (Map SK-3, SK-4, located at the end of Section 22) presents the reach scores for both current habitat condition (ranging from zero to positive one, Map SK-3) and protection (ranging from zero to negative one, Map SK-4). Scores closest to negative one depict reaches most representative of reference habitat conditions. Scores closest to positive one depict reaches with habitat conditions least similar to reference conditions. Confidence scores range from zero to one and are associated with the ratings assigned by local biologists based on documentation or their expert opinion regarding reference and current habitat attributes for each reach.

Table 22.16. Ranking of reaches with the largest deviation from the reference habitat conditions for mountain whitefish in the Spokane Subbasin. A reach rank equal to 1 has the greatest deviation from reference condition in comparison to other reaches. Reach scores range from 0 to 1, with 1 having the greatest deviation from reference. Values associated with each habitat attribute range from 1 to 11, a value of 1 indicates a habitat attribute having the greatest deviation from reference compared to the other attributes within that reach. In some cases multiple habitat attributes have a value of 1 indicating all attributes equally deviate the most from the reference.

Sequence	Reach Name	Re ach Rank	Reach Score	Riparian Condition	Channel stability	Habitat Diversity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions
61	Mainstem Hangman - Upper	1	0.5	9	6	7	1	1	5	3	10	7	3	10
46	State line to Mission Hangman Tribs	2	0.5	9	5	7	1	2	4	2	11	8	6	10
49	Western Tributaries of Hangman Ck	2	0.5	9	5	7	1	2	4	2	11	8	6	10
44	Little Hangman	4	0.5	10	5	8	1	2	6	2	11	8	2	6
62	Mainstem Hangman - Middle	5	0.4	9	6	7	3	1	2	3	10	8	3	10
63	Mainstem Hangman - Lower	5	0.4	9	6	7	3	1	2	3	10	8	3	10
47	Mission to Indian Creek Hangman Tribs	7	0.4	10	4	5	1	2	3	5	11	8	7	9
45	Moctileme	8	0.4	9	2	7	1	3	6	3	11	8	3	10
43	Rose	9	0.4	8	2	7	1	3	6	3	10	8	3	10
42	North Fork Rock	10	0.4	9	5	7	1	2	6	2	10	8	2	10
41	Rock	11	0.3	9	4	6	1	2	5	7	10	7	2	10
3	Blue/Oyachen/Orzada	12	0.3	8	3	6	2	10	4	5	10	9	1	7
7	Little Chamokane	13	0.3	8	3	5	1	9	4	2	9	6	6	9
48	Hangman Headwaters	13	0.3	10	4	5	1	2	2	5	11	5	5	9
27	Hauser/Post Falls	15	0.3	9	3	3	1	7	1	11	10	6	7	5
54	Mainstem Spokane R - Seven Mile to Nine Mile Falls Hydro	16	0.3	7	6	4	1	9	5	9	9	7	3	2

55	Mainstem Spokane R - Nine Mile Falls to Long Lake Dam	17	0.3	6	6	3	1	10	8	4	10	9	4	2
14	Frog/W.Dragoon	18	0.3	9	2	3	1	4	4	10	10	7	4	8
21	Peone/Deadman	19	0.3	7	3	5	1	5	4	9	9	7	2	9
11	Lower Chamokane	20	0.3	7	3	4	1	7	5	5	10	7	2	10
57	Spokane Arm of Lake Roosevelt, Little Falls Dam to confluence with Colombia	21	0.3	6	4	4	2	9	9	7	9	8	2	1
15	Dragoon	22	0.2	9	2	3	1	3	3	10	10	7	3	8
52	Mainstem Spokane R- Upriver Dam to Monroe St Hydro	23	0.2	7	8	4	2	9	5	9	9	5	1	3
18	North Spokane	24	0.2	8	6	4	1	5	3	10	10	9	2	7
25	Upper Little Spokane Tribs	25	0.2	7	2	5	1	6	3	9	9	8	9	3
59	Mainstem Little Spokane River - Lower	26	0.2	7	5	3	1	7	4	9	9	5	2	9
56	Mainstem Spokane R - Long Lake Dam to Little Falls Dam	27	0.2	7	5	3	2	9	6	9	9	8	3	1
24	West Branch Little Spokane Tribs	28	0.2	7	2	3	1	4	4	9	9	7	9	6
2	Sand Ck	29	0.2	7	2	4	1	9	3	4	9	7	4	9
60	West Branch Little Spokane	30	0.2	5	4	3	1	8	6	8	8	2	7	8
58	Mainstem Little Spokane River - Upper	31	0.2	7	5	2	1	7	3	10	10	3	7	6
50	Mainstem Spokane R- C d'A Lake to Post Falls Dam	32	0.2	5	8	3	2	4	7	8	8	5	1	8
51	Mainstem Spokane R- Post Falls Dam to Upriver Dam	33	0.2	6	7	3	2	7	3	7	7	5	1	7
17	Mud/Wethey/Huston	34	0.2	8	2	5	1	3	7	9	9	5	3	9
30	Lower Spring Creek	35	0.2	7	6	3	1	5	4	9	9	7	1	9
40	California	36	0.2	6	5	3	1	6	2	9	9	6	3	9
29	Hayden	37	0.2	8	1	4	3	1	5	11	10	9	7	5
53	Mainstem Spokane R - Monroe St to Seven Mi Bridge	38	0.2	5	7	3	1	8	4	8	8	5	2	8
22	Upper Deadman	39	0.2	6	5	2	1	2	2	8	8	6	8	8

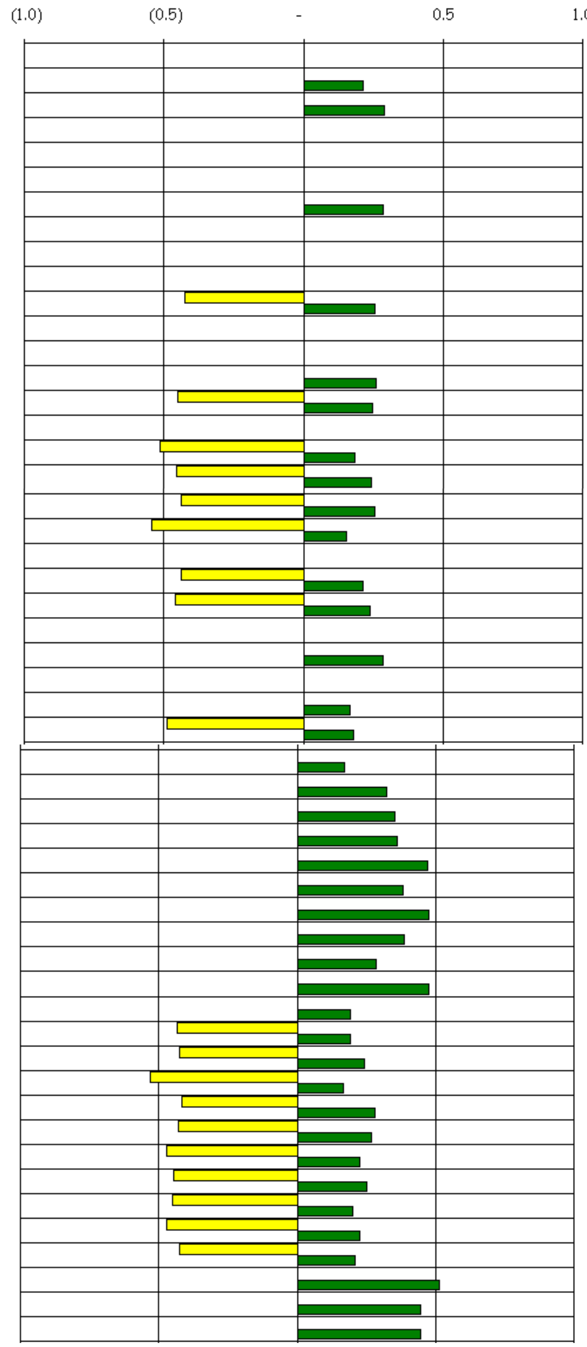
Table 22.17. Ranking of streams whose habitat is most similar to the reference condition for mountain whitefish in the Spokane Subbasin in comparison to other reaches. A reach rank equal to 1 reveals the reach with current conditions most similar to reference conditions in comparison to other reaches. Reach score ranges from 0 to -1, with -1 having the least deviation from reference. Values associated with each habitat attribute range from 1 to 11, a value of 1 indicates a habitat attribute being most similar to the reference compared to the other attributes within that reach. In some cases multiple habitat attributes have a value of 1 indicating all attributes are equally the most similar to the reference.

Sequence	Reach Name	Reach Rank	Reach Score	Riparian Condition	Channel stability	Habitat Diversity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions
22	Upper Deadman	1	-0.54	11	5	10	6	3	7	1	9	8	1	4
53	Mainstem Spokane R - Monroe St to Seven Mi Bridge	2	-0.53	11	4	10	7	1	5	1	9	7	5	3
17	Mud/Wethey/Huston	3	-0.51	11	7	9	5	2	5	1	8	9	2	4
30	Lower Spring Creek	4	-0.49	10	3	11	4	2	7	1	8	6	4	8
56	Mainstem Spokane R - Long Lake Dam to Little Falls Dam	5	-0.47	10	4	9	5	1	5	1	8	7	3	11
59	Mainstem Little Spokane River - Lower	6	-0.47	10	4	10	9	2	6	1	7	8	5	3
25	Upper Little Spokane Tribs	7	-0.46	11	4	10	9	3	6	1	6	4	1	6
18	North Spokane	8	-0.46	11	3	10	9	2	7	1	7	6	4	4
15	Dragoon	9	-0.45	11	8	9	9	2	5	1	6	7	2	4
58	Mainstem Little Spokane River - Upper	10	-0.45	9	4	9	6	2	5	1	7	8	2	11
57	Spokane Arm of Lake Roosevelt, Little Falls Dam to confluence with Colombia	11	-0.45	10	7	9	4	1	3	2	8	6	4	11
21	Peone/Deadman	12	-0.44	11	5	9	9	2	6	1	6	8	4	3
24	West Branch Little Spokane Tribs	13	-0.44	10	5	9	8	3	4	1	7	5	1	11
51	Mainstem Spokane R- Post Falls Dam to Upriver Dam	14	-0.43	10	3	7	4	1	5	1	6	9	7	11
55	Mainstem Spokane R - Nine Mile Falls to Long Lake Dam	15	-0.43	10	4	9	8	1	5	2	7	6	2	11
11	Lower Chamokane	16	-0.43	11	6	10	9	1	5	2	8	6	3	3
60	West Branch Little Spokane	17	-0.43	9	5	8	7	1	4	1	6	9	3	11
52	Mainstem Spokane R- Upriver Dam to Monroe St Hydro	18	-0.42	10	3	9	4	1	5	1	6	7	7	11
54	Mainstem Spokane R - Seven Mile to Nine Mile Falls Hydro	19	-0.41	8	3	8	8	1	5	1	7	6	4	11

Table 22.18. Tornado diagram for mountain whitefish in the Spokane Subbasin. Degree of confidence for protection and current habitat conditions range from 0.0 to 1.0 with the greatest confidence equal to 1.0. Protection reach scores are presented on the left side and current habitat reach scores are presented on the right. Negative scores are in parentheses.

NP = Not present

Sequence	Reach Name	Protection Confidence	Current Habitat Condition Confidence
1	McCoy /Ente'	NP	
2	Sand Ck	0.88	0.78
3	Blue/Oyachen/Orzada	0.88	0.78
4	South Slopes/Harker Canyon	NP	
5	South Slopes/Mill Canyon	NP	
6	Upper Chamokane	NP	
7	Little Chamokane	0.71	0.70
8	Camas	NP	
9	Included in #7	NP	
10	Included in #7	NP	
11	Lower Chamokane	0.88	0.78
12	Rail Ck/Walkers Prairie	NP	
13	TumTum/ North 1/2 only	NP	
14	Frog/W.Dragoon	0.88	0.78
15	Dragoon	0.88	0.78
16	Little Sandy Canyon	NP	
17	Mud/Wethey/Huston	0.71	0.70
18	North Spokane	0.88	0.78
21	Peone/Deadman	0.71	0.70
22	Upper Deadman	0.71	0.70
23	Bear/Cottonwood/Pell	NP	
24	West Branch Little Spokane Tribs	0.88	0.78
25	Upper Little Spokane Tribs	0.88	0.78
26	Thompson Creek	NP	
27	Hauser/Post Falls	0.71	0.70
28	Rathdrum Ck	NP	
29	Hayden	0.71	0.70
30	Lower Spring Creek	0.71	0.70
40	California	0.71	0.70
41	Rock	0.71	0.70
42	N Fk Rock	0.71	0.70
43	Rose	0.71	0.70
44	Little Hangman	0.71	0.70
45	Moctileme	0.71	0.70
46	Stateline to Mission Hangman Tribs	0.88	0.78
47	Mission to Indian Creek Hangman Tribs	0.88	0.78
48	Hangman Headwaters	0.88	0.78
49	Western Tributaries of Hangman Ck	0.55	0.61
50	nstem Spokane R- C d'A Lake to Post Falls Dam	0.71	0.70
51	tem Spokane R- Post Falls Dam to Upriver Dam	0.71	0.70
52	n Spokane R- Upriver Dam to Monroe St Hydro	0.71	0.70
53	em Spokane R - Monroe St to Seven Mi Bridge	0.71	0.70
54	pokane R - Seven Mile to Ninemile Falls Hydro	0.71	0.70
55	n Spokane R - Ninemile Falls to Long Lake Dam	0.71	0.70
56	Spokane R - Long Lake Dam to Little Falls Dam	0.71	0.70
57	lt, Little Falls Dam to confluence with Colombia	0.71	0.70
58	Mainstem Little Spokane River - Upper	0.71	0.70
59	Mainstem Little Spokane River - Lower	0.71	0.70
60	West Branch Little Spokane	0.88	0.78
61	Mainstem Hangman - Upper	0.88	0.78
62	Mainstem Hangman - Middle	0.71	0.70
63	Mainstem Hangman - Lower	0.71	0.70



22.4.5 Current Management

Fisheries managers foresee mountain whitefish having a greater recreational importance in the future as a result of habitat loss and the continued degradation of the existing fishery resources. To avoid over-exploitation of this species and create a baseline for future management strategies, current information is needed regarding life history strategies, population size, abundance, capacity, and genetic integrity.

Currently, WDFW fish regulations for 2003/2004 categorize mountain whitefish as a game species with a daily catch limit of 15 fish with no minimum size limit. Some special rules do apply to areas of eastern Washington. For example, from SR 291 Bridge to the West Branch of the Little Spokane River, mountain whitefish are only harvested from December 1 to March 1 with no minimum size limit and a daily limit of 15 fish. Only one single hook (3/16 inch) or smaller measured point to shank (size #14) may be used (WDFW 2003/2004).

22.5 Focal Species – Kokanee Salmon

22.5.1 Historic Status

Prior to the construction of the dams on the Spokane River, specifically Little Falls Dam in 1911, local residents observed sockeye migration up the Little Spokane River (A. Scholz, EWU, personal communication, 2003). After the construction of Little Falls Dam, these sockeye were landlocked and are now referred to as kokanee. An initial genetic analysis suggests a genetically distinct kokanee stock resides in the Chain Lakes, located in the East Branch of the Little Spokane River drainage, as a result of long-term reproductive isolation and low number of effective breeders (WDFW 2002). Chain Lakes kokanee are most likely a remnant native sockeye stock.

22.5.2 Current Status

Currently, most of the kokanee stocked in the Spokane Subbasin are of coastal origin from Lake Whatcom, thus considered an exotic (see Table 22.1). However, residual native stocks persist and/or are suspected to persist throughout the Subbasin. For example, the kokanee population existing in the Chain Lakes section of the Little Spokane River drainage is likely a native stock (Scholz, EWU, personal communication, 2003). In 1999, the WDFW collected 25 kokanee and sent samples to the University of Montana for protein electrophoretic analyses. While the number of samples is not sufficient to provide statistically significant results, the data suggest the stock is distinct from other kokanee populations in the IMP. This naturally reproducing population is relatively small with an estimated population of 1,500 adult spawners in the early 1990s and observed spawning population over 1,000 adults in 2002 (A. Scholz, EWU, personal communication, 2003).

There are also several other indigenous stocks of kokanee that are entrained into the Spokane Arm, some of which reproduce in Lake Roosevelt tributaries. Refer to the aquatic assessment of the Upper Columbia Subbasin in Section 30.5 for more details regarding kokanee in Lake Roosevelt.

22.5.3 Limiting Factors Kokanee Salmon

Historically kokanee were present in 13 of 63 delineated reaches and watersheds in the Subbasin. The 13 reaches were evaluated for changes from reference to current habitat conditions (Table 22.19). The results show the western section of the Subbasin with habitat traits least representative of reference conditions. The habitat attributes having changed the most over time include pollutants, obstructions, fine sediments, and channel stability (Table 22.19).

Kokanee are currently present in 12 of 63 delineated areas in the Subbasin. However, the distribution of kokanee has changed over time. Kokanee are no longer found in six reaches included in the historic distribution. These areas encompassed the Little Chamokane, McCoy, Ente', and Sand creeks and lower reach of the Little Spokane River. There are five reaches on the mainstem of the Spokane River currently having kokanee where they were not present historically. Only the 12 reaches where kokanee are currently present were evaluated for protection (Table 22.20). The top three areas recognized to have habitat attributes most similar to reference conditions are located within the Little Spokane River watershed (Table 22.20).

The tornado diagram (Table 22.21) and maps (Map SK-5, Map SK-6, located at the end of Section 22) presents the reach scores for both current habitat condition (ranging from zero to positive one, Map SK-5) and protection (ranging from zero to negative one, Map SK-6). Scores closest to negative one depict reaches most representative of reference habitat conditions. Scores closest to positive one depict reaches with habitat conditions least similar to reference conditions. Confidence scores range from zero to one and are associated with the ratings assigned by local biologists based on documentation or their expert opinion regarding reference and current habitat attributes for each reach.

Table 22.19. Ranking of reaches with the largest deviation from the reference habitat conditions for kokanee in the Spokane Subbasin. Reach rank equal to 1 has the greatest deviation from reference condition in comparison to other reaches. Reach scores range from 0 to 1, with 1 having the greatest deviation from reference. Values associated with each habitat attribute range from 1 to 11, a value of 1 indicates a habitat attribute having the greatest deviation from reference compared to the other attributes within that reach. In some cases multiple habitat attributes have a value of 1 indicating all attributes equally deviate the most from the reference.

Sequence	Reach Name	Reach Rank	Reach Score	Riparian Condition	Channel stability	Habitat Diversity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions
3	Blue/Oyachen/Orzada	1	0.3	9	2	7	3	9	3	5	9	8	1	5
7	Little Chamokane	2	0.3	9	4	3	2	9	4	4	9	8	4	1
55	Mainstem Spokane R - Nine Mile Falls to Long Lake Dam	2	0.3	8	2	5	1	8	2	4	8	7	6	8
57	Spokane Arm of Lake Roosevelt, Little Falls Dam to confluence with Colombia	4	0.3	8	2	5	2	8	8	6	8	7	2	1
1	McCoy /Ente'	5	0.3	10	1	4	2	4	2	4	10	9	4	4
11	Lower Chamokane	6	0.3	8	2	5	1	6	2	8	8	7	8	2
25	Upper Little Spokane Tribs	6	0.3	9	2	5	1	7	4	6	9	8	2	9
56	Mainstem Spokane R - Long Lake Dam to Little Falls Dam	8	0.3	8	5	3	2	8	5	8	8	7	3	1
24	West Branch Little Spokane Tribs	9	0.2	8	2	4	1	5	3	8	8	7	8	5
59	Mainstem Little Spokane River - Lower	10	0.2	8	5	3	1	6	3	8	8	7	2	8
2	Sand Ck	11	0.2	8	2	4	1	8	2	4	8	7	4	8
58	Mainstem Little Spokane River - Upper	12	0.2	9	4	2	1	6	2	9	9	6	6	4
18	North Spokane	13	0.2	7	5	7	7	3	1	7	7	6	1	3

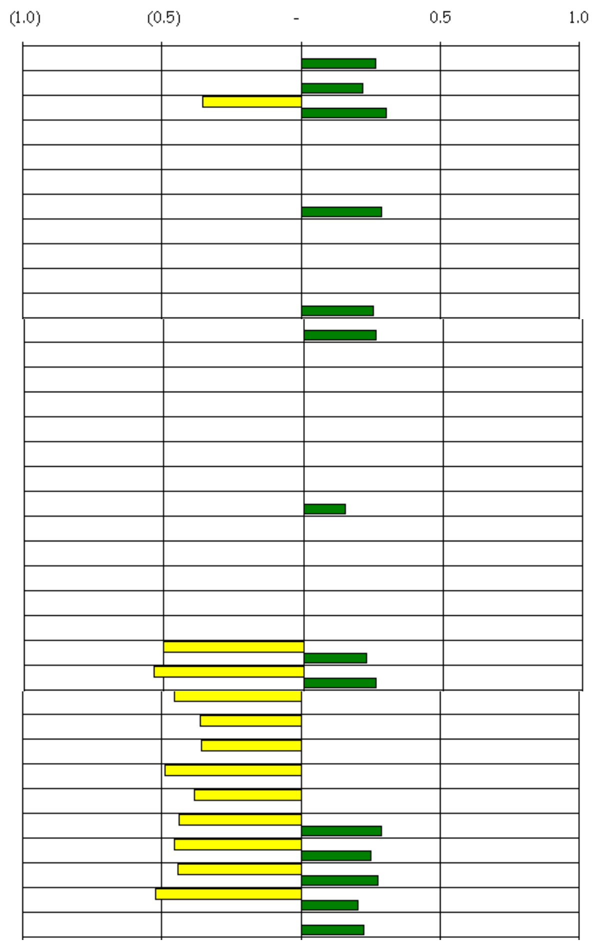
Table 22.20. Ranking of streams whose habitat is most similar to the reference condition for kokanee in the Spokane Subbasin in comparison to other reaches. A reach rank equal to 1 reveals the reach with current conditions most similar to reference conditions in comparison to other reaches. Reach score ranges from 0 to -1, with -1 having the least deviation from reference. Values associated with each habitat attribute range from 1 to 11, a value of 1 indicates a habitat attribute being most similar to the reference compared to the other attributes within that reach. In some cases multiple habitat attributes have a value of 1 indicating all attributes are equally the most similar to the reference.

Sequence	Reach Name	Reach Rank	Reach Score	Riparian Condition	Channel stability	Habitat Diversity	Fine sediment	High Flow	Low Flow	Oxygen	Low Temperature	High Temperature	Pollutants	Obstructions
25	Upper Little Spokane Tribs	1	-0.53	11	5	9	8	4	5	1	1	9	1	5
58	Mainstem Little Spokane River - Upper	2	-0.52	10	5	8	7	3	6	1	1	8	3	10
24	West Branch Little Spokane Tribs	3	-0.50	10	6	8	7	4	5	1	1	8	1	10
53	Mainstem Spokane R - Monroe St to Seven Mi Bridge	4	-0.49	9	7	9	9	1	4	1	5	8	5	1
50	Mainstem Spokane R- C d'A Lake to Post Falls Dam	5	-0.45	9	5	9	9	3	3	1	5	8	7	1
56	Mainstem Spokane R - Long Lake Dam to Little Falls Dam	5	-0.45	8	7	8	8	1	3	1	4	6	5	8
57	Spokane Arm of Lake Roosevelt, Little Falls Dam to confluence with Colombia	7	-0.44	8	7	8	8	1	1	3	4	5	6	8
55	Mainstem Spokane R - Nine Mile Falls to Long Lake Dam	8	-0.44	8	7	8	8	1	2	2	5	6	2	8
54	Mainstem Spokane R - Seven Mile to Nine Mile Falls Hydro	9	-0.38	8	6	8	8	1	3	1	4	7	4	8
51	Mainstem Spokane R- Post Falls Dam to Upriver Dam	10	-0.36	8	4	8	8	1	3	1	4	7	6	8
52	Mainstem Spokane R- Upriver Dam to Monroe St Hydro	11	-0.36	8	5	8	8	1	3	1	4	7	6	8
3	Blue/Oyachen/Orzada	12	-0.35	8	6	8	8	1	4	2	4	6	8	2

Table 22.21. Tornado diagram for rainbow trout in the Spokane Subbasin. Degree of confidence for protection and current habitat conditions range from 0.0 to 1.0 with the greatest confidence equal to 1.0. Protection reach scores are presented on the left side and current habitat reach scores are presented on the right. Negative scores are in parentheses.

NP = Not present

Sequence	Reach Name	Protection Confidence	Current Habitat Condition Confidence
1	McCoy/Ente'	0.88	0.78
2	Sand Ck	0.88	0.78
3	Blue/Oyachen/Orzada	0.88	0.78
4	South Slopes/Harker Canyon	NP	
5	South Slopes/Mill Canyon	NP	
6	Upper Chamokane	NP	
7	Little Chamokane	0.71	0.70
8	Camas	NP	
9	Included in #7	NP	
10	Included in #7	NP	
11	Lower Chamokane	0.88	0.78
11	Lower Chamokane	0.88	0.78
12	Rail Ck/Walkers Prairie	NP	
13	TumTum/ North 1/2 only	NP	
14	Frog/W.Dragoon	NP	
15	Dragoon	NP	
16	Little Sandy Canyon	NP	
17	Mud/Wethey/Huston	NP	
18	North Spokane	0.88	0.78
19	West Spokane - North side only	NP	
20	Downtown/East Spokane	NP	
21	Peone/Deadman	NP	
22	Upper Deadman	NP	
23	Bear/Cottonwood/Pell	NP	
24	West Branch Little Spokane Tribs	0.88	0.78
25	Upper Little Spokane Tribs	0.88	0.78
50	nstem Spokane R- C d'A Lake to Post Falls Dam	NP	
51	tem Spokane R- Post Falls Dam to Upriver Dam	NP	
52	n Spokane R- Upriver Dam to Monroe St Hydro	NP	
53	em Spokane R - Monroe St to Seven Mi Bridge	NP	
54	pokane R - Seven Mile to Ninemile Falls Hydro	NP	
55	n Spokane R - Ninemile Falls to Long Lake Dam	0.71	0.70
56	Spokane R - Long Lake Dam to Little Falls Dam	0.71	0.70
57	lt, Little Falls Dam to confluence with Colombia	0.71	0.70
58	Mainstem Little Spokane River - Upper	0.71	0.70
59	Mainstem Little Spokane River - Lower	0.71	0.70



22.5.4 Current Management

The WDFW is responsible for fishing regulations in the Little Spokane watershed. To ensure that a stock of a native species does not continue to decline, regulations prohibit all harvest of kokanee specifically within the Chain Lakes of the Little Spokane River.

Currently, there is a collaborative multi-agency artificial production program for Lake Roosevelt including the Spokane Arm. Lake Roosevelt fishery management agencies consisting of the WDFW, STOI, and Colville Confederated Tribes direct hatchery stocking in the Spokane Arm of Lake Roosevelt including annual releases of kokanee. Hatchery releases support a sport fishery as well as supplement kokanee returns up to Little Falls Dam where a terminal subsistence fishery for Spokane Tribal members exists as well as egg collection for artificial propagation occurs. Current brood stocks from Lake Roosevelt, Lake Whatcom, and Meadow Creek are utilized for artificial production.

22.6 Focal Species – Chinook Salmon

The restoration of Chinook salmon in Lake Roosevelt, which includes the Spokane Arm, is a management goal of the Indian Tribes in the IMP. Additionally, the historic range of Chinook salmon included the Spokane River and Little Spokane River drainages prior to hydropower development. Therefore, the restoration of Chinook salmon is pertinent to the Spokane Subbasin. For additional information about Chinook salmon in Lake Roosevelt refer to the Upper Columbia Subbasin Section on focal species.

22.6.1 Historical Status

Historically, Chinook salmon were prevalent in the Spokane River downstream of Spokane Falls (Douglas 1836; Stone 1883; Elliot 1914; Gangmark and Fulton 1957; Scholz et al. 1985). Chinook salmon spawned throughout the Spokane River prior to the construction of the dams. Historical evidence indicates the Coeur d' Alene Tribe harvested Chinook as far upstream in Hangman Creek as the current town of Tekoa, Washington (Scholz et al. 1985, Seltice 1990) and possibly as far as DeSmet, Idaho (Scholz et al. 1985).

22.6.2 Current Status

The only naturally reproducing population of Chinook salmon is a non-anadromous population that exists upstream in Coeur d' Alene Lake, the neighboring Subbasin. All Chinook observed within the Spokane Subbasin originated from the Coeur d' Alene Lake population. In the Spokane Subbasin, Chinook salmon have been observed as far downstream as the Spokane, Little Falls Dam, Little Falls Pool, and Chamokane Creek (Conner et al. 2004). Recent surveys in 2001 and 2002 have also observed individual Chinook salmon in Lake Spokane (Osborne et al. 2003) and Nine Mile Reservoir (Connor et al. 2003b), respectively.

22.6.3 Current Management

Currently, there are no efforts devoted to Chinook management within the Subbasin since they have been extirpated from the Spokane River and its tributaries. WDFW sport fishing regulations (2003/2004) group Chinook salmon with trout (Washington regulations available: https://fortress.wa.gov/dfw/erules/efishrules/index.jsp). There are no regulations on the Spokane Indian Reservation.

22.7 Focal Species – Largemouth Bass

22.7.1 Historic Status

Largemouth bass are not native to the Spokane Subbasin or western United States. In the late 1800s, warmwater fish were broadcast across the western United States. Largemouth bass were more than likely introduced multiple times in the Subbasin, however documentation for specific dates and places are unavailable. It is known largemouth bass were present in Lake Spokane prior to the introduction of smallmouth bass in the 1980s (Avista 2002).

22.7.2 Current Status

The current distribution of largemouth bass within the Subbasin includes the Spokane Arm of Lake Roosevelt (Lee et al. 2003), Lake Spokane (Osborne et al. 2003), Little Falls Pool (Scholz, personal communication, 2004), and the Little Spokane River drainage covering the Little Spokane River, Dry Creek, Diamond Lake, Eloika Lake, Fan Lake, Sacheen Lake, Little Spokane River, and Dry Creek (Connor et al. 2003b). In 1992, largemouth bass were sampled in Little Falls Pool (Scholz, EWU, personal communication, unpublished data). In 2000, largemouth bass were sampled in Benjamin and McCoy Lakes. Natural spawning is occurring in Benjamin Lake although only one size class was observed in McCoy Lake (Crossley 2000). Largemouth bass were not identified in any previous studies of the interior lakes of the Spokane Indian Reservation. Available documentation regarding largemouth bass population abundance and structure was limited to Lake Spokane. Populations in the Spokane Arm are very limited, and are likely fallouts from Lake Spokane (STOI unpublished data).

In 2001, Osborne et al. (2003) surveyed the warmwater fishery in Lake Spokane. Results show largemouth bass growth rates in Lake Spokane calculated using the overall mean (using direct proportion method) and weighted mean (using Lee's modification of the direct proportion method) were greater than the average growth rate in Washington (Table 22.22). Total length varied in size from 152 to 550 mm. Age ranged from 2 to 13 years with most of the population dominated by largemouth bass age 5 and older. The lack of young-of-the-year and age 1 largemouth bass observed during this survey suggests low recruitment or problem with the sample timing (Osborne et al. 2003).

Table 22.22. Back-calculated overall and weighted mean length at age (mm) of largemouth bass in Lake Spokane during June 2001 compared to the Washington state mean length at age. Overall mean based on direct proportion method, weighted mean based on Lee's modification of the direct proportion method.

	Total Length (mm) at Age												
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Overall Mean	85	221	315	369	403	428	450	469	482	493	498	538	550
Weighted Mean	103	227	316	369	404	425	450	477	488	501	506	537	550
WA State Mean	60	146	222	261	289	319	368	396	440	485	472	496	NA

(*Source*: Osborne et al. 2003)

The condition of largemouth bass based on relative weight varied greatly (W_r 52 – 144) and did not appear to be related to fish size. Approximately equal numbers of largemouth bass exhibited conditions above and below the national average (Osborne et al. 2003).

Due to a lack of trend data, the 2001 warmwater fisheries survey was unable to determine whether the largemouth bass population is in decline or has stabilized (Osborne et al. 2003). Even with the apparently low juvenile recruitment, the size structure in 2001 appears to be similar to documentation from the 1980s by Bennett and Hatch (1991, as cited in Osborne et al. 2003). Potential factors limiting largemouth bass recruitment include elevated predation pressures, lack of juvenile cover, winter induced-stressors, zooplankton entrainment, and unsuitable over-wintering habitat. All of these factors are related to annual drawdowns at Long Lake Dam. Lower water levels increases the density of predatory fish in Lake Spokane, reduces cover and shelter for juveniles, and elevates stress for juveniles that can result in mortality (Osborne et al. 2003).

22.7.3 Current Management

Lake Spokane is managed as a cold and warmwater fishery. Overall, surveys conducted by Osborne et al. (2003) conclude the warmwater fishery is doing well under current environmental conditions and management strategies. Osborne et al. (2003) also speculates any change in management strategy for largemouth bass may not have a large impact on the population, but could instead negatively affect the other gamefish populations.

Largemouth bass sport fishery is not considered a “trophy” fishery in Lake Spokane but does provide ample opportunity for tournament anglers and the general public. Since 2001, fishing regulations have been more conservative with a 305-432 mm (12-17 inch) slot limit and may influence the future structure of the population. It is likely current age structure of the largemouth bass population is reflective of the past regulations. Past statewide regulations in Washington allowed anglers to harvest five largemouth bass, but only three could be greater than 381 mm (15 inches) (Osborne et al. 2003).

Currently in the state of Washington, there is no minimum size limit with a daily limit of five bass less than 305 mm (12 inches) or no more than one bass greater than 432 mm (17 inches). In addition to the slot limit regulations, anglers must release all largemouth bass from May 1 to June 30 to limit harvest during the spawning season.

Additional information exists in the form of current regulations in the fishing regulations pamphlet (Available: https://fortress.wa.gov/dfw/erules/efishrules/index.jsp).

22.8 Environmental Conditions[2]

22.8.1 Environmental Conditions within the Subbasin

22.8.1.1 Historical Conditions – Spokane River

Historically, the Spokane River provided ideal salmonid production habitat. Habitats were characterized by cold, clean water, diverse habitat complexity, and unembedded substrates (Gilbert and Evermann 1895). The hydrograph of the Spokane River and tributaries were unaltered and passage between the Spokane River and tributaries were not impeded by hydroelectric development allowing for species movement and genetic exchange between different regions of the Subbasin. Habitat conditions were also well suited for an abundant and diverse community of aquatic invertebrates (Gilbert and Evermann 1895). Invertebrate communities supported juvenile anadromous salmonids and entire life histories of resident salmonids.

Aquatic habitats were, in part, the result of intact riparian and upland habitats. Mature coniferous forests, dense riparian communities, and rolling grasslands provided shade for rivers and streams. Prior to timbering of the Subbasin, snow melted off gradually throughout the spring and summer and extensive wetland and riparian habitats buffered inputs during peak runoff. Gradual melting of snow helped maintain cool water

[2] Large portions of Section 22.8 were contributed to by the Spokane River Subbasin Summary Report (2000) pp. 9-13.

conditions during the warm summer months. Groundwater inputs (Spokane-Rathdrum Aquifer) to the Spokane River also contributed to maintain favorable thermal conditions for salmonids. Further, water from snowmelt and precipitation was filtered by stable soils, thus soil erosion and sediment from adjacent hill slopes was less extensive.

22.8.1.2 Current Conditions – Spokane River

Compared to historic conditions, Spokane River fish community has been significantly impacted by hydroelectric development and impaired water quality from various land use, pollutants from point and non-point sources, and other anthropogenic activities. The Spokane River is listed on Washington State's 1998 303(d) list for exceeding water quality standards regarding temperatures, metals in surface waters, PCBs, pH, metals in sediments, and total phosphorus. The upper reaches of the Spokane River are also included on Idaho's 1998 303(d) list for similar water quality impairments. These include impairments as a result of bacteria, dissolved oxygen, metals, nutrients, sediments, and temperature. The 2002/2004 Water Quality Assessment also added dissolved oxygen and TDGs to the list of parameters not meeting water quality standards in some reaches of the Spokane River, while other reaches in the Spokane River are now reportedly meeting temperature and pH water quality standards (Available January 2004: http://www.ecy.wa.gov/programs/wq/303d/2002/2002_list.html).

As discussed in Section 21.2, there are seven dams on the Spokane River and several other impoundments on the tributaries. The hydroelectric development on the Spokane River does not provide fish passage facilities thus preventing the historic migration patterns of fish species, genetic exchange, and disrupting metapopulation dynamics. The hydrodevelopment also modified some of the free-flowing river habitats into reservoir habitats providing less favorable habitat conditions for salmonids. Reservoir habitats or slackwater habitats modify river conditions resulting in slower flows, lower dissolved oxygen levels, warmer temperatures, and increased deposition of sediment.

The operations of Post Falls Dam and subsequent storage of water in Coeur d' Alene Lake has resulted in modifications of the Spokane River hydrograph as depicted in Figure 22.3. Figure 22.3 presents comparable high flow years from pre- (1890-1906) to post- (1965-1975) operation of Post Falls Dam. In the early 1900s before Post Falls Dam was constructed, Coeur d' Alene Lake's natural mean summer (July) lake elevation oscillated between 2121 and 2124 ft above mean sea level (amsl) (Figure 22.4) when Coeur d' Alene Lake "drained" throughout the summer. After operations began at Post Falls Dam (1906), summer lake levels increased to about 2126.5 ft amsl. In 1942, lake storage was further increased, which is reflected in today's summer lake level averaging 2128 ft amsl (Figure 22.4). Under current operations at Post Fall Dam, more water is stored during the summer to maintain higher than natural lake levels thus reducing available water downstream to the Spokane River (figures 22.3 and 22.4).

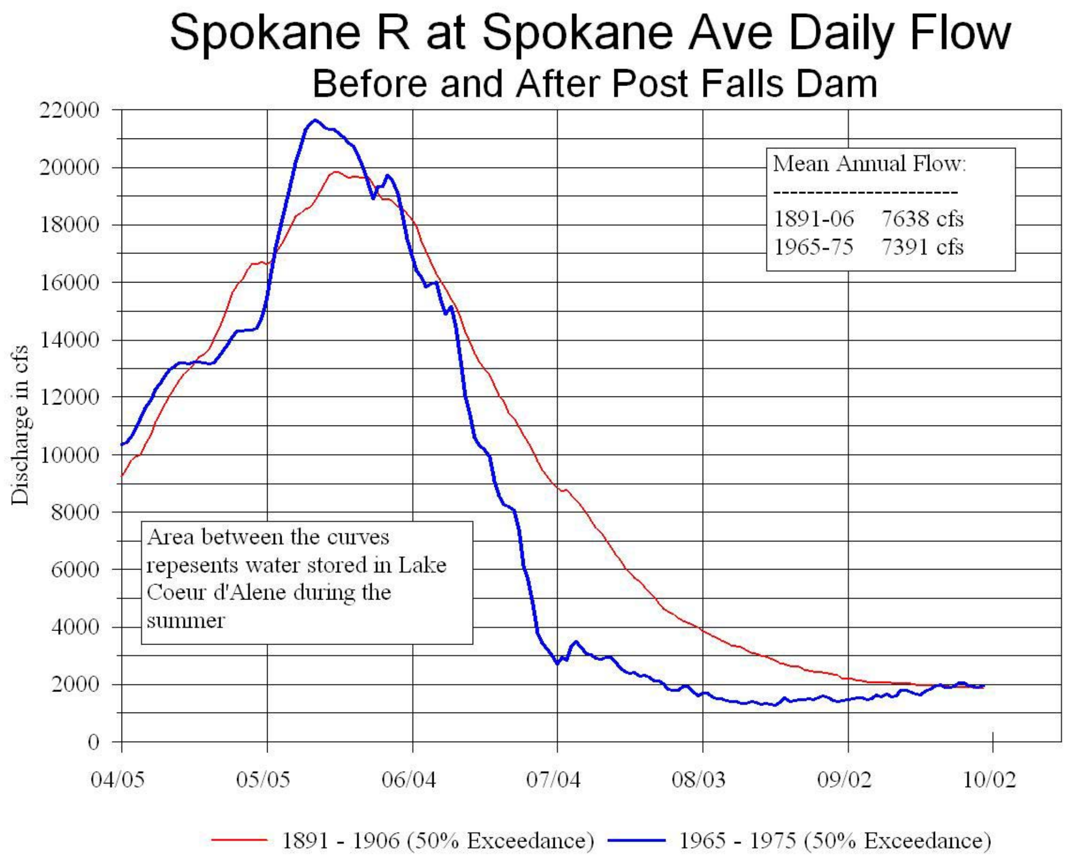


Figure 22.3. Graph shows 50 percent exceedance of average daily flow in the Spokane River of two comparable high flow years, pre- dam 1891-1906 and post- dam 1965-1975. (*Source*: WDOE using USGS data from gage station 12422500)

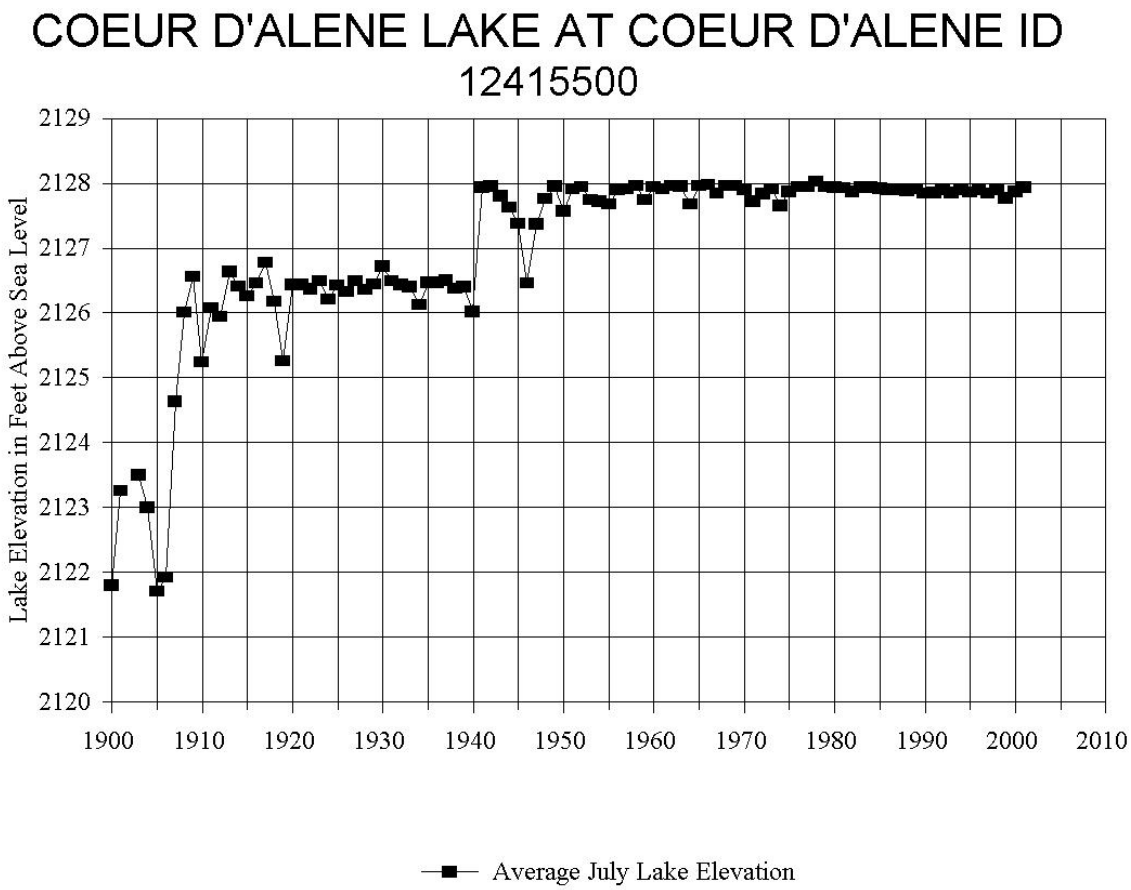


Figure 22.4. Coeur d' Alene Lake mean lake elevation in July from 1890-2003. Pre-Post Fall Dam is represented by years 1890-1906. The first managed summer lake levels (2126.5 ft) are represented by years 1907-1941. Current summer lake level management (2128 ft) is represented by years 1942-present. (*Source*: WDOE 2004)

Although the mean annual hydrograph for the Spokane River has not shown much change since the operation of Post Falls Dam in 1906 (Figure 22.5), noticeable seasonal alterations occur. Figure 22.6 depicts a declining trend in the 7-day low summer/fall flow data (1890-2003) that may reflect impacts from dam operations and/or increased water demands in the Spokane area during this time of year. However, the cause and effect relationship of dam operations and/or water demands to the seasonal flows of the Spokane River is not yet well understood or defined. The 7-day low flow between 1 June and 1 October has declined from a range pre-Post Falls Dam (1890-1906) between 1300 and 2600 cfs to a range post-Post Fall Dam (1942-2003, representative of current summer lake level management 2128 ft amsl) between 500 and 1800 cfs (Figure 22.6). Currently, snow melt and spring runoff are capable of recharging the aquifer and the Spokane River each year, thus the reduction in the 7-day low flow during the summer/fall (Figure 22.6) is not currently impacting or visible in the annual mean flow (Figure 22.5). However, the decreasing trend in the summer/fall 7-day low flows may affect fish survival during these time periods.

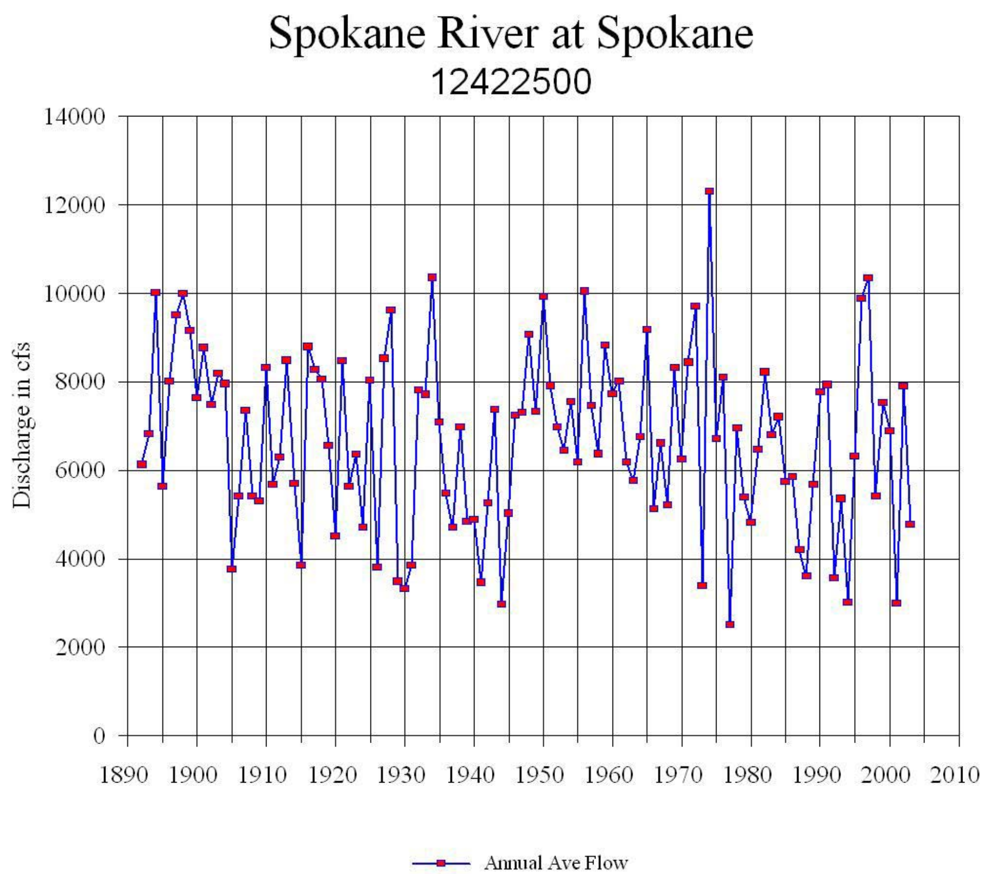


Figure 22.5. Annual mean flow in the Spokane River between 1890-2003 from USGS gage station 12422500 (*Source*: WDOE 2004)

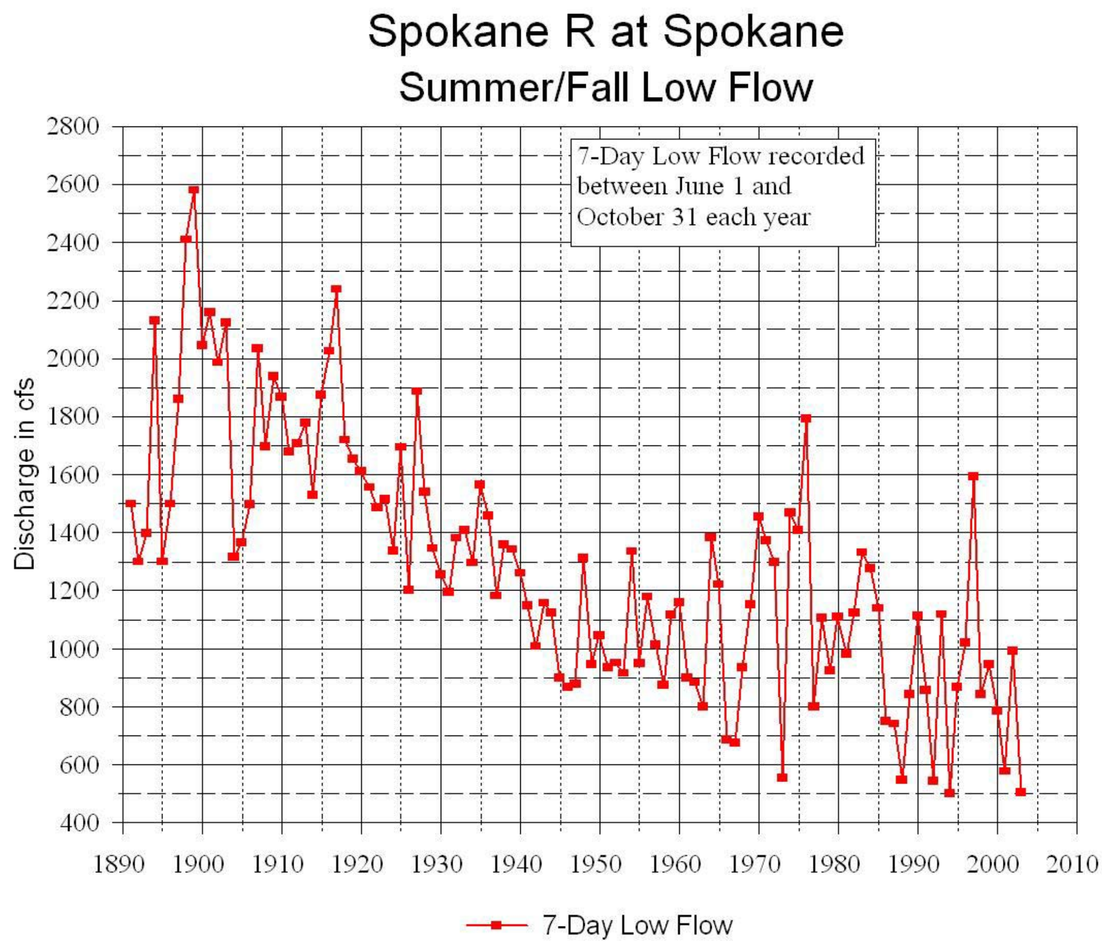


Figure 22.6. Spokane River summer/fall 7-day low flow data between June 1 and October 31 from 1890-2003. Post Falls Dam was present in 1906. Lake management for summer lake elevation was increased in 1942. (*Source*: WDOE 2004 using USGS data from gage station 12422500).

The Spokane River has also been impacted from upstream mining activities in the Coeur d' Alene Subbasin from the outlet of Coeur d' Alene Lake downstream to Lake Roosevelt. As early as the 1920s, mine-related contaminants from Coeur d' Alene Subbasin were observed in the Spokane River (Casner 1991, as cited in Parametrix 2003). In general, pollutants (various heavy metals and PCBs) have either leached into the river from the Coeur d' Alene Basin Mining Districts in Idaho (Johnson 2001, as cited in Osborne et al. 2003) or been directly discharged into the river by industrial sites and wastewater treatment plants in Spokane (Golding 2001, as cited in Osborne et al. 2003). The occurrence of heavy metals such as arsenic, cadmium, mercury, lead, and zinc can negatively affect fish populations at various life stages (Leland and Kuwabara 1985). Fish are most sensitive to effects of trace metals in embryo-larval and early juvenile stages (Leland and Kuwabara 1985), which are compounded by the limited amount of rearing habitat available. Toxic effects of heavy metals also impact invertebrate populations (Leland and Kuwabara 1985) and are likely a contributing factor in the reduction of invertebrate diversity in the mainstem of the Spokane River. Kadlec (2000, as cited in Johnson 2001) concluded the elevated metal concentrations in the Spokane River extending from the outlet of Coeur d' Alene Lake downstream to the Spokane Arm were negatively impacting phytoplankton productivity and macroinvertebrate communities, and most likely having a negative impact on the distribution and abundance of fish populations.

Other contaminants such as PCBs and polycyclic aromatic hydrocarbons (PAHs) have also been detected in resident fish species in the Spokane River (Johnson 2001). The highest PCB concentrations in fish tissue were found between Upriver Dam and Trentwood (RM 80.2 - 86.5), while moderate to low levels were observed upstream near Post Falls (RM 96.5) and downstream below Upriver Dam (RM 80.2) (Johnson 2001). The same trend was also found for PCB levels in the sediments. As part of a recent PCB study, sediment grab samples were collected in Little Falls Pool, between Little Falls Dam and Long Lake Dam, and from Little Falls Pool downstream to Porcupine Bay located in the Spokane Arm in 2003 (Jack et al. 2003). However, no PCB data have been analyzed from water, sediment, or fish samples from Little Falls Dam downstream to Long Lake Dam (Johnson 2001).

Impaired water quality conditions (increased levels of nutrients, temperature, pollutants) experienced in Coeur d' Alene Lake also influence downstream conditions in the Spokane River. Increased summer water temperatures create high metabolic demand for native salmonid species requiring cool water conditions. The reduced macroinvertebrate diversity and density in the mainstem of the Spokane further exacerbates the increased metabolic demands of salmonids. Facilities discharging biochemical oxygen demand and/or ammonia into the river in Idaho (City of Coeur d' Alene Advanced Wastewater Treatment Plant, Hayden Area Regional Sewer Board Publicly-owned Treatment Works, City of Post Falls Publicly-owned Treatment Works) and in the river in Washington (Liberty Lake Publicly-owned Treatment Works, Kaiser Aluminum Industrial Wastewater Treatment Plant, Inland Empire Paper Company Industrial Wastewater Treatment Plant, and City of Spokane Advanced Wastewater Treatment Plant) contribute to the degradation of water quality in the Spokane River and reservoirs. In addition, non-point source pollution sources such as agriculture and residential and commercial development in surrounding watersheds contribute to higher biological oxygen demands and increase nutrient loading into the Spokane River. Dissolved oxygen levels have also been low (<4 mg/L) downstream of Long Lake as a result of the high biological oxygen demands and phosphorus loading combined with stratification of Lake Spokane (CH2MHILL, 2000, 2001, 2002; Golder Associates 2003a).

The increased demands for water diversions and withdrawals have impacted long-term stream flows and trends within the Spokane Subbasin. In 1999, WDOE and WDFW agreed upon a minimum in-stream flow target of 2,000 cfs at Spokane Falls (Golder Associates, Inc. 2001). This minimum target was based on 50 percent of natural flows in the Spokane River prior to the operations of Post Falls Dam (1891-1906) (Golder Associates, Inc. 2001). The non-attainment of this target flow occurs almost every year. Potential factors leading to non-attainment of minimum target flows include water consumption, diversion, and impoundment (Post Falls Dam) as well as oscillating climatic periods such as the wet and dry Pacific Decadal Oscillation (PDO) periods (Golder Associates, Inc. 2001). Research of past climatic patterns suggest that 1891-1906 was within a wet PDO period, which may indicate the minimum in-stream flow target is not representative of oscillating climatic periods (Golder Associates, Inc. 2001). Low base flow conditions contribute to elevated water temperatures, decreased habitat complexity, decreased habitat area, and low dissolved oxygen levels.

In the Spokane River between Upper Falls and Post Falls Dam substrate remains relatively unembedded; however, the presence of Post Falls Dam has reduced the entrainment of larger gravel and cobble size substrates. Historically, and presently, Coeur d' Alene Lake has intercepted significant amounts of bedload originating within the upper Spokane River watershed (Corsi, IDFG, personal communication). These types of bedload movement impediments contribute to reduced entrainment of smaller gravel and cobble allowing for a relatively homogeneous substrate composition dominated by large cobble through boulder size substrate to remain. This large substrate limits the native salmonid spawning habitat, where currently there are only three major spawning sites for rainbow trout located between Post Falls and Upper Falls Dam (Avista Corp 2000).

22.8.1.3 Historic Conditions – Little Spokane River

The Little Spokane River was historically a cold and clear lotic system flowing through narrow and fertile valleys (Gilbert and Evermann 1895). The riparian corridor was covered mostly with "a network of brushes" with some trees along the banks (for example, cottonwood, maples, and alders), while the upland community on the high hills was "sparsely covered with pines" (Gilbert and Evermann 1895).

Gilbert and Evermann (1895) reported the fish community was abundant and supported eight to ten fish species. The Little Spokane River was also classified as having "excellent salmon and trout" habitat (Gilbert and Evermann 1895). Many cutthroat trout and whitefish were observed in 1894, and local Indians harvested an estimated 40,000-50,000 salmon in October 1, 1881 (Gilbert and Evermann 1895).

Even in 1894, anthropogenic activities were starting to impact the Little Spokane River. Destruction of the riparian zone via the removal of timber and brush on riverbanks and the cultivation of land in the flood plains had noticeably increased surface erosion (Gilbert and Evermann 1895).

22.8.1.4 Current Conditions – Little Spokane River

Relative to historic conditions, current aquatic habitat and water quality conditions in the Little Spokane River and its tributaries have been heavily degraded. Various anthropogenic activities in the surrounding watershed such as timber harvest, agriculture, and urban development have undoubtedly influenced the water quality. In addition, man-made barriers in the stream channel prevent passage for resident fishes. There are no dams on the mainstem of the Little Spokane River, but there are a variety of dams on the tributaries intended for irrigation, recreation, and water quality (Golder Associates Inc., 2001). Eight reaches on the Little Spokane River are on Washington State's 1998 303(d) list exceeding clean water standards for fecal coliform, dissolved oxygen, pH, PCBs, and temperature. Water availability for human consumption, as well as adequate stream levels and flows for fish is another critical issue within this watershed.

Flows in the upper reaches of the Little Spokane River are largely influenced by tributary input (Dragoon and Deadman creeks), while the lower reaches are largely influenced by groundwater discharge. Past studies in the Little Spokane River have shown a declining trend in mean annual flows between 1950 and 1990; however, more recent hydrologic data suggest an increasing trend between 1990 and 2000 (Figures 22.7) (USGS, 2003). The declining trend in streamflow from 1950 to 1990 was originally associated with lower than average annual precipitation coupled with increased demands for water withdrawals and diversions (Dames & Moore and Cosmopolitan Engineering Group 1995). However, data from the past decade (1990-2000) showing an increasing trend in streamflow may be indicative of the influence large-scale climatic oscillations, such as wet and dry Pacific Decadal Oscillation periods, have on hydrologic regimes (Golder Associates, Inc. 2001).

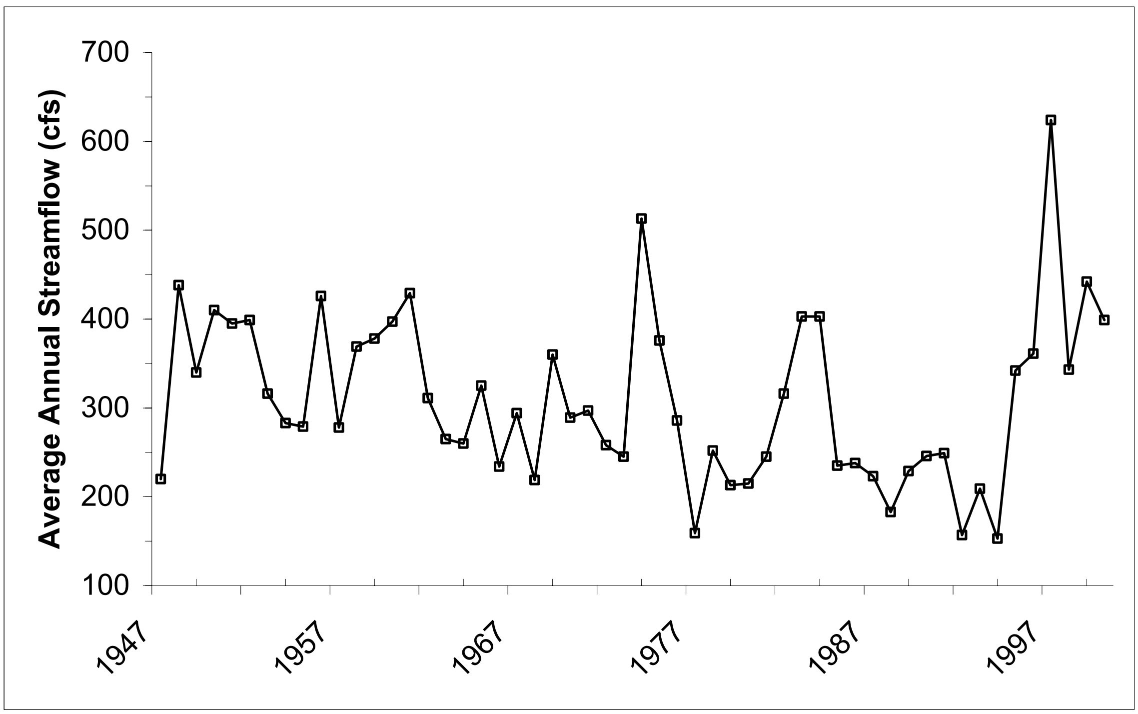


Figure 22.7. Mean annual flow (cfs) in Little Spokane River at Dartford 1947-2000. (*Source*: USGS, 2003)

In 1976, four stations were established to monitor minimum in-stream flows on the Little Spokane River (Chapter 173-555 WAC). These minimum in-stream flow targets were set at 20 percent of the exceedance level based on historical records (Table 22.23). Between 1948 and 1978, eight days/year, on the average, did not meet minimum flow targets; and the annual daily average of non-attainment of minimum base flows between 1970 and 1995 was 53 days (Dames & Moore and Cosmopolitan Engineering 1995). Periods of low streamflow below minimum in-stream flow targets most often occur during the summer. During the summer months in 2001 (a low water year) and in 2003, minimum in-stream flow targets were not met from July to October (Figure 22.8). Seven-day low flow between 1 July and 15 September 1945-2003 also shows an overall declining trend in flow with nineteen occurrences from 1965 to 2003 where flow was below the minimum in-stream summer target of 115 cfs (Figure 22.9). However, when analyzing flow at a different scale such as the mean monthly flow (1929-2001), flows remain above the minimum target levels (figures 22.8 and 22.10). It is important to note streamflow data presented only reflects one station (Dartford) and does not necessarily reflect water quality conditions of the entire Little Spokane River drainage.

Table 22.23. Minimum in-stream flow targets set in 1976 for four locations on the Little Spokane River presented in cubic feet per second

Month	Day	Elk	Chattaroy	Dartford	Confluence
January	1	40	86	150	400
	15	40	86	150	400
February	1	40	86	150	400
	15	43	104	170	420
March	1	46	122	190	435
	15	50	143	218	460
April	1	54	165	250	490
	15	52	143	218	460
May	1	49	124	192	440
	15	47	104	170	420
June	1	45	83	148	395
	15	43	69	130	385
July	1	41.5	57	115	375
	15	39.5	57	115	375
August	1	38	57	115	375
	15	38	57	115	375
September	1	38	57	115	375
	15	38	63	123	380
October	1	38	70	130	385
	15	39	77	140	390
November	1	40	86	150	400
	15	40	86	150	400
December	1	40	86	150	400
	15	40	86	150	400

(*Source*: Chapter 173-555 WAC)

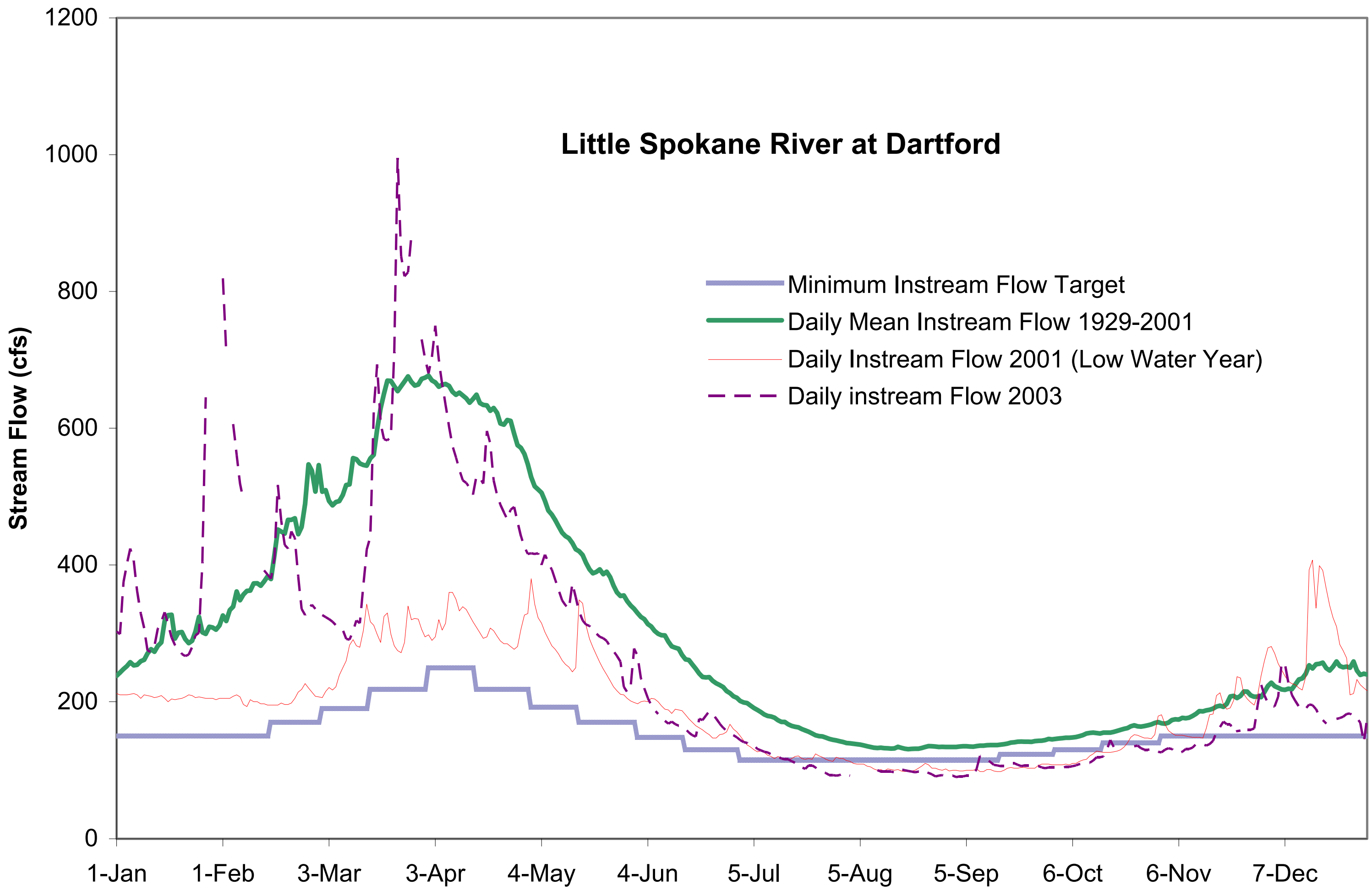


Figure 22.8. Minimum in-stream flow target, daily mean flow from 1929 to 2001, daily in-stream flow in 2001 during a low water year, and daily in-stream flow 2003 (*Source*: USGS)

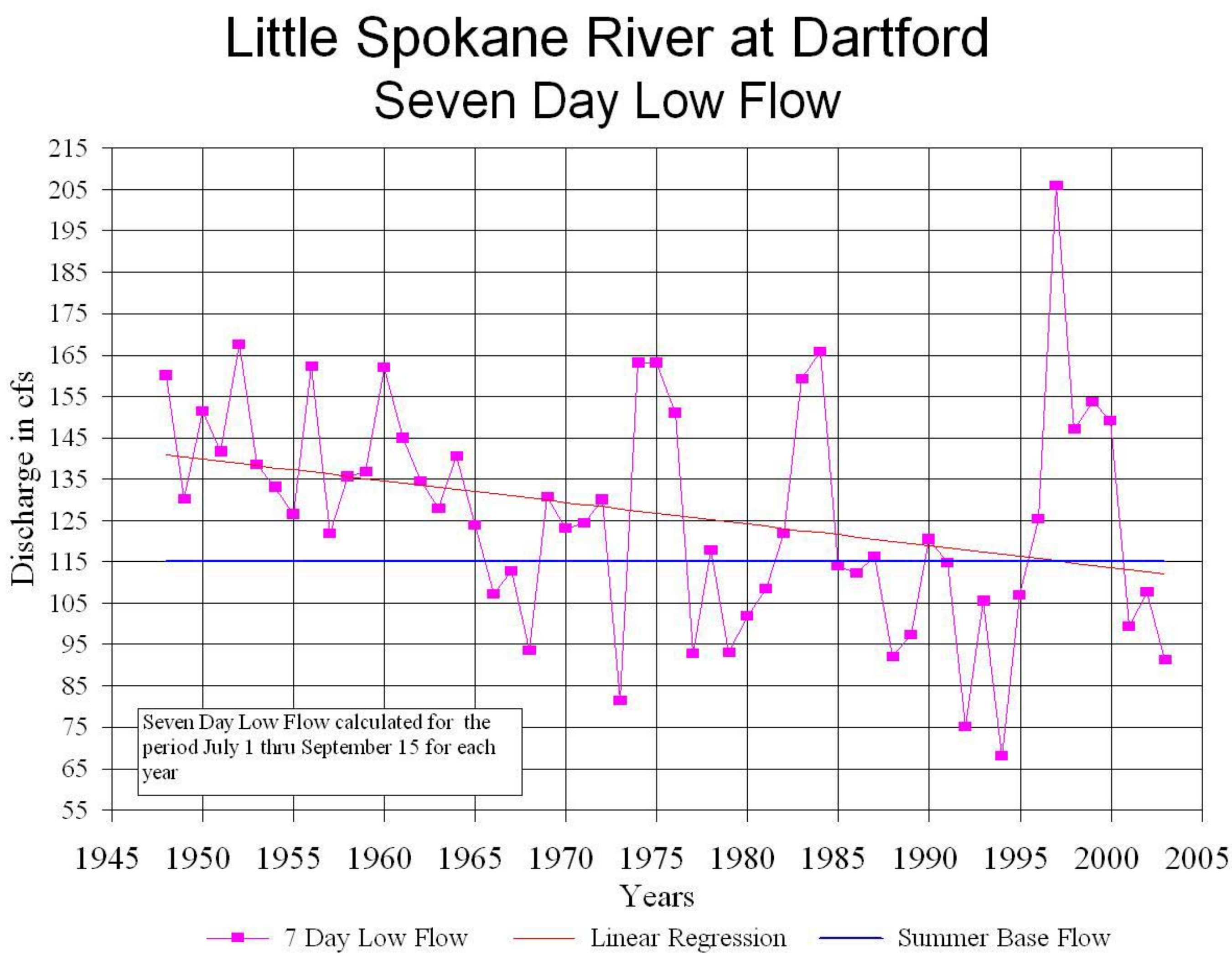


Figure 22.9. Seven-day low flow (cfs) calculated from 1 July to 15 September 1948 to 2003 (*Source:* USGS)

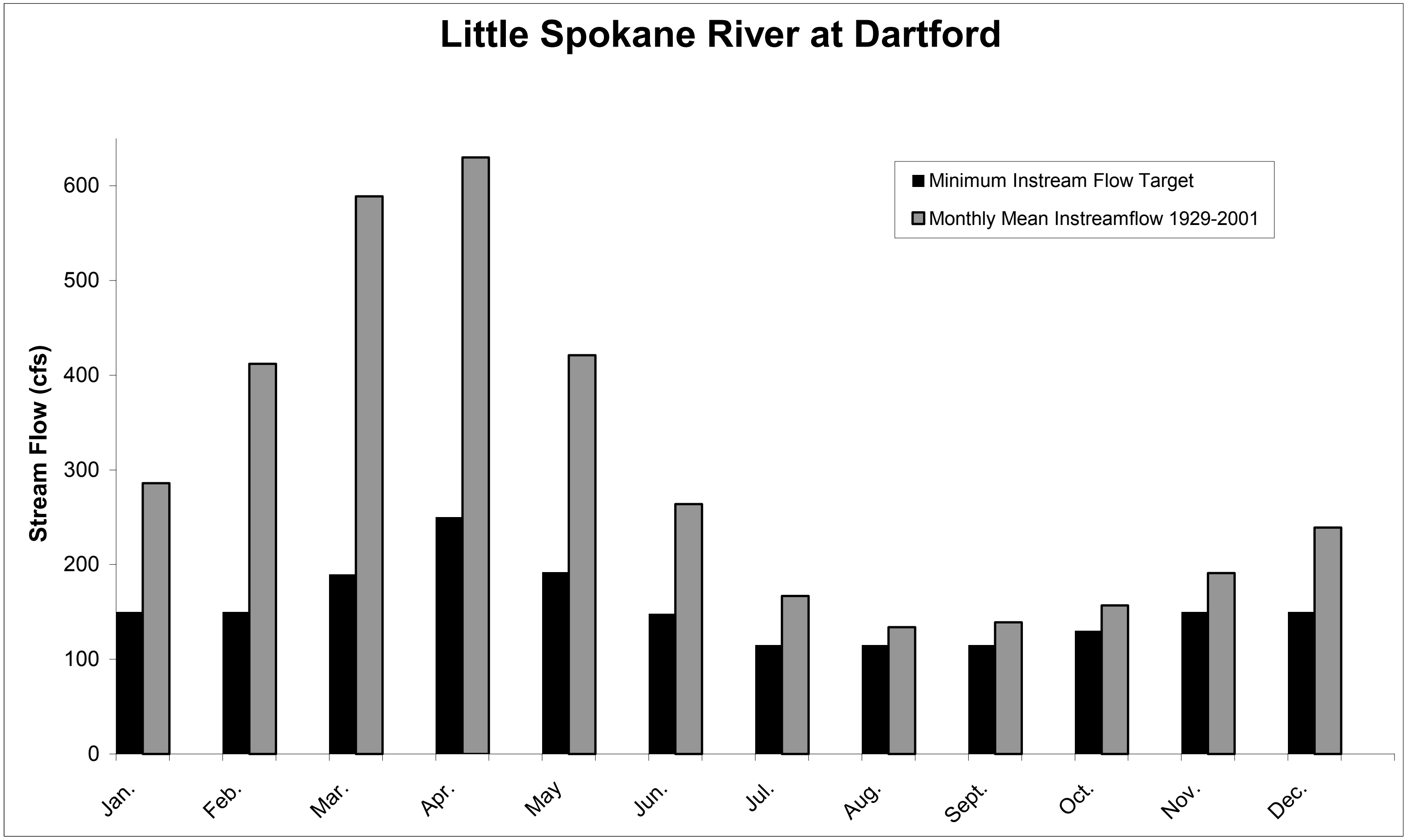


Figure 22.10. Minimum in-stream flow targets set in 1976 by WAC (Chp. 173-555) compared to monthly mean flows measured by the USGS (gage station 12431000) in the Little Spokane River at Dartford.

During the 1990s, annual in-stream flows in the Little Spokane River showed a declining trend despite WAC 173-555 seasonal closures of consumptive appropriation in the Little Spokane River Watershed (1980). Since 1997, mean annual flows appear to be increasing (see Figure 22.7), which was concurrent with a spike in the 7-day low flow from 1996 to 2000 (see Figure 22.9). The 7-day low flow data (July to September) also show flows declining below the minimum in-stream target flow of 115 cfs in 2001, 2002, and 2003 (see Figure 22.9). It is important to note that mean annual flow and summer/fall 7-day flow measurements provide different levels of information. The 7-day flow data may be more appropriate to use when evaluating whether flow conditions are adequate for local aquatic biota during critical life stages that occur under base flow conditions (July to September), whereas mean annual flows may not be able to detect the smaller seasonal changes.

In 1995, the initial Little Spokane watershed assessment conducted to evaluate surface and groundwater conditions came to the following conclusions: 1) streamflows did not meet minimum in-stream flow targets 42 percent of the time during the summer on average years (see Figure 22.8), 2) non-point source pollution was increasingly impacting the water quality within the watershed, and 3) continuous development and population growth (17 percent growth between 1990-2000) in the lower portion of the watershed increasing demands for water rights (Dames & Moore and Cosmopolitan Engineering Group 1995). As a result, an in-stream flow study was conducted in 2002 to review minimum in-stream flow targets and assess the requirements of aquatic biota (Golder Associates, Inc. 2001). This study concluded in general, minimum in-stream flow targets were reasonable for protecting fish habitat of target management species (Golder Associates, Inc. 2001).

22.8.1.5 Historic Conditions – Hangman Creek

In 1870s, prior to heavy settlement of the Hangman Creek watershed, the condition of the stream, riparian area, and floodplain are assumed to have been relatively pristine (Edelen and Allen 1998). Salmon were present in sufficient numbers to support a fishery for the Coeur d' Alene Tribe upstream near where the town of Tekoa, Washington is located (Scholz et al. 1985; Seltice 1990). However, the majority of salmon and trout were captured at the mouth of Hangman Creek, where it enters the Spokane River. Tribes would congregate at the mouth with weirs, spears, and nets to catch salmon and trout in the fall. One weir at the mouth of Hangman Creek was reported to catch 1000 salmon a day for a period of 30 days a year (Scholz et al. 1985).

In general, little is known about the historic conditions of Hangman Creek. Early records were not kept and anecdotal evidence is inconsistent. The Coeur d'Alene harvest of Chinook and steelhead in the area of what is now Tekoa, Washington (Scholz et al. 1985) suggests a clear, clean flowing stream. Stream conditions started to change in the 1880s and 1890s as an influx of settlers moved into the Hangman Creek. The gold mining in nearby communities had declined, so settlers were looking for suitable farmland. Hangman Creek provided fertile soils and opportune farming and ranching from the Palouse soils. As a result, settlers and Indians cleared the watershed of trees and tilled the fertile soils (Edelen and Allen 1998). In 1985, Gilbert and Evermann (1895) classified Hangman Creek as "an unimportant stream … found to be a small, rather filthy stream, not suitable for trout or other food-fishes, but well supplied with minnows and suckers of several species." These observations were made in Tekoa, Washington near the Idaho-Washington state line. The degraded state of Hangman Creek in 1894 was most likely the result of the strong influx of settlers and consequential land use activities, which was not described by Gilbert and Evermann (1895), such as timber harvest, agriculture, and a sugar beet processing plant near the town of Fairfield, Washington that discharged its pollutants directly into the stream (Leitz 1999). Other historical accounts of the flow in Hangman Creek vary from seasonally dry (original Public Land Survey Notes) to "almost as high in low water time as it was in high water time" (Cornelius Mooney circa 1920). The scant and contradictory evidence of the historic condition of Hangman Creek only highlights the lack of information as to its potential.

22.8.1.6 Current Conditions – Hangman Creek

Hangman Creek watershed has been significantly altered through past and present land uses including but not limited to agriculture, urban development, wetland/riparian destruction, forestry practices, and road construction. Agriculture constitutes 64 percent of Hangman Creek watershed land use and is most prevalent in the upper and middle reaches of Hangman Creek. The lower portion of Hangman Creek watershed is expected to endure 50 percent of the City of Spokane's urban growth in the next ten years (STRC 1997).

Agriculture, in the form of dryland farming and grazing, is prevalent throughout the watershed. Most croplands are plowed to the edge of the streams. Riparian zones have been severely impacted causing increased width-to-depth ratios from increased bank erosion. Channelization and vegetation removal (upland and riparian) combined with steep slopes, fine Palouse derived soils, coupled with exacerbated high runoff, have made the watershed more susceptible to streambed and upland agricultural erosion (Edelen and Allen 1998). Livestock have unrestricted access to riparian areas, tributaries, and the main channel in the watershed. Grazing impacts are not isolated to large operations in the watershed. Small "Hobby Farms" having too many head of livestock confined in a small area on stream systems also results in barren riparian meadows.

Forestry practices have also cleared much of the upper watershed creating higher peak flows and sediment loading, while decreasing summer low flows. High road densities (1.7-4.7 miles/square mile) in the lower portions and moderate road densities (0.7-1.7 miles/square mile) in the upper portions of the watershed also contribute significantly to sedimentation (refer to Section 21, Figure 21.14). The watershed within the state of Idaho has a road density of 3.9 miles/square mile (data on file, Coeur d' Alene Tribe Water Resources Program, 2003). Road density within Washington state portion of the watershed range between 0.1-4.7 miles/square mile with the highest road density in the city of Spokane (refer to Section 21, Figure 21.14).

Land use activities have reduced the quantity and quality of in-stream habitat complexity, such as natural meander patterns and large woody debris (LWD) recruitment. The cumulative effects of land use activities (agriculture, forestry) have changed the natural hydrograph, impaired downstream water quality, increased the sediment load, and degraded fish and wildlife habitat in Hangman Creek.

Hangman Creek is one of the largest contributors of bedload and suspended sediments into the Spokane River. Bedload and suspended sediments originating from Hangman Creek are transported to and deposited behind Nine Mile Dam and eventually settle out in Lake Spokane. Soletero et al. (1992) estimated Hangman Creek contributes 77 percent of the total annual sediment load to Lake Spokane. The annual suspended sediment load from Hangman Creek was estimated to be 52,000 tons in 1998 and 211,000 tons in 1999 (SCCD 2000). The increased sediment load has also more locally resulted in embedded substrate and unsuitable spawning habitat for salmonids. The principal source of suspended solids comes from non-point sources (roads, annual cropland, eroding streambanks) and consists mainly of alluvium and flood deposits that are highly erodible (SCCD 1994).

Aquatic habitats in Hangman Creek have been degraded physically and biologically with respect to the fisheries community requiring high environmental quality conditions. Hangman Creek flows are flashy, streambanks are unstable, and water quality is substandard. Results from an invertebrate inventory conducted throughout the Hangman Creek watershed found very few taxa requiring high environmental quality conditions (environmentally sensitive species) (Celto et al. 1998). These taxa were only found in two tributaries, Marshall and Rock creeks, and only found in one year (Celto et al. 1998). These biotic data reinforce the observations on degraded physical habitat conditions observed throughout the watershed.

In the lower and middle region of Hangman Creek, six reaches are on Washington State's 1998 303(d) list for exceeding EPA water standards for the following parameters: fecal coliform, pH, dissolved oxygen, and temperature. According to Washington State water criteria (WDOE), Hangman Creek also exceeds in parameters set for nutrients (nitrate, ammonia, nitrite, total phosphorus) and turbidity. The upper reaches of Hangman Creek are located in Idaho and are also listed on Idaho's 1998 303(d) list exceeding water quality criteria set for habitat alteration, sediment, nutrients, and pathogens. Low flows, high temperatures, and low dissolved oxygen concentrations also impair the upper reaches (Peters et al. 2003). Water quality at base flow and presence of trout in the upper reaches of Hangman Creek within the boundaries of Idaho are presented in Table 22.24.

Table 22.24. Summary of water quality at base-flow, compared to salmonid presence for the Hangman Creek watershed, 2002

Location	Intermittent Flow?	Max Daily Temp >20° C	DO < 7.0mg/L	TSS > 7mg/L	Are trout present?
Hangman Creek-State line	No	Yes	Yes	No	No
Hangman Creek-Nehchen Hump	No	Yes	?	Yes	No
Hangman Creek, Site 5	No	?	?	No	Yes
Hangman Creek, Site 6	No	No	No	No	Yes
Upper Hangman Creek, Site 7	No	No	No	No	?
Little Hangman Creek	No	Yes	Yes	No	No
Lower Moctileme Creek	No	Yes	No	No	No
Upper Moctileme Creek	No	No	No	Yes	No

Location	Intermittent Flow?	Max Daily Temp >20° C	DO < 7.0mg/L	TSS > 7mg/L	Are trout present?
Lower Mission Creek	No	Yes	?	No	No
EF Mission Creek	No	No	No	No	Yes
MF Mission Creek	No	No	No	No	Yes
WF Mission Creek	No	No	No	Yes	Yes
Lower Sheep Creek	No	Yes	Yes	No	No
Upper Sheep Creek	No	No	No	No	Yes
Upper Nehchen Creek	No	No	No	No	Yes
Lower Indian Creek	No	No	No	No	Yes
N.F. Indian Creek	No	No	No	No	Yes
Upper Indian Creek	No	No	No	No	Yes
E.F. Indian Creek	No	No	No	Yes	No
Upper S.F. Hangman Cr.	No	No	No	No	?
Martin Creek	No	No	No	No	?
Hill Creek	?	No	Yes	Yes	?
01SH013000 across from Hill	?	No	No	No	?
Bunnel Creek	No	No	No	No	Yes
Parrot Creek	No	No	No	No	?
Smith Creek	Yes	?	Yes	Yes	No
Lower Nehchen Creek	Yes	NA	NA	No	Yes
N.F Rock Creek	Yes	Yes	Yes	Yes	No
Mineral Creek	Yes	NA	NA	NA	No
Lolo Creek	Yes	NA	Yes	Yes	No
Tensed Creek	Yes	NA	NA	Yes	No
Upper Tensed Creek	Yes	NA	NA	No	No
Papoose Creek	Yes	NA	NA	?	?
Conrad Creek	Yes	NA	NA	No	Yes

(*Source*: taken from Table 18 in Peters et al. 2003)

22.8.1.7 Current Conditions – Chamokane Creek

No historical reference of Chamokane Creek was available regarding habitat condition or status on the presence, distribution, abundance, or condition of native salmonids. Studies in the late 1980s and early 1990s found the area in Chamokane Creek below Ford, WA to be highly productive, similar to blue ribbon trout streams (Scholz et al. 1988). A minimum in-stream flow of 24 cfs protects aquatic habitats from water withdrawals. The largest impacts to water quality included activities such as farming and logging with some grazing.

In 2002, STOI conducted a survey to investigate habitat conditions and fish presence in Chamokane Creek (Conner et al. 2003b). This survey included the area below Tshimikain Falls. Chamokane Creek has a low gradient (1.3 percent), substrate is represented predominately by cobble (40 percent) and gravel (40 percent), and habitat type is characterized as having 22 percent pool habitat, 49 percent riffle habitat, and 29 percent run habitat (Conner et al. 2003b). During the summer, mean temperatures in the lower portion of the creek remain below 20 °C (Conner et al. 2003b). In 2003, salmonids were observed throughout Chamokane Creek with an average density of 16.09 fish/100 m^2 from the mouth upstream to Ford, Washington (Conner et al. 2004). Chamokane Creek provides a unique fishery for tribal members and low densities could be related to high fishing pressure. Additional information regarding land use activities and their influence on water quality in the Chamokane Creek drainage is available in a Watershed Plan (STOI, personal communication, 2004).

22.8.1.8 Current Conditions – Lake Spokane Reservoir
For a historical description of the environmental conditions in Lake Spokane prior to impoundment, refer to historic conditions in the Spokane River.

The completion of Long Lake Dam in 1915 established the 39-km long reservoir known as Lake Spokane. The alteration in hydrology from a free-flowing river system ideal for native salmonids to a slow moving system has modified environmental conditions (velocity, temperature, dissolved oxygen, thermal stratification) and has allowed for the persistence of introduced nonnative warmwater species (for example, smallmouth bass, largemouth bass, yellow perch, black crappie). Currently, both warm- and cool-water fish species inhabit Lake Spokane, which is managed as a mixed species fishery.

Water quality impairment in Lake Spokane is a great concern since it impacts the recreational value of the fishery. The lake has a long history of water quality issues preceding the 1960s (Cunningham and Pine 1969; Soltero et al. 1975; Anderson and Soltero 1984; Jack and Roose 2002, as cited in Osborne et al. 2003). Before secondary treatment of wastewater, Lake Spokane was classified as eutrophic. After the commencement of secondary wastewater treatment in 1977, phosphorus loading was reduced declassifying Lake Spokane to a mesotrophic or meso-eutrophic depending on flushing rates and season. A chronology of events that have had the most significant impacts on water quality in Lake Spokane are listed below (Cusimano 2004):

> **Prior to 1958**: City of Spokane discharged raw sewage into the river
> **1958**: City of Spokane built the first facility for primary wastewater treatment.
> **1976-1978**: Raw sewage effluent was discharged into the Spokane River and resulted in toxic blue-green algal blooms and the entrapment of 126 metric tons of phosphate in Lake Spokane.
> **1977**: City of Spokane constructed an advanced wastewater treatment facility (secondary wastewater treatment with 85 percent phosphorus removal).
> **1979:** A Spokane River wasteload allocation study for all sources discharging phosphorus was a result of a decision by the Spokane Supreme Court.
> **1987**: Department of Ecology recommended 259 kg/day TMDL for Lake Spokane.

1989: A Memorandum of Agreement was endorsed for control measures to be implemented by the point-source dischargers. A Technical Advisory Committee was created to manage phosphorus concentrations.
1990: Regional phosphate bans.
1992: EPA approved 25 μg/L total phosphorus TMDL for Lake Spokane.

Past studies have found phosphorus loading and upstream sources (Little Spokane River, Hangman Creek, and the mainstem Spokane River drainages) to be linked to the low dissolved oxygen, algal blooms, increase of aquatic macrophytes, and poor quality conditions in Lake Spokane (Cunningham and Pine 1969; Soltero et al. 1992). A phosphorus budget developed by Soletero et al. (1992) found upstream sources from the Little Spokane River and Spokane River contribute about 94 percent of the total phosphorus loading into Lake Spokane while groundwater and sediments release contribute about 5 percent and less than 1 percent, respectively. Nuisance algal blooms and anoxic conditions in the hypolimnion are further exacerbated by inflow and lower flushing rates between June to October resulting in thermal stratification and a complex mixing regime. In 2003, WDOE conducted a study to evaluate the existing total phosphorus criterion and associated TMDL for Lake Spokane. Publication of the results was recently made available in 2004 (Cusimano 2004, Available: http://www.ecy.wa.gov/biblio/0403006.html).

22.8.1.9 Current Conditions – Spokane Arm
For a historical description of the environmental conditions in the Spokane Arm prior to the construction of Grand Coulee Dam, refer to historic conditions in the Spokane River.

The most current information about the Spokane Arm is presented in *The Lake Roosevelt Fisheries Evaluation Program 2000 Annual Report* (Lee et al. 2003). Lee et al. (2003) report significantly higher mean water temperatures in the Spokane Arm (13.5 ˚C) (outlet of the Spokane River) compared to Lake Roosevelt (11.4 ˚C). In 2000, Spokane Arm shoreline temperatures were significantly greater than pelagic temperatures between June and September, and both shoreline and pelagic temperatures were greater than 17 ˚C during this time (Lee et al. 2003). The annual mean level of dissolved oxygen (DO) in the Spokane Arm was 9.2 mg/L (Lee et al. 2003). The lowest DO concentrations were measured at a depth of 33 m (2.9 mg/L) while surface DO levels were at 8.9 mg/L and the overall mean DO concentration in the water column was at 6.6 mg/L (Lee et al. 2003). Water quality standards of Washington State and STOI require the Spokane Arm dissolved oxygen levels to remain at or be greater than 8 mg/L (Lee et al. 2003). Fish require a minimum of 5 mg/L (Lasee 1995, as cited in Lee et al. 2003). Although low DO concentrations were concurrent with higher summer water temperatures, Lee et al. (2003) suggest the decomposition of summer algal blooms were correlated to the low dissolved oxygen levels rather than warm water temperatures. In 2000, the mean TDG saturation was highest (112 percent) from late March to mid-May in the Spokane Arm (STOI unpublished data). During the sampling period (late March to mid-May), mean TDG saturation varied from 109 to 119 percent (late March, 109 percent; mid-April, 119 percent; early May 116 percent; mid-May 116 percent). The annual mean for TDG in the Spokane Arm was 105.2 percent. The maximum TDG levels at the tailrace of Little Falls Dam was between 125-134 percent from 1999-2001 (CH2MHILL, 1999, 2000, 2001). High TDG levels are the suspected cause of net pen fish kills within the Spokane Arm of

Lake Roosevelt in 1999 and previous years (Tim Peone, personal communication, 2004). The Spokane Tribe of Indians has not been able to successfully raise fish in net pens in Little Falls Pool.

For more information regarding current environmental conditions in Lake Roosevelt refer to discussions on the Upper Columbia Subbasin in Section 30.9.1 Environmental Conditions.

22.8.2 Out-of-Subbasin Effects and Assumptions

The function and structure of the Spokane Subbasin aquatic ecosystem have been altered from activities within and outside of the Spokane Subbasin. The historic hydrograph of the Spokane River and drainage has been altered by river regulation. Dams without fish passage facilities on the Columbia and on the mainstem of the Spokane River have extirpated anadromous salmonids from the Spokane Subbasin and restricted historic ranges of other native salmonids. The dams on the Columbia River have isolated fish populations and fragmented important habitat for the completion of different life stages (spawning, rearing, migration). Introduction of nonnative stocks and species has likely altered the genetic integrity of the few remaining native stocks of salmonids. Land activities upstream such as mining in the Coeur d' Alene Subbasin have contributed to pollution problems in the Spokane River. Point source and non-point source (introductions of PCBs, mercury, lead, zinc, and cadmium) have degraded water and sediment quality conditions in many parts of the watershed.

22.9 Limiting Factors and Conditions

The development of hydropower facilities and other barriers without fish passage facilities on the Spokane River and tributaries has been the principal factor limiting genetic exchange, distribution, and habitat connectivity for focal species and other native fish species. Barriers on the stream channel concurrent with land use activities have modified and degraded aquatic habitat conditions. Below is a description of factors specific to the Spokane River, Little Spokane River, Hangman Creek, and Lake Spokane resulting in less than optimal habitat conditions and are currently identified as limiting factors for focal species. No data regarding change in habitat conditions or identifying limiting factors was available for Chamokane Creek drainage or Little Falls Pool. Refer to Section 30.10 Limiting Factors and Conditions in Lake Roosevelt for additional information relevant to limiting factors and conditions in the Spokane Arm.

22.9.1 Physical Habitat Alterations/Limiting Habitat Attributes

QHA was utilized to compare historic versus current physical stream conditions with respect to 11 habitat attributes. Details of the analysis method are provided in Section 3. QHA model does not determine which habitat attributes are most biologically limiting, but does identify which physical attributes have undergone the greatest deviation from the reference stream/reach condition. These results, coupled with knowledge of local biologists and biological status and interactions of the focal species, can assist in identifying key limiting factors. This section provides QHA results on a subbasin level for the Spokane Subbasin. Results specific to each focal species are discussed in each focal species section.

As shown on Map SK-7 (located at the end of Section 22) waters in the Spokane Subbasin were divided into subwatersheds and reaches for QHA analysis. A few areas (shown in Map SK-1 in blue) were not analyzed with the QHA model because of a lack of fish-bearing streams. Using the QHA model, habitat conditions were analyzed where mountain whitefish, rainbow trout, and kokanee were distributed historically and currently. Table 22.25 provides a list of reaches with less than optimal (value = 4) reference conditions.

Table 22.25. Reaches were ranked as containing less than optimal habitat conditions in the reference condition

Sequence	Reach Name	Habitat Attribute < Optimal
2	Sand Creek	Obstructions
6	Upper Chamokane	Obstructions
7	Little Chamokane	Obstructions
8	Camas	Obstructions
11	Lower Chamokane	Obstructions
12	Rail Ck/Walkers Prairie	Obstructions
23	Bear/Cottonwood/Pell	Obstructions
24	West Branch Little Spokane Tribs	Obstructions
30	Lower Spring Creek	Obstructions
33	Lower Coulee	Riparian Condition, Fine Sediment, Low Flow
36	Lower Deep Creek	Riparian Condition, Fine Sediment, Low Flow
58	Mainstem Little Spokane River,Upper	Obstructions
60	West Branch Little Spokane	Obstructions
61	Mainstem Hangman - Upper	Fine Sediment
62	Mainstem Hangman - Middle	Fine Sediment, High Temperatures
63	Mainstem Hangman - Lower	Fine Sediment, High Temperatures

The habitat parameters with the greatest deviation from reference conditions vary by species and are presented in Table 22.26. This table should be interpreted as an indication of the types of habitat parameters problematic for the focal species in the Subbasin as a whole. Some reaches had more than one habitat parameter ranked as being equally deviant from the reference, hence the number of reaches listed adds up to more than the total number of reaches ranked. Most reaches had more than one habitat parameter currently ranked less than the reference. Table 22.26 only lists those habitat parameters having the greatest deviation from reference, not all parameters less than optimal. Fine sediment appears to be the most common problem throughout the watershed and for all species.

Table 22.26. Habitat conditions with the greatest deviation from reference conditions as presented in the QHA model output for each focal species in Spokane Subbasin. In parentheses are the number of reaches or watersheds with the particular habitat attribute exhibiting the largest deviation.

Mt. Whitefish (39)	Kokanee (13)	Redband/Rainbow (49)
Fine Sediment (30)	Fine Sediment (7)	Fine Sediment (26)
High Flow (5)	Obstructions (3)	Habitat Diversity (18)
Pollutants (4)	Pollutants (2)	Low Flow (15)
Obstructions (2)	Channel Stability (1)	Pollutants (5)
Low Flow (1)	Low Flow (1)	Channel Stability (3)
Channel Stability (1)		

For a more detailed analysis of limiting habitat attributes identified for each focal species (mountain whitefish, kokanee salmon, redband/rainbow trout), refer the sections on focal species where QHA results are discussed.

22.9.2 Description of Historic Factors Leading to Decline of Focal Species[3]

22.9.2.1 Spokane River

In the Spokane River above Spokane Falls, most of the habitat degradations are related to water quality conditions. Increased water temperature, low dissolved oxygen concentrations and toxic levels of arsenic, cadmium, mercury, lead and zinc all are parameters of the Spokane River watershed listed on the Washington State's 1998 303(d) list. These factors impact fish populations and invertebrate populations potentially creating a negative synergistic effect on the aquatic community.

Low base flows likely result from an amalgamation of factors such as poor land use practices in headwater areas, water demands and consumption from expanding urban areas in the Subbasin, and impoundment by Post Falls Dam. Land use over the last 100 years, water diversions, and dams have altered the spring freshet such that the current annual peak flow event occurs relatively rapidly rather than the natural condition of gradual run-off. This situation creates low, late summer base flows, limiting habitat area and complexity. Additionally, low base flows contribute to degraded water quality conditions such as increased water temperature and reduced dissolved oxygen (less than 8 mg/L).

Limiting factors in the Spokane River below Spokane Falls are generally related to dams and reservoir inundation. Warm water conditions and low dissolved oxygen levels from upstream are exacerbated by reservoirs. Past and present wastewater practices have contributed and continue to contribute nutrients to the system allowing aquatic vegetation to thrive in low velocity habitats. Accumulation of decaying aquatic vegetation creates biological oxygen demands, thus exacerbating the already low dissolved oxygen concentrations and has exhibited anaerobic conditions in some areas.

The turbine intakes are positioned low enough that the water discharged down the river has a lower temperature, and a lower dissolved oxygen because Long Lake stratifies and becomes anoxic in the hypolimnion. High levels of TDG are a major problem below

[3] Large portions of Section 22.9 were contributed to by the Spokane River Subbasin Summary Report (2000) pp. 13-15.

Long Lake Dam with levels reaching over 139 percent saturation (CH2MHILL 1999, 2000, 2001; Golder Associates 2003a) when the standard is 110 percent. A continual network of reservoirs prevents the dissolved gas from reaching equilibrium.

As a result of habitat modification (for example, temperature, flow regimes) nonnative species are in many regards better adapted for the available habitats. In addition, they provide important recreational fishing opportunities as well as cultural and economic benefits. As a result of these introductions, many of the nonnative game species have established self-sustaining populations and often out-compete and/or prey upon the native species.

22.9.2.2 Little Spokane River

Several reaches within the Little Spokane drainage are included on the Washington State 1998 303(d) list for violating water standards (temperature, pH, dissolved oxygen, fecal coliform, and PCBs). Approximately half of the drainage (over 400 miles) has substandard or impaired water quality throughout the year (Dames & Moore and Cosmopolitan Engineering Group 1995). Water quality appears to be good in only 16 percent (126 miles) of the watershed. The remaining 26 percent (205 miles) of the watershed has not yet been analyzed or data was insufficient (Dames & Moore and Cosmopolitan Engineering Group 1995).

22.9.2.3 Hangman Creek Watershed

As a result of past and current land practices, modifications and physical changes to the stream channel and floodplain, Hangman Creek drainage is described to have “flashy” flow conditions, unstable banks, and substandard water quality. Past and current land use activities continue to impact and degrade the aquatic habitat in the Hangman Creek drainage limiting the distribution, abundance, and presence of salmonids (for example, rainbow trout). Water quality is generally poor and state standards for fecal coliform, temperature, pH, and dissolved oxygen are often not in compliance (SCCD 1994, 1999, 2000; WDOE 1998). Other water quality issues that have been recently identified but not included in the 1998 303(d) lists consist of high sediment load, turbidity, ammonia, low flows, and total phosphorus. In the upper Hangman Creek drainage in Idaho, low flows, low dissolved oxygen, high levels of total suspended solids (chronic and acute), and high temperatures impair stream conditions and salmonid distribution (see Table 22.24). Of the streams supporting salmonids, Indian Creek is the only one where stream conditions are not impaired to the point of limiting salmonid distributions.

22.9.2.4 Little Falls Pool

Little Falls Dam is a “run of the river” dam that generally operates within the upper portions of the reservoir. The shift in fish assemblage and decline in native salmonid abundance is attributed to habitat alteration as a result of land use activities influencing upstream watersheds (for example, Hangman Creek and Little Spokane River) and regulation of flow from dam operations on the Spokane River. Two key water quality alterations impacting conditions in Little Falls Pool include TDG and dissolved oxygen levels. During the spring months, TDG saturation often exceeds the 110 percent water quality standard while dissolved oxygen levels fall below 4 mg/L during the summer and fall months (CH2MHILL 1999, 2000, 2001). High TDG occurs primarily in the spring months (CH2MHILL 1999, 2000, 2001).

22.9.2.5 Lake Spokane Reservoir

The construction of the Long Lake Dam prevents upstream migration of fish and has fragmented native salmonid populations. The transformation from a free flowing river to a lacustrine system has also changed with community dynamics allowing for nonnative fish species to out-compete and displace native species. Water conditions have also been altered allowing for a warmwater fishery previously inhabited by only coldwater fishes.

The fluctuation in reservoir water conditions during the winter can potentially limit the stability of warmwater species populations, such as the focal species largemouth bass. Potential factors limiting largemouth bass recruitment include elevated predation pressures, winter induced-stressors, zooplankton entrainment, and unsuitable over-wintering habitat. All of these factors are related to annual drawdowns. Lower water levels increases the proportional stock density of predatory fish in Lake Spokane, reduces cover and shelter for juveniles, and elevates stress for juveniles that can result in mortality (Osborne et al. 2003).

22.9.2.6 Spokane Arm of Lake Roosevelt

The construction of Chief Joseph and Grand Coulee dams have prevented the upstream migration of salmonids and other fish species into the Spokane Arm, resulting in a significant reduction of native salmonid species. Once abundant anadromous salmon and steelhead have been largely replaced by nonnative salmonids (brown trout, brook trout, coastal rainbow trout, etc). Pacific lamprey have been extirpated from the lower Spokane River, and white sturgeon numbers have declined significantly over the past 60 years. Additionally, native resident fish populations have declined in the Spokane Arm, impacted through habitat alteration and degradation, degraded water quality and by the introduction of nonnative, largely warmwater fish species. The transformation from a free-flowing environment to a more lacustrine system has negatively impacted water quality through increased water temperatures and TDG and decreased dissolved oxygen levels. The salmonid community structure of the lower Spokane River has shifted from a redband trout, bull trout, mountain whitefish, and westslope cutthroat trout assemblage to one comprised primarily of coastal rainbow trout, kokanee salmon, lake whitefish, brown trout, and brook trout (STOI unpublished data). Historically, native non-salmonid species assemblages were comprised of burbot and white sturgeon. Currently, non-salmonid species assemblage is primarily comprised of species such as smallmouth bass (nonnative), walleye (nonnative), and largescale suckers (STOI unpublished data). Native minnow (Cyprinidae) assemblages have been all but depleted from the Spokane Arm, likely a result of habitat degradation and predation by nonnative species.

SECTION 23 – Table of Contents

23 Spokane Subbasin Inventory of Existing Programs – Aquatic

23.1 Current Management Directions[1]

The states of Washington and Idaho and the Native Tribal governments each have planning and management functions for fish and wildlife resources in the Spokane Subbasin. Cooperation exists, and although emphasis and legal mandates may be difficult, their programs should be compatible.

State and Federal agencies and Tribal governments that have management authority over fish and wildlife resources in the Spokane Subbasin include the U.S. Fish and Wildlife Service (USFWS), U.S. Forest Service (USFS), Washington Department of Fish and Wildlife (WDFW), Washington Department of Ecology (WDOE), the Spokane Tribe of Indians (STOI), and the Coeur d' Alene Tribe. Other state and federal agencies, including, but not limited to, the U.S. Army Corps of Engineers (USACE), Environmental Protection Agency (EPA), and the Natural Resources Conservation Service (NRCS) are involved in programs that affect the land or water that provide habitat for fish and wildlife. A complete list of state, federal, and Tribal entities that are involved in management of fish and wildlife or their habitats is included in section 2.4.1, along with a description of the agency's management direction.

The following section describes the local government entities that are involved in natural resources management in the Spokane Subbasin.

23.1.1 Local Government

23.1.1.1 Lincoln County Conservation District (LCCD)

Mission Statement

The philosophy of the District is that all natural resources are integrated. Their mission is to protect and enhance soil, water, air, plants, animals and human (SWAPAH) of Lincoln County through an integrated approach and educate the general public about the responsible use of SWAPAH, through economically viable and socially acceptable programs. Their intention is to promote the responsible use, increase knowledge and research of the natural resource base.

Current Management Strategies

The LCCD's current management strategies can be summarized from excerpts of the District's updated Long Range Plan. The goals and objectives include:

<u>Water Quality</u>

- Address water quality concerns in streams and lakes in Lincoln County
- Address groundwater issues in Lincoln County
- Implement restoration projects that would improve water quality

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[1] Portions of Section 23.1 were contributed to by the Spokane River Subbasin Summary Report (2000) pp. 17-20, 25.

- Work with Natural Resources Conservation Service (NRCS), US Fish and Wildlife Service (USFWS), Washington Department of Ecology (WDOE) and Lincoln County to address water quality complaints

Wildlife

- Establish wildlife-habitat and enhance forest/wetland resources through NRCS programs that include: Conservation Reserve Program (CRP), Environmental Quality Incentive Program (EQIP), and Wildlife Habitat Incentive Program (WHIP)

Education / Information / Communication

- Increase public awareness of District activities
- Provide educational conservation information to the public through newsletters, public meetings, newspaper articles, etc.

District Operations and Management

- Maintain an active and effective LCCD board
- Promote district programs and activities
- Insure adequate funding for LCCD operations

In the last five years, the LCCD has been involved in a minimal number of projects in Spokane and Upper Columbia subbasins. Many landowners in these subbasins have taken advantage of NRCS programs that include CRP, EQIP, and WHIP. Currently, funding sources are focused on finding solutions to improve water quality in the Upper Crab/Wilson Creek Watershed Water Resource Inventory Area (WRIA) #43.

23.1.1.2 Spokane County Conservation District (SCCD)

In Washington state, the SCCD has taken the lead role in facilitation and implementation of watershed management activities within the Hangman Creek (WRIA 56) and Little Spokane River (WRIA 55) watersheds, and to a lesser extent the Spokane River watershed (WRIA 54/57). A large number of research, planning, and implementation projects have been conducted over the last decade. Currently, WRIA 54, 55, 56, and 57 are undergoing watershed planning.

The SCCD has developed working relationships with many of the local landowners, governmental entities, and interest groups to improve the long-term conditions within the watersheds. The SCCD is the lead facilitator of watershed planning for the Hangman Creek watershed and is currently working with the Pend Oreille Conservation District on a water quality management plan for the Little Spokane River. Under ESHB 2514, the work focuses on water quantity issues in the Subbasin, but does address other issues such as water quality, TMDLs, habitat, and instream flow.

23.1.1.3 Pend Oreille Conservation District (POCD)

The POCD sponsored a (WDOE) grant on the Little Spokane Watershed in 1998. Information was collected in partnership with SCCD. Data was collected for quantity and field and laboratory water quality parameters. Currently POCD is working with SCCD on a water quality management plan for the Little Spokane River.

23.1.1.4 Coeur d' Alene Tribe

The Coeur d' Alene Tribe is taking the lead role with watershed management activities on the Idaho section of Hangman Creek, as well as other projects designed to make substitutions to Tribes for subsistence fishing lost. Efforts are focused on water quality, habitat, instream flow, land acquisition for restoration purposes, and short term solutions to provide subsistence such as put and take ponds.

23.2 Existing and Imminent Protections

Washington Department of Fish and Wildlife (WDFW) maintains regulatory control of all activities that may impact water/aquatic habitat within the state of Washington through enforcement of the hydraulic code. Additionally, the department is an active partner in application of the Growth Management Act (GMA), intended to protect focal species habitat for redband/rainbow trout, mountain whitefish, and kokanee. Protection is afforded through the "Wild Salmonid Policy" developed by WDFW. "The goal of this Wild Salmonid Policy is to protect, restore, and enhance the productivity, production, and diversity of wild salmonids and their ecosystems to sustain ceremonial, subsistence, commercial, and recreational fisheries, non-consumptive fish benefits, and other related cultural and ecological values" (http://www.wa.gov/wdfw/fish/wsp/joint/final/fwsp01.htm).

23.2.1 Hydraulic Code (1949)

The Washington State Legislature in 1949 passed the "Hydraulic Code" (RCW 75.20.100-160). The law requires any person, organization, or government agency wishing to conduct any construction activity in or near state waters must do so under the terms of a permit, called the Hydraulic Project Approval (HPA), issued by WDFW. State waters include all marine and fresh waters. The law's purpose is to ensure needed construction occurs in a manner that prevents damage to the state's fish, shellfish, and their habitat.

23.2.2 Salmon Recovery Act (Washington State House Bill 2496)

The Washington State Legislature established Lead Entities in ESHB 2496, the state Salmon Recovery Act (RCW 77.85), which the governor signed into law in April 1998. Since 1999, the legislature has provided funding to WDFW to support the infrastructure and capacity needs of Lead Entities engaged in salmonid habitat protection, restoration, and assessment at the watershed level.

23.2.3 Watershed Management Act (Washington State House Bill 2514)

In 1998 the governor signed HB 2514, the Watershed Management Act, providing the impetus for Watershed Planning Units to form throughout the state. WDOE administers this program through grants.

23.3 Inventory of Restoration and Conservation Projects

Refer to Appendix H for a comprehensive list of BPA and non-BPA funded projects within the IMP.

23.3.1 BPA Funded Projects

Many of the BPA funded projects listed below are not limited to the Spokane Subbasin, but are tied to two or more subbasins located in the Intermountain Province.

Joint Stock Assessment Project #9700400

Discussed in section 2.4.3 Inventory of Restoration and Conservation Projects under the subheading Resident Fish Stock Status Above Chief Joseph and Grand Coulee Dams (all of the IMP within Washington).

Spokane Tribal Hatchery #9104600

The Spokane Tribal Hatchery (Galbraith Springs) project originated from the Northwest Power Planning Council (Council) 1987 Columbia Basin Fish and Wildlife Program. The *goal* of this project is to aid in the restoration and enhancement of the Lake Roosevelt and Banks Lake fisheries adversely affected by the construction and operation of Grand Coulee Dam. The *objective* is to produce kokanee salmon and rainbow trout for release into Lake Roosevelt for maintaining a viable fishery. The goal and objective of this project adheres to the Council's Resident Fish Substitution Policy and specifically to the biological objectives addressed in the Council's Columbia River Basin Fish and Wildlife Program to mitigate for hydropower related fish losses in the blocked area above Chief Joseph/Grand Coulee Dams.

The Spokane Tribal Hatchery (managed by the STOI is one component of 4 artificial production *projects* operated complementary of one another as part of a *program* to restore and enhance the Grand Coulee impoundment fisheries (Lake Roosevelt and Banks Lake). The other artificial production components include the Sherman Creek Hatchery, Ford Trout Hatchery and the Lake Roosevelt Kokanee and Rainbow Trout Net Pen Projects. The Spokane Tribe operates the Spokane Tribal Hatchery, the WDFW operates the Sherman Creek Hatchery, Ford Trout Hatchery and the Kokanee Net Pen Project and the Lake Roosevelt Development Association operates the Rainbow Trout Net Pen Project.

Each project has its own production goal to collectively produce up to 1,000,000 kokanee yearlings, 1.4 million kokanee fry/fingerlings and 500,000 rainbow trout yearlings for annual stocking into Lake Roosevelt and Banks Lake. Fishery managers from the WDFW, STOI and Colville Confederated Tribes comprise the Lake Roosevelt Hatcheries Coordination Team responsible for directing hatchery and net pen rearing operations. Performance and evaluation of hatchery and net pen reared fish released into the project area and the impact on the biota is monitored and evaluated by the Lake Roosevelt and Banks Lake Fisheries Evaluation Programs.

Sherman Creek Hatchery #9104700

Sherman Creek Hatchery's (managed by WDFW) primary objective is the restoration and enhancement of the recreational and subsistence fishery in Lake Roosevelt and Banks Lake. The Sherman Creek Hatchery (SCH) was designed to rear 1.7 million kokanee fry for acclimation and imprinting during the spring and early summer. Additionally, it was designed to trap all available returning adult kokanee during the fall for broodstock operations and evaluations. Since the start of this program, the operations on Lake Roosevelt have been modified to better achieve program goals.

The WDFW, STOI and the Colville Confederated Tribes (CCT) form the interagency Lake Roosevelt Hatcheries Coordination Team (LRHCT), which sets goals and objectives for both Sherman Creek and the Spokane Tribal Hatchery. It also serves to coordinate enhancement efforts on Lake Roosevelt and Banks Lake.

The primary changes have been to replace the kokanee fingerling program with a yearling (post smolt) program of up to 1 million fish. To handle the increased production, twenty net pens were constructed and are currently operated. The second significant change was to rear up to 300,000 rainbow trout fingerling at SCH from July through October, for stocking into the volunteer net pens. This enables the Spokane Tribal Hatchery (STH) to rear additional kokanee to further the enhancement efforts on Lake Roosevelt.

Current objectives include increased use of native/indigenous stocks where available for propagation into Upper Columbia River Basin Waters.

The Lake Roosevelt Fisheries Evaluation Program (LRFEP) is responsible for monitoring and evaluation on the Lake Roosevelt Projects. From 1988 to 1998, the principal sport fishery on Lake Roosevelt has shifted from walleye to include rainbow trout and kokanee salmon (Underwood et al. 1997; Tilson and Scholz 1997). The angler use, harvest rates for rainbow and kokanee, and the economic value of the fishery have increased substantially during this 10-year period. The investigations on the lake also suggest that the hatchery and net pen programs have enhanced the Lake Roosevelt fishery while not negatively impacting wild and native stocks within the lake.

Lake Roosevelt Trout Net Pen Project #9500900

The Lake Roosevelt Net Pen Project is a grass roots, community based, effort to enhance rainbow trout harvest opportunities. This project began in the 1980s with local anglers looking for a method to enhance the Lake Roosevelt fishery. In 1996, BPA provided a coordinator to assure this program's continuation. Today the project produces approximately 500,000 rainbow trout and 250,000 kokanee salmon for the Lake Roosevelt sport and subsistence fishery. The STH rears the rainbow trout from eggs in November to fry in September. The hatchery then transfers the fish to the net pens in September, where they are reared to catchable size by June. The rainbow trout are released ideally in June, but in years of deep drawdown, physical limitations require earlier releases. The net pen program produces the most successful fishery in the lake. Over 95 percent of all rainbow trout captured in the lake are from the net pens.

Chief Joseph Kokanee Enhancement Project #9501100)
The goals of the Chief Joseph Kokanee Enhancement Project are to protect and enhance the natural production of kokanee stocks above Chief Joseph and Grand Coulee dams, to provide successful subsistence and recreational fisheries, and to provide a broodstock source for artificial production in Lake Roosevelt.

Field activities began during in the fall of 1995 and continue today. Activities include: (1) spawning escapement monitoring and enumeration of adult kokanee present in Lake Roosevelt and Lake Rufus Woods Reservoir tributaries (San Poil River, Big Sheep Creek, Deep Creek, Onion Creek, Ora-Pa-Ken Creek, and Nespelem River respectively), (2) collection of genetic material from adult tributary spawning populations in the aforementioned streams and free-ranging kokanee in Lake Roosevelt kokanee, (3) collection of kokanee "swim-up" from redds and monitoring fry emigration from the San Poil River to Lake Roosevelt, (4) hydroacoustic monitoring of fish entrainment through Grand Coulee Dam.

A critical accomplishment of this project has been the identification of a potentially unique stock of kokanee. Genetic evaluations have resulted in the collection of information that may characterize a free-ranging kokanee population in Lake Roosevelt. Rapid declines of the adult tributary spawning population have been documented through adult spawning escapement and redd surveys from 1995-1997, although more recent information may not support this (John Arterburn, CCT, personal communication). This population has been identified as critically depressed and declining.

Additional important achievements related to this project include the identification of spawning locations in the San Poil River and Barnaby Creek, seasonal adult run-timing, and potential limiting factors to tributary production such as abnormal peak late-winter and early-spring flows, bedload movement, and passage barriers relating to reservoir operations. The project has documented substantial entrainment related to Grand Coulee Dam. Important data have and continue to be collected to access entrainment characteristics related to project operations (flood control draft, power draft, power peaking, and spring and summer flow augmentation).

Lake Roosevelt Rainbow Trout Habitat/Passage Improvement Project #9001800
The goal of the project is to contribute to subsistence and recreational fisheries by protecting and enhancing the production of adfluvial rainbow trout populations through improvement to fish passage and in-stream habitat in Lake Roosevelt tributaries.

Early fisheries investigations (Scholz et al. 1985) indicated that the lack of high-quality spawning and rearing habitat was a limiting factor to adfluvial rainbow trout production in Lake Roosevelt. Limited stream surveys also identified fish passage barriers (improper culvert installation and intermittent flows) as limiting production.

Twenty-seven streams were examined during 1990-1991 to assess fish habitat, fish population estimates and potential limiting factors to adfluvial rainbow trout production. Five streams were selected for planning and implementation of passage and habitat improvements based upon the presence of adfluvial rainbow trout, limiting factors, and potential for improved production.

Design and implementation of habitat and passage improvement actions on the five selected streams began in 1992 and continued through 1995. Implementation actions affected 20.9 miles of stream course. Specific actions included re-installation of six culverts, 500 meters of channel reconstruction (meanders) installed in previously channeled stream courses, and 125 in-stream structures installed in efforts to improve passage and improve habitat quality. Riparian improvements included placing 14,500 riparian plants/shrubs/trees and livestock exclusion fence along 4.5 miles of stream course. Habitat quantity was increased by 11 percent through passage improvement alone.

Monitoring of the effectiveness of implementation actions began in 1995 and is expected to continue through 2001. Definitive results and evaluation will be available in post-2001. However, interim accomplishments realized during the monitoring activities include trend information related to adult spawning year-class strength, adult run-timing, juvenile outmigration timing, juvenile population densities, and longevity and function of instream structures and channel reconfiguration.

Lake Roosevelt Monitoring Program #1994-043-00

Project Description:

This program has two primary goals. The first is to monitor and evaluate the performance of fish released into Lake Roosevelt by the Spokane Tribal and Sherman Creek hatcheries and the net pen program. The second goal is to develop a fisheries management plan for Lake Roosevelt that prescribes mitigation/substitution actions and hydro-operations that will maximize ecosystem diversity, complexity, and sustainability. In order to develop an achievable fisheries management plan, a better understanding of this dynamic reservoir ecosystem is required. The Lake Roosevelt Ecology Model is being developed to improve knowledge of physical and chemical limnology, hydrology, and biological production of the reservoir to better predict the effects of single actions on the ecosystem and fishery. Objectives include development of a Lake Roosevelt Fishery Management Plan with hydro-operation recommendations, refined analyses of trophic interactions and effects of various parameters on trophic levels, maintenance of databases in order to validate, refine, and maintain the Lake Roosevelt Ecology Model, validation and refinement of the Lake Roosevelt Ecology Model, monitoring and evaluation of impacts of hatchery origin fish on native species and the lower trophic levels of Lake Roosevelt, monitoring and evaluation of wild fish and different hatchery stocks of kokanee salmon, and rainbow trout performance in Lake Roosevelt.

Associated Monitoring:

This program is the monitoring and evaluation tool for the Sherman Creek and Spokane Tribal Hatcheries.

Accomplishments:
Accomplishments include identification of changes in the fish assemblage and community structure of resident fish species, identification of diet preferences and dietary overlaps that could lead to competition (inter- and intraspecific), evaluation of various hatchery stocks performance through tagging studies, tracking of the economic value of the Lake Roosevelt fishery through fishing pressure and harvest in Lake Roosevelt as identified by a reservoir-wide creel study, and established a limnological dataset for the Lake Roosevelt Ecology Model. Additionally, management goals for specific species were also formulated.

Lake Roosevelt Sturgeon Recovery Project #1995-027-00
Project Description:
Without effective intervention, white sturgeon population appears headed for extinction in the Columbia River upstream from Grand Coulee Dam. Natural recruitment has failed and the population now consists of an aging cohort of adults whose numbers are steadily dwindling. As described in Section 10.4A of the 1994 FWP, concern has arisen over the declining status of native sturgeon populations throughout the Columbia River Basin. White sturgeon populations above Grand Coulee Dam were closed to harvest in 1996 due to increasing concerns over the apparent declining status of the population. Mitigative and/or restorative efforts have become necessary to maintain this particular white sturgeon stock, which possesses genetic traits different from other Columbia River stocks (Setter and Brannon 1992; Brannon et al. 1987). Similar genetic differences and recruitment failure for the Kootenai River white sturgeon stock led to its listing as an endangered species in 1994. In 1998, the WDFW and the STOI sampled an aged white sturgeon population above Grand Coulee Dam and confirmed virtually no recruitment has occurred during the past 20 to 25 years.

The Upper Columbia River White Sturgeon Recovery Plan, initiated in Canada and completed with involvement by U.S. parties, identifies the lack of information on the actual numbers and limiting factors of white sturgeon in U.S. waters of the transboundary reach between Lake Roosevelt and Keenleyside Dam as a critical uncertainty. The overall goal is to prevent the extinction of Upper Columbia River white sturgeon and to recover the population to a level allowing for harvest.

Objectives of the program include development of recovery plans for white sturgeon in the Upper Columbia River in coordination with U.S., Canadian, Federal, State, and Tribal parties to determine abundance, distribution, and population productivity of adult white sturgeon, whether one or multiple white sturgeon populations exist, and to conduct a limiting factors analysis of white sturgeon in the Upper Columbia River between Grand Coulee Dam and the international border. Additional objectives are to determine whether suitable white sturgeon spawning habitat and conditions exist between Grand Coulee Dam and the international border, to determine abundance, distribution, and relative year-class strength of juvenile white sturgeon between Grand Coulee Dam and the international border, and to evaluate the feasibility of prospective recovery measures for white sturgeon in the transboundary reach.

Associated Monitoring:
The program will do initial studies to determine current status of white sturgeon in the Upper Columbia River between Grand Coulee Dam and the international border. The program, now and in the future, will monitor implementation of recovery efforts.

Accomplishments:
During 2001-2002, this project assisted in the development of an Upper Columbia River White Sturgeon Recovery Plan reviewing available information on sturgeon status and biology, identified objectives, strategies, and measures for sturgeon recovery, and outlined a coordinated effort on both sides of the border.

Special Notes:
Delays in contracting in 2001-2002 delayed adult sampling for an additional year, and minimized juvenile sampling in 2002. Currently, the program is fully staffed for needs in 2003-2004. Monitoring to determine current population status, and evaluation of artificial production feasibility as a conservation interim action is moving forward.

Lake Roosevelt Emergency Fish Restoration Project
Project Description:
This project was a one-time funded project by BPA to compensate for power system operations during the power emergency period. A solicitation was developed by the Colville Confederated Tribes Fish and Wildlife Department and submitted to BPA for funding.

Several factors were involved in creating the request for funding. These included safety of the volunteers maintaining the project during the cold, windy winter months. Many of the net pens were badly worn and damaged from the recent untimely drawdown period. Safety was another primary concern. The final concern was that the drawdown occurred during a time when high entrainment traditionally happened. New net pen complexes were purchased that had safety walkways and handrails installed. A total of four pen complexes of four pens each were purchased and installed.

The project purchased a large number of triploid steelhead trout for planting in Lake Roosevelt at various locations. The first lot of fish purchased averaged 1.6 pounds each and the following group at 2.2 pounds each. Following this, another 100,000 fingerlings were purchased and planted into net pens. Four sets of net pens were purchased by this project and donated to the Lake Roosevelt Net Pen Program along with associated tools, docks and storage bins.

All of the large triploid trout were tagged with floy tags to determine the success of triploids in the fishery. In addition 10,000 of the fingerling were tagged upon release.

Associated Monitoring:
The project was a total success as evidenced by tag recovery documented by the Lake Roosevelt Monitoring Project. While no monitoring efforts were undertaken by the project, the Lake Roosevelt Monitoring Project is collecting data pertinent to the project's success. Current Lake Roosevelt monitoring efforts are still documenting the recruitment

of the triploids to the creel.

Accomplishments:

- Replaced many old degraded net pens with new net pens and docks having a safety handrail attached and a skid resistant walkway.
- Purchased needed equipment and waterproof storage boxes for fish feed.
- Contributed to a very successful winter steelhead fishery along Lake Roosevelt.
- Helped generate further positive public feelings for the Tribal and BPA funded fishery enhancement effort.
- As evidenced by the number of letters from the local business operators, the project created a windfall for local restaurants and motel owners.
- Planted 12,000 pounds of catchable triploid steelhead trout all along the reservoir from Spring canyon to as far north as Northport.
- Planted 100,000 fingerling trout from the spring transfers.
- The fish planted by the project are still recruiting to the creel.
- Used triploids to supplement the Lake Roosevelt fishery, which is not only cost-effective but also enduring. The fish seem to remain in the lake (not entraining out) over time, which may suggest they be used on a continuing basis. Unfortunately the project was only funded for a single year.

Coeur d' Alene Tribe

A complete list of Coeur d' Alene Tribal projects, programs, and accomplishments is presented in Section 7: Coeur d' Alene Subbasin Inventory of Existing Programs-Aquatic.

Fish Enhancement on the Coeur d' Alene Reservation

This project began in 1987, when the Council amended the Columbia River Basin Fish and Wildlife Program as to conduct baseline stream surveys of tributaries located on the Coeur d' Alene Indian Reservation. An ongoing resident fish substitution project, this project is funded through the BPA Project #9004400 to mitigate for lost anadromous fishing opportunities resulting from the construction and operation of Grand Coulee Dam. Initial work used a modified Missouri method (Fajen and Wehnes 1981) to rank reservation streams according to their potential for habitat development for westslope cutthroat trout and bull trout. Four streams (Alder, Benewah, Evans, and Lake creeks) were identified as having the best potential for restoration and were targeted for further study.

Between 1992 and 1994, the tribe described watershed processes and resource conditions in the four target drainages. Channel types delineated a framework to predict channel response and to identify areas best suited for improvement projects (Rosgen 1991). Channel stability evaluations provided a quantitative determination of existing channel stability (Kappesser 1992; Pfancuch 1975). Riparian stand conditions identified potential LWD recruitment and channel shading problems. Biological assessments included physical aquatic habitat evaluation, trout population estimates, biomass estimates, individual stock assessments, and quantification of benthic macroinvertebrates.

In 1994, the Council adopted and in 1995 funded the recommendations for: 1) habitat restoration in Lake, Benewah, Evans, and Alder creeks; 2) purchase of critical watershed areas; 3) an educational/outreach program to facilitate a "holistic" watershed protection process; 4) an interim hatchery production fishery for tribal and non-tribal members of the reservation through construction, operation and maintenance of five trout ponds; 5) design, construct, operate and maintain a trout production facility; and 5) a five-year monitoring program to evaluate the effectiveness of the production and habitat improvement projects.

Coeur d' Alene Tribe Trout Production Facility

A trout production facility is planned for the Coeur d' Alene Reservation to supplement native fish stocks in tributaries located on the Reservation, as well as, provide fish for an interim fishery in trout ponds. The Coeur d' Alene Tribe Trout Production Facility is intended to rear and release westslope cutthroat trout into rivers and streams with the express purpose of increasing the numbers of fish spawning, incubating and rearing in the natural environment. It will use the modern technology hatcheries offer to overcome the mortality occurring in lakes, rivers, and streams after eggs are laid in the gravel. Supplementation of native fish stocks in conjunction with effective habitat restoration will be the primary means of achieving these biological goals.

Implement Wildlife-Habitat Protection and Restoration on the Coeur d' Alene Indian Reservation: Hangman Watershed

<u>Project Description:</u>

Protect and/or restore riparian, wetland, and priority upland wildlife-habitats within the Hangman Watershed on the Coeur d' Alene Indian Reservation as part of mitigation efforts in the Spokane River Subbasin. Components of this project include the identification of landscape scale management processes that have lead to the 303d listing of Hangman Watershed streams, and formulating and implementing an economical means of restoring the Hangman Watershed streams to a high level of geomorphic and ecologic integrity. The ultimate goal of the Hangman Restoration Project is to prepare the landscape of the Hangman Watershed for the return of salmon to the Spokane Subbasin.

<u>Associated Monitoring:</u>

Produced a Draft Wildlife Monitoring Plan defining:

- Protocols to monitor trends of specific wildlife species and assemblages to reflect effectiveness of management on acquired properties.
- Protocols to monitor broad scale vegetation patterns throughout the Hangman Watershed east of the Washington-Idaho border.
- Protocols to monitor changes in vegetative communities occurring as a result of protection and restoration.

Continue adaptive management in project implementation through:

- Annual noxious weed monitoring of project site.
- Evaluations of survival and growth of restoration stock within one year of planting.
- Landscape photography on a five-year cycle.

Accomplishments:

- Developed a GIS database of land ownership and areas currently managed to provide some measure of wildlife-habitat protection or restoration.
- Assembled a list of native or desired plants for target restoration sites.
- Prepared a draft Habitat Prioritization Plan using landscape and fisheries data to select parcels offering the greatest potential to improve wildlife and fish habitats.
- Initiated an Instream Flow/Hydrology study expected to:
    1. Predict available fish habitats for specific flow regimes.
    2. Produce estimates for changes in stream flow for specific changes in land management.
    3. Identify areas important to establishing and monitoring annual flow patterns in streams that support native species and minimize erosion.

Hangman Creek Fisheries Restoration on the Coeur d' Alene Indian Reservation, BPA Project 2001-032-00

Project Description:

This is a sister project to *Implement-Habitat Protection and Restoration on the Coeur d' Alene Indian Reservation: Hangman Watershed*. This project establishes the historic and current distribution of redband trout (*Oncorhynchus mykiss gairdneri)* and other native fish species throughout Hangman Creek and its tributaries. The main emphasis is to substitute restoration of resident fish habitat for lost subsistence from anadromous fish resulting from construction of the Columbia River dams. These findings will determine if the trout are redband and if they are recoverable. If not, then another native salmonid species may be pursued as an alternative for Tribal subsistence. Phase I of the project is a bioassessment of the watershed and restoration project planning. Phase II is implementation of restoration plans, and Phase III will be monitoring of the effectiveness of restoration efforts.

Some of the methods being used to assess salmonid habitat are:

- Conduct a fisheries inventory for distribution and population estimates using electroshocking equipment.
- Study migratory habitats to determine if fish are adfluvial or resident fish.
- Conduct a genetics study to determine if salmonids are pure strain Redband Trout and their relationship to other rainbow stocks in the Spokane River watershed.
- Perform water quality/quantity testing by taking discharge, D.O., pH, conductivity and temp, as well as collecting water samples for laboratory analysis.
- Conduct a macro invertebrates study in Hangman Creek and its' tributaries to identify species, numbers, diversity and biomass as another means to assess the health of Hangman Creek and its tributaries. water quality and erosion data will continue to be collected to establish background data. The first year of genetics sampling will be reported in a preliminary report in 2004, and a final report in 2005. Conducting a two-year Instream Flow Incremental

Methodology (IFIM) study to assess the feasibility of improving baseline flows and temperatures.
- Coordinating Idaho Department of Environmental Quality BURP (Beneficial Uses Reconnaissance Project) surveys within Idaho boundaries.
- Assessing erosional processes.
- Characterize the watershed by channel typing using Rosgen protocols in order to use the proper restoration techniques.
- Educate and involve the public in restoration activities.

Accomplishments
- Mapped out salmonid distribution throughout the Idaho reaches of Hangman Creek
- Collected water quality/quantity data in 2002-2004
- Collected genetics samples in 2003 to be analyzed in 2004 by WDFW
- Surveyed fourteen sites using BURP methodology during 2002-2003.
- Collected continuous temperature and discharge measurements to be used for the IFIM study.
- Coordinated efforts of logging operations to remove 3 culverts and block access to stream crossings in 2002.
- Collected erosion and sediment data using bank pins and analyzing water samples for Total Suspended Solids in 2003.

23.3.2 Non-BPA Funded Projects

23.3.2.1 Federal Energy Regulatory Commission (FERC)

Re-licensing of the Spokane River Hydropower Project

Project Description:

The project entails a re-licensing of five Avista dams (Post Falls, Upper Falls, Monroe Street, Nine Mile, and Long Lake dams) on mainstem of Spokane River.

Associated Monitoring:

Initial studies using radio-telemetry are intended to track fish to determine seasonal fish distribution, habitat preference, and critical spawning areas for the mainstem Spokane River. Bull trout and cutthroat trout studies are ongoing in Coeur d' Alene Lake as part of the FERC process. In 2003, these studies include monitoring of TDGs and water temperatures, as well as evaluating the water budget.

Accomplishments:

Studies are currently ongoing in 2003/2004 with the FERC licensing expected to be complete in 2004/2005. Studies incorporate water quality, TDG monitoring, etc. Protection, Mitigation, and Enhancement (PME) efforts will commence once the FERC license is renewed. Fish passage is one objective that will be identified at each facility once passage is achieved at Chief Joseph and Grand Coulee dams.

23.3.2.2 Project sponsored by the Pend Oreille Conservation District

Little Spokane Water Quality Assessment

Project Description:

The "Little Spokane Water Quality Assessment" WDOE grant G9900036 was partnered with the Spokane Conservation District. The report contains baseline data for ten sites from October 1998 through September 1999. This project took place in both Pend Oreille and Spokane counties.

23.3.2.3 Projects sponsored by Spokane County Utilities Division

Little/Middle Spokane WRIA 55/57

Project Description:

The Utilities Division of the Spokane County Public Works Department is the lead agency for the Middle Spokane River Watershed Planning of the Little/Middle Spokane WRIA 55/57. The Planning Unit began in 1998 and commenced work on phase 3 in July 2002, which is expected to be complete the first quarter of 2004. The watershed assessment scope of work includes:

1. Planning unit facilitation and purpose
2. Develop a generalized water balance for WRIA 55/57
3. Develop current water use estimates for residential, commercial, industrial and agricultural activities
4. Develop estimates of instream flow needs
5. Estimate future water needs
6. Water rights and claims
7. Water quality

(Source: http://www.ecy.wa.gov/watershed/55scope%20of%20work.htm)

Major issues to be addressed include water supply needs and the sole aquifer source, Spokane Valley-Rathdrum Prairie aquifer, and FERC re-licensing of the Spokane Hydroelectric River Project and instream flows. An instream flow assessment for the Middle Spokane is still being considered. For more information go to http://www.wcy.wa.gov/watershed/5557.html.

Accomplishments:

The following tasks have been completed: the executive summary of the Level 1 assessment and an instream flow assessment on the Little Spokane River (2003).

The Little Spokane River Watershed Plan Development; A Compilation of Project Results (2001-2002)

Project Description:

This project was intended to fill baseline data gaps in the water quality and quantity issues for the Little Spokane River watershed. The data collected for this project included a basin-wide macro invertebrate study, a basin-wide riparian GIS mapping study, selected nitrogen sampling on Deadman and Little Deep creeks near recent housing developments, and a network of stream discharge stations. The project was funded by the WDOE and ended in 2002.

Associated Monitoring:
No additional monitoring is planned at this time.

Accomplishments:
Baseline information was collected on nitrates, riparian areas, and macroinvertebrate populations.

Notes:
The SCCD is currently undertaking the formal water quality management plan with another WDOE grant. WDOE will be conducting a formal TMDL process in the watershed.

23.3.2.4 Projects sponsored by the Spokane County Conservation District (SCCD)

WRIA 54 (Lower Spokane River)

Project Description:
WRIA 54 encompasses the lower Spokane River (see Figure 21.2 in Section 21). This project began in 2004 and is expected to be complete in 2008. The project is funded by WDOE and is sponsored by Spokane County. Collaborators for this project include WRIA 54 Stakeholders and planning unit members. The purpose of the project is to produce a written watershed plan that addresses water quality, water quantity, and instream flow within WRIA 54.

Accomplishments:
The initiating governments have met and are joining together a planning unit team to begin assessment of WRIA with the overall goal of completing a watershed plan.

A Chronicle of Latah (Hangman) Creek: Fisheries and Land Use (SCCD, 1998)

Project Description:
The chronicle of fishery resources in the watershed documents early accounts of the creek and fish from Native Americans, exploration journals, and local historians and residents. From the early accounts, it suggests Hangman Creek was once a highly productive salmon rearing stream and home to native cutthroat and rainbow trout. The project was funded by the Washington State Conservation Commission and ended in 1997.

Associated Monitoring:
Dr. Al Scholz and Charles Lee, Eastern Washington University, recently conducted an extensive fishery sampling study on Hangman Creek (1998-2002). Their work consisted of 63 different sites throughout the entire Hangman basin. They recorded the number, relative abundance, and catch-per-unit effort of all species captured through backpack electro-fishing. Preliminary tables and maps may be available, but the final report is not yet completed.

Accomplishments:
Research of historical archives, newspaper articles, reports, resource agency records, historical society collections and long-time resident interviews were utilized to compile a chronology of land use events impacting the fisheries in Hangman Creek.

Hangman (Latah) Creek Comprehensive Flood Hazard Management Plan (CFHMP)
Project Description:
The Hangman Creek Stream Team was initiated by the WDOE in the spring of 1996 following a four-day run-off event (a peak flow of 14,700 cfs) incurring widespread flooding and stream bank damage to the lower portion of Hangman Creek. A group of private citizens and resource agency staff was organized to address flooding and erosion damage issues concerning lower Hangman Creek. The project was funded by the WDOE and ended in 2000.

The goals of the CFHMP were to:
- Identify stream bank erosion sites
- Identify recurring flood problem areas
- Realize trends and opportunities in land use suitability and capability
- Analyze flood plain management factors within Spokane County and the City of Spokane jurisdictional boundaries

The CFHMP Work Group, the public, and professional agency representatives developed alternatives to the local problem sites. Land use recommendations reflect potential changes to current policy guidelines and could be utilized by public officials as a resource in evaluating areas in Hangman Creek for development and planning.

Accomplishments***:***
Identified problem areas and alternatives.

Hangman Creek Management Plan (SCCD, 1994)
Project Description:
In 1994, the SCCD completed a watershed management plan for Hangman Creek. The plan provides information on the watershed characteristics, soils, general land uses in the watershed, land ownership, flow data, fauna and flora, water quality problems, and best management practices (BMPs). In order to address water quality problems associated with Hangman Creek, the management plan included a Water Quality Monitoring Plan. The project was funded by WDOE and although funding ended in 1994, the last objective was completed in 2002.

Accomplishments:
This management plan identified and characterized many of the current land use issues remaining today. It outlined a strategy to reduce overall pollutant loading with associated BMP implementation.

The first of the objectives was completed in 1999 with the publication of the *Hangman (Latah) Creek Water Quality Monitoring Report, Water Resources Public Data File 99-*

01. The second objective was completed in 2000 with the publication of the *Hangman Creek Subwatershed Improvement Project Report*. The third objective was completed in 2002 with the publication of *The Hangman Creek Water Quality Network: A Summary of Sediment Discharge and Continuous Flow Measurements (1998-2001)*.

Hangman Creek Riparian/Sediment Reduction Projects

Project Description:

The projects listed below are designed to enhance the shorelines through riparian rehabilitation, stabilization, and sediment reduction. The SCCD has worked on many projects in Hangman Creek over the last five years.

- Grunte Project
- Leuthold Project
- Snyder Project
- 12 Riparian Projects on Hangman Creek

Accomplishments:

The projects listed above are all helping reduce sediment loads to Hangman Creek, through bank stabilization, riparian vegetation, and other measures. The number of projects completed on Hangman Creek continues to grow. Additional projects have increased landowner awareness of programs and assistance.

Hangman Creek Subwatershed Improvement Project Report (SCCD, 2000)

Project Description:

To quantify the effectiveness of erosion-reducing BMPs on water quality, a sub-watershed improvement project was carried out on two nearly identical small watersheds. For the sub-watershed improvement project, the SCCD monitored two sub-watersheds of Hangman Creek over a four-year period, from October 1995 through October 1999. The purpose of the monitoring was to determine if the implementation of BMPs could be shown to improve the water quality of the receiving waters. The project was funded by WDOE and ended in 1999.

Accomplishments:

The main benefits of this project include reduced sediment runoff, increased storage of water and sediment on farms, increased riparian vegetation, and better wildlife habitat. This project was not designed or intended to evaluate specific individual BMPs; rather, a watershed approach was used in the design of the project BMPs. Because of the watershed approach used in this project, no specific BMP can be recommended as being the best to install. What can be recommended is the use of a site-specific approach with farm planning to decide the best BMPs to install for each individual farm or location.

Hydrology of the Hangman Creek Watershed (WRIA 56)

Project Description:

The primary purpose of this study is to review pertinent hydrologic and geologic literature and establish a general water balance for the Hangman (Latah) Creek watershed (WRIA 56.) The study area includes all of the land within the watershed, which spans two states and four counties: Spokane and Whitman counties in Washington and

Benewah and Kootenai counties in Idaho. This project was funded by WDOE and ended in June of 2003.

Accomplishments:
Baseline information on hydrology and groundwater.

Biological Assessment of Hangman (Latah) Creek Watershed (SCCD, 1998)
Project Description:
The goal of the study was to collect macroinvertebrate data from Hangman Creek to determine if the health of the stream could be related to the local land uses. The project was funded by the Washington State Conservation Commission and although funding ended in 1997, data is still being gathered by various agencies.

Associated Monitoring:
The WDOE (EAP/EMTS) has recently conducted additional biological sampling on Hangman Creek. They collected macroinvertebrate samples during the fall season of 2003 (August). This additional sampling is tied to the upcoming TMDL assessment work in 2004.

Accomplishments:
The biological assessment did develop a baseline that can be of further assistance in the years to come. Conservation practices throughout the watershed may provide significant impacts that can be measured in 5-10 years. The issue of grass burning throughout the watershed may alter farming practices and cause more producers to return to annual crops. This practice may have adverse impacts to water quality and invertebrate populations. The information gained will be valuable to future efforts.

Notes:
The biological monitoring program in the watershed is not comprehensive. Additional sites and extended monitoring are needed to better assess the biological integrity of tributaries and portions of the main stem on Hangman Creek.

Hangman (Latah) Creek Management Plan, 2004 (WRIA 56)
Project Description:
The SCCD accepted the facilitation role for the development of the WRIA 56 management plan in the fall of 1999. The SCCD, under RCW 90.82, formed a central Planning Unit (PU) representing various watershed stakeholders: special districts, local residents, governmental agencies, and affected tribes. Together, the PU commenced the task of assessing and evaluating existing information, conducting short-term studies, and formulating recommendations that will affect the future of water use in the basin for many years to come. The PU developed this management document in an effort to balance and protect the watershed's instream resources, associated habitats, and economic interests. The project is currently in phase 3 with the final plan due in fall 2004 (http://www.ecy.wa.gov/watershed/56.html). Major issues being addressed in the watershed plan include instream flows in Hangman Creek, future demand of domestic water supply, and water quality related to suspended sediment.

Accomplishments:
The collaboration (buy-in) of local governments and agencies with local landowners and interest groups will be invaluable for implementation of the plan.

Notes:
The management plan includes a compilation of projects: instream flows, water balance, historical vegetation map, water quality summary, hydrological investigations, PFC inventory, GIS map layers (groundwater elevations, precipitation, water rights, current land use).

Hangman Creek Main Stem Channel/Riparian Evaluation
Project Description:
In the spring of 2003, the SCCD conducted an inventory to assess the functional status of riparian-wetlands along the main stem of Hangman Creek. The extensive assessment evaluated over fifty-eight river miles within the Washington state portion of the watershed.

Accomplishments:
The assessment determined Hangman Creek has extensive riparian-wetland problems magnified by years of human perturbation. The main stem was mapped. The tributaries will be completed at a later date. This project was a pilot effort in eastern Washington.

Hangman (Latah) Creek Water Quality Monitoring Report (SCCD, 1999). Public Data File 99-01
Project Description:
The water quality report completed in 1999 summarizes water quality monitoring at six stations over a three-year period. The stations monitored were:

1. Hangman Creek at the Idaho State Line
2. Little Hangman Creek
3. Rattler Run Creek at the mouth
4. Hangman Creek at Bradshaw Road
5. Rock Creek at Jackson Road
6. Hangman Creek at Keevy Road

Associated Monitoring:
Additional monitoring on the mainstem of Hangman Creek is periodically conducted by the SCCD and WDOE. The SCCD conducts the basic suite of parameters during seepage runs and other associated projects.

Accomplishments:
The data collected helps to illustrate the water quality issues and concerns throughout the entire basin.

Hangman Creek Water Quality Network: A Summary of Sediment Discharge and Continuous Flow Measurements (1998-2001)

Project Description:

This Washington State Conservation Commission grant is a continuation of a water quality improvement project initiated in 1997. The SCCD monitored stream discharge at five stations and sampled for bedload sediments at three sites within the Hangman Creek watershed. The SCCD coordinated with the USGS on sampling suspended sediment at the USGS gaging station (Marne Bridge).

Accomplishments:

This project provided baseline information on suspended and bedload transport through the system (apportioned). The discharge (seepage) measurements provided valuable surface/ground water interaction information. It illustrated how 80 percent of the summer flows occur within the last five miles of the stream.

Pre-Settlement Vegetation of the Hangman Creek Watershed and Soil Loss

Project Description:

This investigation provides an assessment of the historic condition of the native vegetative cover and estimates how changes in land use throughout the Hangman Creek watershed have influenced the overall water availability and soil loss.

Accomplishments:

This produced the first historic vegetative cover map (GIS layer).

Hangman Creek Instream Flow Project

Project Description:

Hardin and Davis, Inc. (HDI) studied habitat conditions in Hangman Creek and its tributaries. HDI used Physical Habitat Simulation (PHABSIM), Stream Network Temperature Model (SNTEMP), and hydrological investigations to evaluate instream flow conditions for fisheries. This project was funded by WDOE and ended in May of 2003.

Accomplishments:

The project gathered baseline information on fish habitat requirements.

Notes:

Coeur d' Alene Tribe is conducting similar work in the headwaters of Hangman Creek.

23.3.2.5 Projects sponsored by the Spokane Tribe of Indians

Water Quality and Quantity Monitoring on Spokane Indian Reservation

Project Description:

This project is located in Wellpinit. It began in 1993 and is ongoing. The purpose of the project is to protect and enhance the water resources of the Spokane Indian Reservation. Project collaborators include WDOE, EPA, and STOI. EPA provides funding.

Associated Monitoring:
Monitoring activities associated with the project include: all major stream flows and water quality, inland lake water quality, total dissolved gas on Spokane and Columbia Rivers, groundwater, bacteria, sediments, stream surveys, and review of land use activity.

Accomplishments:
Thus far project accomplishments include EPA approved Spokane Tribal Water Quality Standards (WQS), identification of water not meeting the WQS, annual reports summarizing annual monitoring/data collection, and the Chamokane Creek watershed plan.

Spokane Tribe Integrated Resource Management Plan
Project Description:
This project is located in Wellpinit. It began in 2003 and is ongoing. The purpose of the project is to write a new 10-year Integrated Resource Management Plan (IRMP) replacing the 1994 IRMP that will address all land use activities within the Spokane Indian Reservation.

Accomplishments:
The draft IRMP has been completed and a new Forest Management Plan is being developed.

Natural Resource Damage Assessment (NRDA) for the Midnight Mine and Dawn Mill Site
Project Description:
This project started in 2002 and is ongoing. Collaborators include the STOI, National Parks Service, USFWS, and Colville Tribe. The Department of Interior funds the project. The purpose of the project is to assess natural resource damages incurred as a result of the extraction and processing of uranium within the Blue and Chamokane Creek drainages.

Accomplishments:
Studies on sediment, invertebrates, fish, and small mammals have been completed although results and conclusions are not currently available.

23.3.2.6 Project sponsored by EPA
Midnight Uranium Site Superfund Site
Project Description:
This project is ongoing and was started in 2000. The purpose of the project is to assess and clean up Midnight Uranium Mine, which impacts Blue Creek and the lower portion of the Spokane River. Project collaborators include the STOI, EPA, and USFWS.

Accomplishments:
A Draft Ecological Risk Assessment has been completed.

23.3.27 Other Projects with respect to Lake Roosevelt

Other projects with respect to Lake Roosevelt are presented as part of the aquatic inventory in the Upper Columbia (Section 31).

23.4 Strategies Currently Being Implemented Through Existing Projects

23.4.1 Limiting Factors and Strategies Currently Being Implemented

As described in section 2.4, a database was developed listing the recent projects that have been implemented in the Subbasin. Each project was coded for the limiting factors addressed and the strategies employed. Many projects addressed more than one limiting factor or employed more than one strategy.

In the Spokane Subbasin, 56 recent restoration and conservation projects were identified. Of the projects identified, 34 were focused on resident fish, 16 primarily benefited wildlife, five benefited both fish and wildlife, and one was unknown.

A little more than half of the recent projects in the Spokane Subbasin (56 percent) addressed habitat related limiting factors. The efforts have been distributed between improvements to habitat quality (18 percent), improvements to water quality or quantity (14 percent), increases in habitat quantity (15 percent), or reductions to fish or wildlife passage (9 percent) (Figure 23.1). The lack of information has been addressed in 16 percent of the recent projects. Other non-habitat related limiting factors include disease, competition, predation, and hybridization and have been addressed by 11 percent of the recent projects. Indirect mitigation was addressed by 12 percent of projects.

Projects have implemented a diverse array of strategies in the Spokane Subbasin (Figure 23.2). Habitat improvement or restoration activities have been undertaken by 21 percent of the projects. The second largest category includes research, monitoring, and evaluation with 17 percent of projects engaged in this activity.

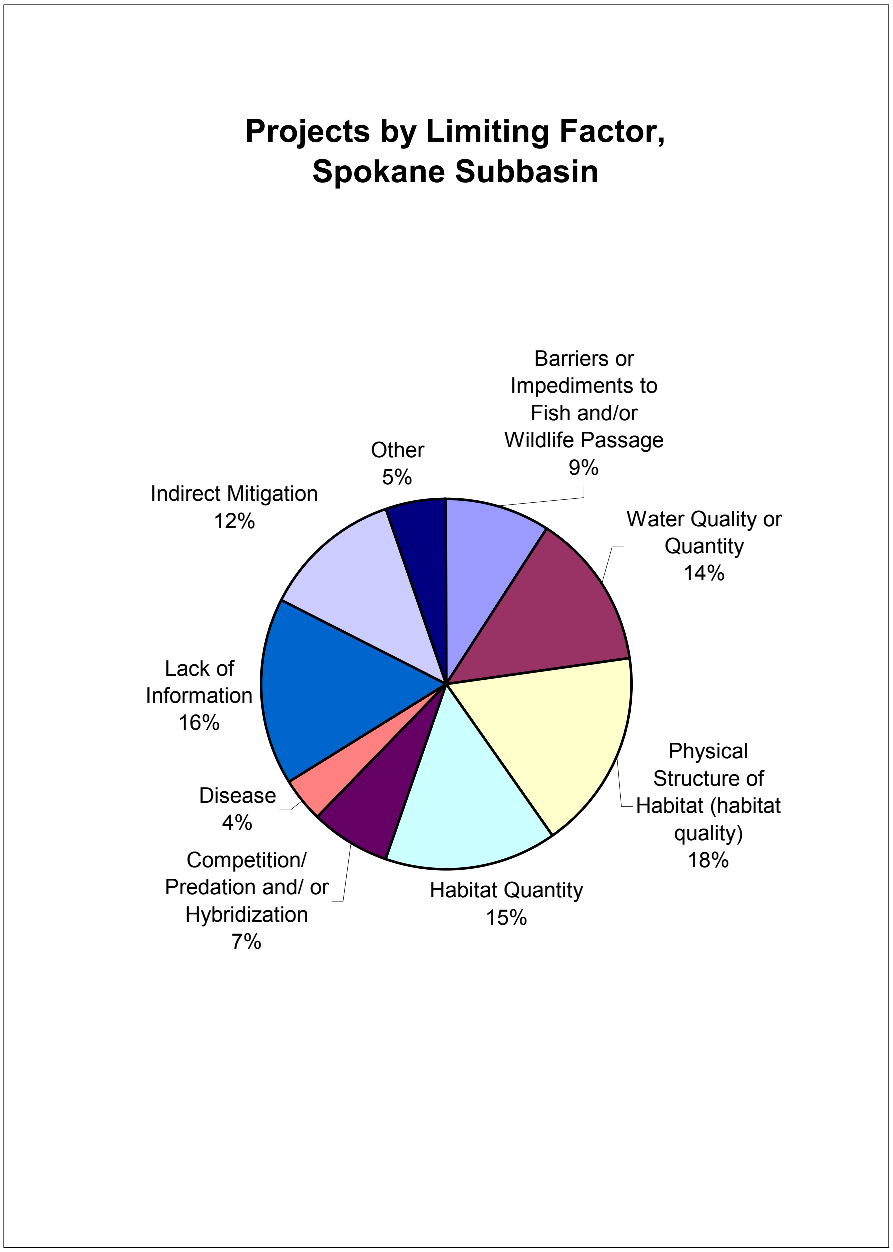

Figure 23.1. The percentage of the 56 recent restoration and conservation projects that addressed various limiting factors within the Spokane Subbasin

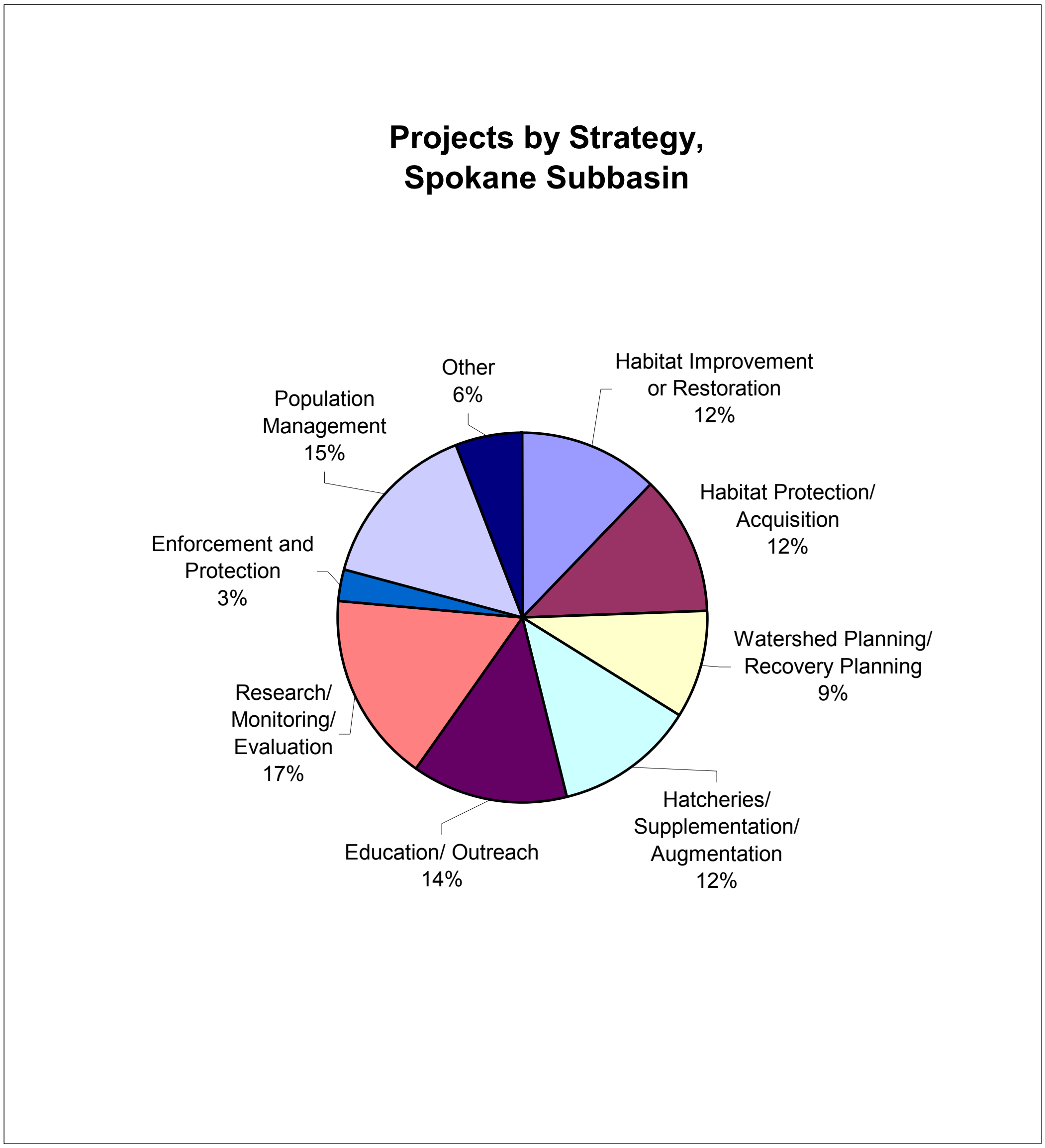

Figure 23.2. The percentage of the 56 recent restoration and conservation projects that addressed various strategies within the Spokane Subbasin

23.4.2 Gaps Between Actions Taken and Actions Needed

The Technical Guide for Subbasin Planners requires that gaps between actions taken and actions needed be identified. This perspective will help determine whether ongoing activities are appropriate or should be modified and lead to new management activity considerations.

In the IMP, the Technical Coordination Group provided information on the gaps based on their knowledge and experience in their subbasins. The input follows.

Many areas in the Spokane Subbasin are in need of additional data. Baseline data gathering was identified as a need in the Spokane Subbasin in general (See management plan objective 1A1, strategy a and objective 1A2 strategy a). Hangman Creek in particular was identified by the technical coordination group as being in need of attention. Hangman Creek was identified as having a wide array of limiting factors (addressed in an earlier section) that affect fish and wildlife in the Spokane Subbasin. Fish and wildlife managers have a particular interest in addressing concerns in this watershed.

Several objectives and strategies are proposed in the Spokane Subbasin Management Plan (Section 26) to address Hangman Creek. For example, Subbasin Objective 1B4: Determine a range of flows suitable for protection and enhancement of native resident fish species in the Subbasin, includes Strategy a: Complete or initiate flow studies on Spokane River, Little Spokane River, Hangman Creek, and other tributaries to determine flows suitable for protection and enhancement of native resident fish species.

Another example is Spokane Subbasin objective 2B3: Supplement non-self sustaining fish species to provide a recreational and subsistence fishery, which includes proposed strategy f: Construct a total of 5 ponds in the Upper Hangman Watershed to function as put-and-take trout fisheries by 2012.

SECTION 24 – Table of Contents

24 Spokane Subbasin Assessment – Terrestrial Resources

24.1 Focal Habitats: Current Distribution, Limiting Factors, and Condition

Vegetation in the Spokane Subbasin ranges from open grass prairies of the rolling Palouse Hills in the southeast to pine savannas at mid-elevations to higher elevation mixed conifer forests in the north and far southeast. Timber management is a major land use in the Little Spokane River drainage. Agriculture is widespread throughout the Subbasin and is the dominant land use in the Hangman/Latah creek drainage. Urban development dominates the east-central portion of the Subbasin, with the cities of Spokane and Spokane Valley comprising the largest urban center in the IMP. The Idaho communities of Post Falls, Hayden and portions of the city of Coeur d' Alene also occur within the Subbasin.

Figure 21.13 (Section 21) shows the current distribution of wildlife-habitat types in the Spokane Subbasin based on IBIS (2003). Table 24.1 presents the corresponding acreages by habitat type and by Subbasin focal habitat. Five focal habitats were selected for the IMP: wetlands, riparian, steppe and shrub-steppe, upland forest, and cliff/rock outcrops. Four of these habitats are represented by the IBIS data displayed in Figure 21.13 and Table 24.1. Cliff/rock outcrop habitats are not mapped by IBIS. Undeveloped, native habitats in the Spokane Subbasin occupy about 55 percent of the area and are dominated by ponderosa pine forest and woodlands (23 percent), eastside interior mixed conifer forest (18 percent), and shrub-steppe (6 percent). Wetlands comprise about 1.6 percent of the area (excluding open water habitats). Developed habitats, including agricultural and urban lands, currently occupy 45 percent of the Subbasin.

The IBIS data is based on satellite imagery at a scale that tends to under-represent habitats that are small in size or narrow in shape. Additional information on habitats within the Spokane Subbasin is available for selected ownerships and/or jurisdictions within the Subbasin; these sources include the WDFW priority habitats and species database, WDOE wetlands mapping, and studies performed by the Coeur d' Alene and Spokane tribes. Data from these sources has been used where available to provide more specific information on habitat distribution within the Subbasin.

Historical vegetation data for the Subbasin is not available at a scale similar to the current condition IBIS data. Native vegetated habitats in the Subbasin have been converted to developed habitats and have also been modified through changes to vegetation type and structure. Refer to the Section 4, Terrestrial Resources of the Intermountain Province for a discussion of historical vs. current habitat types in the Intermountain Province and factors influencing the distribution and quality of those habitats.

Table 24.1. Current wildlife-habitat types in the Spokane Subbasin

Wildlife-Habitat Type	Spokane Current Acres	Percent of Total
Wetlands (Focal Habitat)		
Lakes, Rivers, Ponds, and Reservoirs	30,021	1.6%
Herbaceous Wetlands	1,823	0.1%
Montane Coniferous Wetlands	25,244	1.4%
Riparian and Riparian Wetlands (Focal Habitat)		
Eastside (Interior) Riparian Wetlands	1,430	0.1%
Steppe and Shrub-Steppe (Focal Habitat)		
Westside Grasslands	51	0.0%
Eastside (Interior) Grasslands	84,059	4.5%
Shrub-Steppe	107,867	5.8%
Upland Forest (Focal Habitat)		
Westside Lowland Conifer-Hardwood Forest	4,997	0.3%
Montane Mixed Conifer Forest	584	0.0%
Eastside (Interior) Mixed Conifer Forest	334,048	18.0%
Lodgepole Pine Forest and Woodlands	2,857	0.2%
Ponderosa Pine Forest and Woodland	426,089	22.9%
Upland Aspen Forest	1,108	0.1%
Alpine and Subalpine		
Alpine Grasslands and Shrublands	1,142	0.1%
Developed		
Agriculture, Pasture, and Mixed Environs	763,035	41.1%
Urban and Mixed Environs	73,440	4.0%
Total	**1,857,795**	100.0%

(*Source*: IBIS 2003)

24.1.1 Open Water, Wetlands, and Riparian Areas

Figure 24.1 shows the distribution of wetlands in the Washington portion of the Spokane Subbasin based on the WDOE mapping (WDOE 1999), using aggregated National Wetlands Inventory wetland types. The IBIS wildlife-habitat map (Figure 21.13) is based in part on National Wetland Inventory mapping, but does not utilize all of the wetland categories or show the full extent of very small mapped areas. Table 24.2 summarizes the acreages of wetlands in the Washington portion of the Subbasin by wetland category. Riparian zones have been described for portions of the Subbasin, including the Spokane River and Hangman Creek (Avista 2003, Spokane County Conservation District 2003, and Spokane River Subbasin Summary, Whalen 2000).

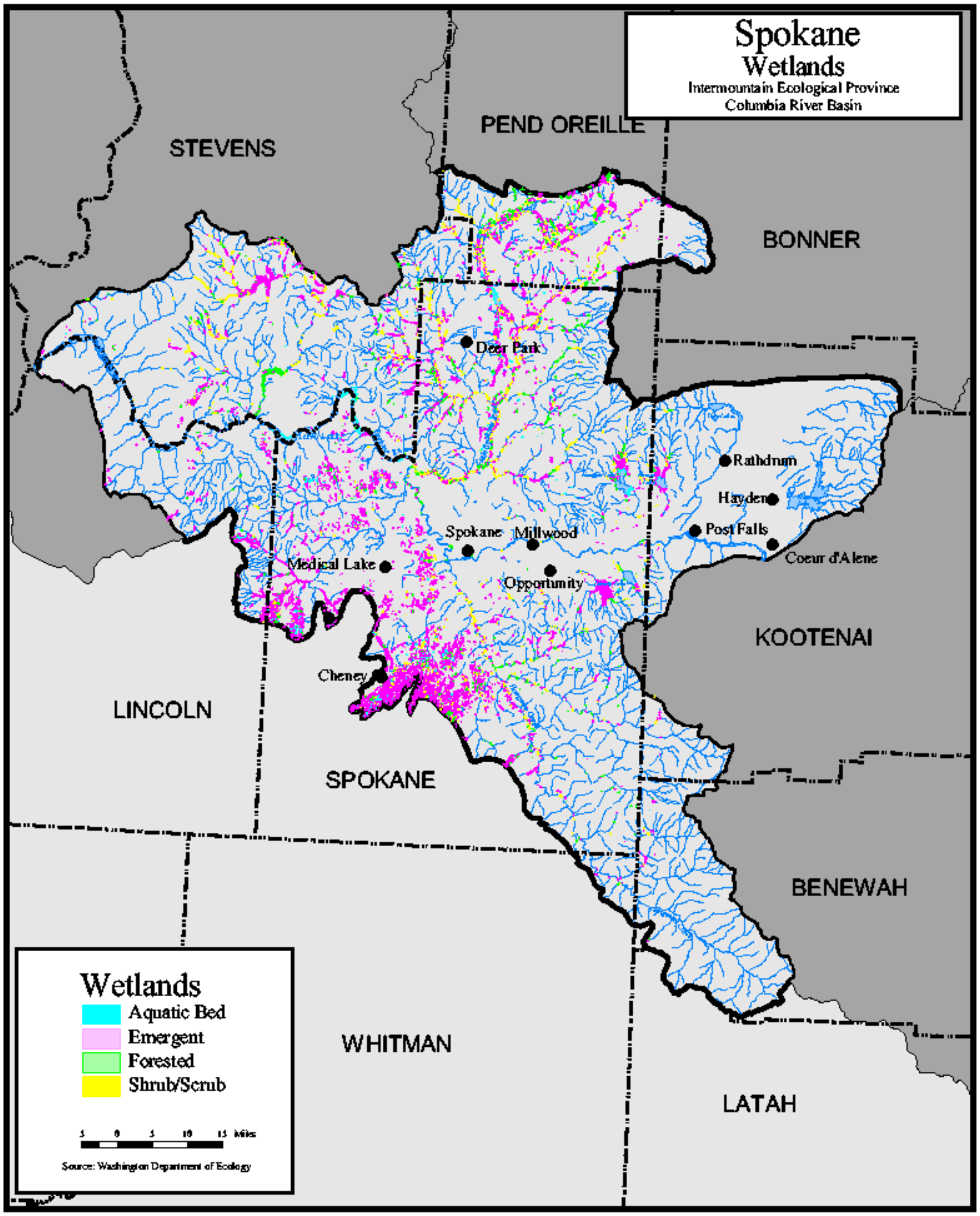

Figure 24.1 Wetland areas within the Spokane Subbasin

Table 24.2. Acres of wetlands in the Washington portion of the Spokane Subbasin by wetland type

Wetland Type	Acres
Emergent	23,370
Scrub/shrub	4,161
Forested	2,957
Aquatic bed	1,674
Total all wetland types	**32,162**

(*Source*: WDOE 1999)

24.1.1.1 Open Water

The Spokane River, Little Spokane River, and Hangman Creek (also known as Latah Creek) are the largest riverine systems in the Subbasin. Large reservoirs include the Spokane Arm of Lake Roosevelt and Long Lake (also referred to as Lake Spokane) above the Long Lake Dam. Major lakes in the Subbasin include Liberty Lake east of Spokane; Hauser, Newman and Spirit lakes in Idaho; and Eloika and Diamond lakes in the Little Spokane River watershed.

The Spokane River has been significantly influenced by water resource projects, with the majority of the river being managed to provide reservoir storage during some portion of each year. The Lake Roosevelt reservoir created by Grand Coulee Dam on the Columbia River inundated approximately 28 miles of the Spokane River (Whalen 2000). Seven other water resource developments are located along the Spokane River's current 111-mile length: the Little Falls Project, the Upriver Project, and the Spokane River Hydroelectric Project consisting of five developments: Post Falls at RM 102, Upper Falls at RM 74.2, Monroe Street at RM 74, Nine Mile at RM 58, and Long Lake at RM 34 (Avista 2003). The remaining free-flowing reaches of the Spokane River are limited to a 15-mile reach downstream of Post Falls Dam, a 2-mile-reach downstream of Upriver Dam, a 10-mile reach below Monroe Street Dam, and a 0.5-mile reach below Nine Mile Dam (Avista 2003).

The Little Spokane River has been influenced by residential, agricultural, industrial, and timber management land uses. Surface water rights within the basin are dominated by irrigation uses (75 percent), with additional withdrawals for domestic use and stock watering (WDOE 1995).

Hangman Creek has been affected by industrial and residential growth near its confluence with the Spokane River. The upper and middle reaches of the watershed support extensive agricultural developments, often up to the edge of the stream (Whalen 2000). Hangman Creek is extremely variable in flow volumes, ranging from near 10 cfs during summer months to over 20,000 cfs during winter storm events (SCCD 2003).

24.1.1.2 Wetlands and Riparian Areas

Riparian vegetation along the Spokane River corridor is limited primarily to narrow, intermittent bands immediately adjacent to the river. Occasional patches of more extensive wetlands occur in areas where the river supports a broader floodplain and at the confluences of major tributary streams (Figure 24.1).

Riparian zones along the 28-mile long Spokane Arm of Lake Roosevelt were inundated by Lake Roosevelt. Approximately 195 acres of river-edge riparian and riparian forest habitats were inundated on the Spokane Reservation (Creveling and Renfrow 1986). The inundated areas included riparian cottonwood forests and other riparian habitats along the lower Spokane River (K. Singer, Spokane Tribe of Indians, personal communication, October 16, 2003). The loss of cottonwood galleries, island habitats, and riverine function due to hydropower development, coupled with the degradation of remaining riparian habitats from agriculture practices, livestock grazing, and development, has contributed significantly towards the decline of shoreline associated populations, e.g., herons and shorebirds (H. Ferguson, WDFW, personal communication, April 2, 2004).

The current shoreline of the Spokane Arm continues to be influenced by the reservoir fluctuations on daily and seasonal bases. During the approximately three-month winter drawdown period, the water surface elevation of Lake Roosevelt is as much as 80 feet below the full pool level. The fluctuation zone is largely unvegetated, and provides little wildlife value.

Riparian habitats along the Spokane River upstream of Long Lake Dam were described by Avista (2003). Long Lake Reservoir supports a narrow band of riparian habitat along much of the shoreline, with more extensive wetlands at canyon mouths, at Woody Slough on the east end of the lake, and at the Little Spokane River delta. The delta area includes deciduous forest, scrub-shrub, and emergent wetlands. Vegetation of the Lake Spokane riparian zones includes a variety of native species as well as introduced weeds such as the aquatic species Eurasian milfoil. Nine Mile reservoir is bounded by varied terrain that includes basalt cliffs, steep unstable slopes, benches, islands, and mud flats. Weedy vegetation dominates the riparian wetlands, including purple loosestrife, reed canarygrass, and Japanese knotweed. Upstream of Nine Mile, riparian vegetation includes emergent, scrub-shrub, and deciduous forest wetlands at intermittent locations along the riverbanks. Cottonwood trees were noted in the reach upstream of Upriver Dam (RM 80).

Woody riparian zones are present along some reaches of the Little Spokane River, including the Little Spokane Natural Area which is located along seven miles of the lower river.

The majority of the Hangman Creek watershed is currently in agricultural land uses, resulting in conversion of native shrub-steppe, tilling of the soil up to the creek's edge, channelization of the stream, and removal of large woody material (Whalen 2000). These activities, in combination with the steep slopes, fine silt and soils, and seasonal high flows, contribute to active erosion along much of the stream. Very little woody riparian vegetation remains along the creeks in this watershed.

Extensive emergent wetlands are associated with several of the major lakes in the Subbasin, including Diamond and Eloika lakes in the Little Spokane drainage, Newman Lake in the eastern Spokane River drainage, the Medical Lake complex, and various lakes and sloughs of the northern Turnbull National Wildlife Refuge near Cheney.

24.1.2 Steppe and Shrub-steppe

Steppe and shrub-steppe habitats currently occupy about 10 percent of the Spokane Subbasin (Table 24.1). Grassland habitats remain primarily in the east-central and northwestern portions of the Subbasin, and in the upper Hangman Creek drainage in the southeastern portion of the Subbasin (Figure 21.9). Shrub-steppe habitats are present mainly in the southwestern portion of the Subbasin. The majority of these habitats have been modified from historic conditions through grazing, agriculture, and rural residential development. Extensive areas have been converted to non-vegetated habitats through industrial and urban development.

Development of the federal hydropower system contributed to the conversion of shrub-steppe habitats to open water reservoirs. Approximately 28 miles of the lower Spokane River was inundated by creation of Lake Roosevelt on the Columbia River (Whalen 2000), including shrub-steppe habitats. A total of 636 acres of shrub-steppe was lost on the Spokane Reservation; a portion of this was located within the Spokane River Subbasin. Construction of other hydropower projects along the Spokane River may have affected steppe and shrub-steppe habitats; however, no estimates of habitat areas inundated are available. Loess soils of the Palouse Hills have been extensively developed for dryland agriculture of wheat, cereal grains, alfalfa, and legumes. One estimate indicates that 56 percent of the Hangman Creek watershed is managed for dryland agriculture (Whalen 2000). The portion of the Hangman Creek drainage within the Coeur d' Alene Reservation was analyzed by the Tribe's Natural Resources Department (G. Green, CDAT, personal communication, September 5, 2003). Based on this analysis, approximately 60 percent of the habitat has been converted to agriculture, with a small amount converted into developed cover types (less than one percent). Throughout the Subbasin, fire suppression and grazing have also modified the plant species composition of remaining grassland and shrub-steppe habitats.

24.1.3 Upland Forests

Upland forests in the Spokane Subbasin are dominated by ponderosa pine (23 percent) and mixed conifer forests (18 percent, Table 24.1). Ponderosa pine forests and woodlands are distributed throughout the Subbasin; mixed conifer forests are found at higher elevations primarily in the northern portion of the Subbasin.

Construction of the Grand Coulee Project resulted in inundation of approximately 1,018 acres of ponderosa pine savannah and 66 acres of ponderosa pine forest on the Spokane Reservation; a portion of these lands are located within the Spokane River Subbasin. The Long Lake and Post Falls project reservoirs also likely inundated limited quantities of ponderosa pine habitats at the time of construction. Agricultural, industrial, and residential development in the Subbasin have converted many acres of ponderosa pine forests and woodlands to non-vegetated cover types. Timber harvest continues to be an important land use on private lands in the upper Little Spokane River drainage; timber management occurs on a smaller scale in other forested portions of the Subbasin. Forest stands in general show a reduction in the proportion of mature and old growth stands with respect to historic conditions, many sites show a general decreasing trend in ponderosa pine with replacement by other coniferous species. Fire suppression also has influenced the stand structure, species composition, and understory structure of forested habitats in the Subbasin.

24.1.4 Other Terrestrial Resource Limiting Factors

As noted in the Section 4, numerous specific habitat elements (called key environmental correlates, or KECs in IBIS terminology) influence the value of wildlife-habitat types to individual wildlife species. Habitat elements may include natural attributes, such as snags, downed wood, soil types, and also include anthropgenic features such as buildings, chemical contaminants, and roads. Information on site-specific habitat elements is critical to determination of habitat suitability for wildlife; however, data is not available at a subbasin-wide level for most habitat elements. Information on selected habitat elements having important influences on habitat quality and wildlife use has been compiled for this assessment, including road density and salmonid nutrients lost to the Intermountain Province.

24.1.4.1 Road Density

Figure 21.14 (Section 21) displays road density by density class in sixth order watersheds of the Subbasin. The area including the cities of Spokane and Spokane Valley is rated as very high road density (4.7 to16.4 miles of road per square mile); most of the surrounding areas are rated as high (1.7 to 4.7 miles of road per square mile). Other areas ranked as high road density include the Hayden Lake area, the Mt. Spokane State Park vicinity, National Forest System lands north of Eloika Lake, and an area along the western edge of the Subbasin. Moderate road densities (0.7 to 1.7 miles per square mile) were determined for areas in the upper Hangman drainage, portions of the Spokane River drainage, and the majority of the Little Spokane River drainage. No areas within the Subbasin were ranked as very low road density.

High road densities are indicative of human land uses and activities. In the Spokane River Subbasin, high and very high road densities are associated primarily with urban centers. High densities are also present on managed timberlands. Road density values in excess of 1.5 miles per square mile are considered suboptimal for mule deer summer range; values greater than 0.5 miles per square mile are suboptimal for the species on their winter range (WDFW 1991). The majority of the Subbasin exceeds the road density levels considered optimal for mule deer winter range; a substantial portion of the Subbasin is at or near (moderate ranking) the value considered suboptimal for summer ranges.

24.1.4.2 Loss of Salmonid Nutrient Base

Construction of the Chief Joseph and Grand Coulee dams on the Columbia River eliminated the potential for salmon to return to areas traditionally and culturally used by the Spokane, Coeur d’ Alene, and other native American Tribes, including portions of the Spokane River Subbasin. The loss of anadromous fish affected not only tribal and recreational use of the fisheries resource, but also affected salmon-dependent wildlife and modified the nutrient input to the overall ecosystem.

Appendix E of the 1987 Columbia Basin Fish and Wildlife Program (Council 1987) presents the results of several alternative calculations to determine the loss of salmon within the Columbia River system due to hydropower development. Based on the pre-1850 run size, with no dams in place, the number of adults at spawning grounds in reaches above Chief Joseph Dam would total 3,175,000 fish, with sockeye comprising greater than 55 percent, summer Chinook 19 percent, and fall Chinook, spring Chinook, coho, and steelhead the remaining 26 percent. Although the analysis does not break out the returns by major river and stream systems, it can be assumed that a significant number of fish would have returned to accessible portions of the Spokane River.

Scholz et al. (1985) compiled information on salmon and steelhead run size and harvest above Grand Coulee Dam. The results of four different techniques to estimate adult run size of the total Columbia River were summarized, showing a range of 1.2 million to 35 million fish. The authors selected the catch-based estimation technique as the most reasonable estimate of total Columbia River run size, equaling 13.1 million fish. The percentage of the total run migrating to the Upper Columbia River was estimated at 5 percent Chinook, 8 percent sockeye, 3 percent coho, and 41 percent steelhead. Using the catch-based total run size, an estimate of run size into the Upper Columbia Basin, prior to major development, was calculated at 1.1 million fish. Minimum annual catch was estimated at 644,000 fish.

24.1.4.3 Lake Roosevelt Shoreline Erosion

Wave action, combined with fluctuating water surface levels and unstable soils, has contributed to erosion of steep banks along portions of the Spokane Arm of Lake Roosevelt. USBR (1984) reported that 11.5 miles of Lake Roosevelt shoreline were lost to slides on Spokane Reservation lands; several of the sites are located on the Spokane Arm.

Erosion of the Lake Roosevelt shoreline has the potential to affect terrestrial resources through direct loss of habitats, including shrub-steppe, grasslands, wetlands, and riparian shrubs and trees. Direct loss of wildlife could occur through effects to active nesting sites of species such as Canada goose or mallard, and burrow or denning sites. Figure 21.12 (Section 21) shows the portion of Lake Roosevelt located within the Spokane Subbasin and highlights the areas of high erosion potential along the shoreline. Analysis of a 300-foot wide band, extending upslope from the average reservoir elevation of 1,290 feet, shows that 23 percent of the area within the band is classified as high erosion potential, while 7 percent of the area is bedrock. To date, site-specific assessment of the effects of shoreline erosion on terrestrial resources has not been conducted.

24.1.5 Land Ownership and Gap Status

Land ownership in the Spokane River Subbasin is summarized in Table 24.3, based on Gap Analysis Program data (IBIS 2003). A map of ownership categories in the province is presented in Section 4, Figure 4.3. The Spokane River Subbasin is dominated by private ownership (84 percent), with small percentages in federal (3 percent), Tribal (8 percent), and state (4 percent). Relative protection levels of native habitats are shown in Table 24.4, GAP Status. No lands within the Subbasin are categorized as Status 1, High Protection, due to the absence of highly protected habitats such as designated wilderness areas. Habitats protected under Status 2, Medium Protection (1 percent of total), include the Coulee Dam National Recreation Area along the Spokane Arm of Lake Roosevelt, Riverside State Park near Spokane, and portions of Mt. Spokane State Park and the Turnbull National Wildlife Refuge. Of the total acreage under Status 2 protection, focal habitats comprise about 89 percent: 2 percent wetlands, 13 percent steppe and shrub-steppe, and 74 percent upland forests. Lands under Low Protection (Status 3) levels total about 8 percent of the Subbasin. Lands with No or Unknown Protection total over 90 percent of the Subbasin. Due to the scale of mapping, small parcels may be incorrectly categorized in this analysis.

Table 24.3. Land ownership in the Spokane Subbasin by wildlife-habitat type

Wildlife-Habitat Types (acres)	Federal Lands	Native American Lands	State Lands	Local Gov't. Lands	Non-Gov't. Org. Lands	Private Lands	Water	Total
Wetlands (Focal Habitat)								
Lakes, Rivers, Ponds, and Reservoirs	1,198	3,148	691	172	0	20,570	6,386	32,164
Herbaceous Wetlands	19	0	29	0	0	2,314	13	2,375
Montane Coniferous Wetlands	258	1,099	620	327	0	25,547	0	27,852
Riparian and Riparian Wetlands (Focal Habitat)								
Interior Riparian Wetlands	4	0	53	0	0	1,445	23	1,526
Steppe and Shrub-Steppe (Focal Habitat)								
Interior Grasslands	802	12,955	3,598	136	0	81,687	0	99,179
Shrub-steppe	2,186	13,929	4,366	116	0	89,659	0	110,256
Upland Forest (Focal Habitat)								
Mesic Lowland Conifer-Hardwood Forest	3,885	0	67	0	0	1,028	0	4,979
Montane Mixed Conifer Forest	414	0	19	0	0	153	0	586
Interior Mixed Conifer Forest	37,685	21,316	35,138	857	0	236,690	0	331,686
Lodgepole Pine Forest & Woodlands	1,136	0	204	1	0	2,675	0	4,016
Ponderosa Pine Forest & Woodlands	4,702	74,498	23,700	2,555	0	310,110	0	415,565
Upland Aspen Forest	16	0	292	1	0	2,300	0	2,609
Alpine and Subalpine								
Subalpine Parkland	0	0	0	0	0	0	0	0
Alpine Grasslands and Shrublands	39	0	61	0	0	1,086	0	1,187
Developed								
Agriculture, Pasture, and Mixed Environs	4,371	14,960	7,839	860	0	721,947	0	749,977
Urban and Mixed Environs	163	0	995	1,167	0	71,554	0	73,878
Total Acres	**56,877**	**141,905**	**77,672**	**6,193**	**0**	**1,568,764**	**6,422**	**1,857,833**

(*Source*: IBIS 2003)

Table 24.4 GAP status of lands in the Spokane Subbasin by wildlife-habitat type

Wildlife-Habitat Type (acres)	1 - High Protection	2 - Medium Protection	3 - Low Protection	4 - No Protection	Water	Total
Wetlands (Focal Habitat)						
Lakes, Rivers, Ponds, and Reservoirs	0	1,261	664	23,702	6,696	32,323
Herbaceous Wetlands	0	19	63	2,276	13	2,371
Montane Coniferous Wetlands	0	398	1,313	26,107	0	27,818
Riparian and Riparian Wetlands (Focal Habitat)						
Interior Riparian Wetlands	0	0	85	1,420	20	1,526
Steppe and Shrub-Steppe (Focal Habitat)						
Westside Grasslands	0	44	0	0	0	44
Interior Grasslands	0	673	5,075	93,469	0	99,218
Shrub-steppe	0	2,499	4,779	102,944	0	110,223
Upland Forest (Focal Habitat)						
Mesic Lowland Conifer-Hardwood Forest	0	0	3,953	1,024	0	4,977
Montane Mixed Conifer Forest	0	0	448	139	0	587
Interior Mixed Conifer Forest	0	9,497	69,805	252,681	0	331,983
Lodgepole Pine Forest & Woodlands	0	13	1,399	2,615	0	4,027
Ponderosa Pine Forest & Woodlands	0	8,759	28,740	378,226	0	415,724
Upland Aspen Forest	0	2	406	2,203	0	2,611
Alpine and Subalpine						
Subalpine Parkland	0	0	0	0	0	0
Alpine Grasslands and Shrublands	0	0	98	1,094	0	1,192
Developed						
Agriculture, Pasture, and Mixed Environs	0	1,299	24,474	723,580	0	749,353
Urban and Mixed Environs	0	378	1,427	72,051	0	73,856
Total Acres	0	**24,843**	**142,730**	**1,683,531**	**6,729**	**1,857,833**

(*Source*: IBIS 2003)

GAP Status Definitions (Source: USGS 2000):

Status 1 – High Protection: An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a natural state within which disturbance events (of natural type, frequency, intensity, and legacy) are allowed to proceed without interference or are mimicked through management.

Status 2 – Medium Protection: An area having permanent protection from conversion of natural land cover and a mandated management plan in operation to maintain a primarily natural state, but which may receive uses or management practices that degrade the quality of existing natural communities, including suppression of natural disturbance.

Status 3 – Low Protection: An area having permanent protection from conversion of natural land cover for the majority of the area, but subject to extractive uses of either a broad, low-intensity type (e.g., logging) or localized intense type (e.g., mining). It also confers protection to federally-listed endangered and threatened species throughout the area.

Status 4 – No or Unknown Protection: There are no known public or private institutional mandates or legally recognized easements or deed restrictions held by the managing entity to prevent conversion of natural habitat types to anthropogenic habitat types. The area generally allows conversion to unnatural land cover throughout.

24.2 Wildlife of the Spokane Subbasin

24.2.1 Wildlife Occurring in the Spokane Subbasin

The Spokane River Subbasin provides a wide range of wildlife-habitat types including grasslands, shrub-steppe, ponderosa pine woodlands, wetlands, and interior mixed coniferous forests. There are approximately 353 terrestrial vertebrate wildlife species using these habitats, many of which are important for ecological, cultural, and/or economic reasons. Table 24.5 presents the terrestrial vertebrate wildlife species occurring within the Spokane Subbasin (IBIS 2003). Due to the large number of wildlife species in the Subbasin, the following discussion focuses on wildlife species that are important indicators of habitat quality, those representing other wildlife species, and those with special management status. WDFW harvest information for key game species is summarized; more detailed harvest information based on WDFW (2004a) is provided in Appendix G. For further information on the broader spectrum of wildlife species in the Subbasin, refer to the Spokane River Subbasin Summary (Whalen 2000).

Table 24.5. Number of wildlife species (and percent of Province total) in the Spokane Subbasin

	Occurring Species	HEP/Priority Species	HEP/Priority Species Closely Associated With Herbaceous Wetlands	HEP/Priority Species Closely Associated With Riparian Wetlands	HEP/Priority Species That Feed Upon Salmon	Occurring Species That Feed Upon Salmon
Amphibians	14 (82%)	1	1	1	0	1
Birds	237 (86%)	10	1	3	2	56
Mammals	86 (85%)	5	1	3	1	22
Reptiles	16 (89%)	0	0	0	0	2
Total	353 (86%)	16	3	7	3	81

(*Source*: IBIS 2003)

24.2.2 HEP and Priority Species of the Spokane Subbasin

Subbasin planners selected a group of wildlife species to represent the focal habitats and wildlife of the Spokane River Subbasin. Wildlife species used in the Grand Coulee Habitat Evaluation Procedures (HEP) study (Creveling and Renfrow 1986) were selected because they were used in the construction and inundation loss assessment for the federal hydrosystem project and because they will be used in the future to evaluate mitigation for the project. Additional wildlife species were selected due to their management, cultural, and/or economic values in the Subbasin; these species also represent specific focal habitats. The list of HEP and priority species for the Subbasin, as well as federal and state-listed threatened and endangered species, is presented in Table 24.6.

Table 24.6. Federal and state endangered/ghreatened, HEP, and priority wildlife species of the Spokane Subbasin and degree of association[1] with focal habitats during breeding

Common & Scientific Names	Federal/ ID / WA Listing Status [2]	HEP/ Priority Status [3]	Focal Habitats				
			Cliff/ Rock Outcrop	Wetland	Riparian	Steppe/ Shrub-Steppe	Upland Forest
American beaver *Castor canadensis*	-	P(1,2,3)	-	Close	Close	-	-
Bald eagle *Haliaeetus leucocephalus*	T / e / t	P(1,3,4)	-	-	General	-	General
Canada goose *Branta canadensis*	-	HEP	General	Close	-	General	-
Canada lynx *Lynx canadensis*	T / - / t	P(4)	-	-	-	-	Close
Columbia spotted frog *Rana luteiventris*	-	P(1)	-	Close	Close	-	-
Fisher *Martes penannti*	- / - / e	P(4)	-	General	-	-	Close
Golden eagle *Aquila chrysaetos*	-	P(1,3)	Close	-	General	General	General
Gray wolf *Canis lupus*	T / e / e	P(4)	-	-	General	General	General
Grizzly bear *Ursus arctos*	T / t / e	P(4)	-	-	-	-	General
Mink *Mustela vison*	-	P(1,2)	-	Close	Close	-	-
Mourning dove *Zenaida macroura*	-	HEP	-	-	Close	General	General
Mule deer *Odocoileus hemionus hemionus*	-	HEP	-	General	General	General	General
Peregrine falcon *Falco peregrinus*	- / e / -	P(4)	Close	-	General	General	General
Pileated woodpecker *Dryocopus pileatus*	-	P(1)	-	General	General	-	General
Ruffed grouse *Bonasa umbellatus*	-	HEP	-	General	Close	-	Close
Sage grouse *Centrocercus urophasianus*	- / - / t	HEP	-	-	-	Close	-
Sage sparrow *Amphispiza belli*	-	P(1)	-	-	-	Close	General
Sharp-tailed grouse *Tympanuchus phasianellus columbianus*	- / - / t	HEP	-	-	-	Close	General
Snowshoe hare *Lepus americanus*	-	P(1)	-	Close	Close	-	Close
Upland sandpiper *Bartramia longicauda*	- / - / e	P(4)	-	General	-	Close	-
White-headed woodpecker	-	P(1)	-	-	General	-	Close

Common & Scientific Names	Federal/ ID / WA Listing Status [2]	HEP/ Priority Status [3]	Focal Habitats				
			Cliff/ Rock Outcrop	Wetland	Riparian	Steppe/ Shrub-Steppe	Upland Forest
Picoides albolarvatus							
White-tailed deer *Odocoileus virginianus*	-	HEP	-	-	<u>Close</u>	General	<u>General</u>
Yellow warbler *Dendroica petechia*	-	P(1)	-	-	<u>Close</u>	-	-

(*Source*: Spokane Subbasin Work Team and IBIS 2003)

[1] **Close** = Animal dependent on the habitat for part or all of its life history requirements.
General = Animal adaptive and supported by numerous habitats.

[2] **E** = Federal Endangered. **T** = Federal Threatened. **e** = State Endangered. **t** = State Threatened. State listings for Idaho and Washington shown in that order.

[3] **HEP** = Species evaluated via Habitat Evaluation Procedures loss assessment for Grand Coulee Dam (Creveling and Renfrow 1986)
P = Priority species designated as important because it is **(1)** ecological indicator for habitat or other animals, **(2)** game animal, **(3)** highly culturally prized, or **(4)** special status for management. Many priority species were selected to represent one or more focal habitat types; the habitat(s) a species represents is(are) indicated by underlined degree of association (e.g., <u>close</u>).

The province-wide status and trends of federal and state-listed threatened and endangered species are discussed in Section 4, Terrestrial Resources in the Intermountain Province. Subbasin level information on occurrence of federal and state-listed species is provided in this Section. The occurrence of HEP and priority species in the Subbasin also is discussed briefly below. Some species were selected primarily as indicators of wildlife guilds or of a focal habitat; for many of these species detailed information on status and trends in the Subbasin is not available.

24.2.2.1 Federal and State Threatened and Endangered Species

Bald eagle. The Spokane Subbasin currently supports 11 bald eagle nesting territories and one communal winter roost (WDFW 2003b). Six nesting territories and the communal roost are located along the Spokane River between Long Lake Dam and Nine Mile Dam. The other five territories occur at Diamond Lake, Eloika Lake, Liberty Lake, Newman Lake, and Philleo Lake (H. Ferguson, WDFW, personal communication, April 2, 2004).

Canada lynx. The Spokane Subbasin is outside of the six Lynx Management Zones (LMZs) or subsequent Lynx Analysis Units (LAUs) established by the WDFW (Stinson 2001). Even though LMZs do not encompass all areas potentially used by lynx, habitat management within these zones is expected to hold the greatest promise for supporting lynx populations. The closest historic Washington location for lynx in this Subbasin was reportedly near Chewelah, where a skull was collected in 1917 (Stinson 2001). The only recent occurrence of Canada lynx in Washington’s part of the Spokane Subbasin is a

1992 sighting at Liberty Lake Regional Park (WDFW 2003b). In the Idaho portion of the Spokane Subbasin, no lynx sightings are documented (IDFG 2003).

Fisher. Records for the Washington portion of the Subbasin show one sighting of a fisher in 1998 within a tributary drainage east of the Little Spokane River (WDFW 2003b).

Gray wolf. The wolf's occurrence within the Washington side of the Spokane Subbasin is very rare, as reflected by only one recorded sighting of an adult in 1991 near Long Lake Dam (WDFW 2003b). No current records of gray wolf are recorded for the Idaho portion of the Spokane Subbasin (IDFG 2003), although wolf have been observed in Idaho's Kootenai County, based on either museum records, incidental sightings, or field surveys (IDFG 2001). The closest wolf pack, named the Marble Mountain pack, is in the Coeur d' Alene Subbasin east of the Spokane Subbasin on the central border between Benewah and Shoshone counties (Mack and Holyan 2003).

Grizzly bear. The Spokane Subbasin is outside of the seven federal grizzly bear Recovery Plan zones, although the Selkirk Zone is located in the Pend Oreille Subbasin to the north. The Washington portion of the Subbasin has a single confirmed grizzly sighting in 1996 from the Dragoon Creek drainage (WDFW 2003b). The Idaho Conservation Data Center does not monitor this species, so occurrence of grizzly in the Idaho portion of the Subbasin is unknown.

Peregrine falcon. Within the Spokane subbasin in Washington, one eyrie is present in the Hangman Creek drainage and another unoccupied hack site is a few miles away on the Spokane River (WDFW 2003b). Another new eyrie may have been found in 2003 at Hawk Creek and will be verified in 2004 (H. Ferguson, WDFW, personal communication, April 2, 2004). The Idaho portion of the Subbasin has no record of peregrine sightings (IDFG 2003).

Sage grouse. In 1998, the Washington Fish and Wildlife Commission listed the sage grouse as threatened. Populations of sage grouse have been dramatically reduced in Washington state due to conversion of suitable shrub-steppe habitats to agricultural uses and degradation of remaining shrub-steppe (Schroeder et al. 2003). Direct effects to sage grouse breeding and wintering habitats are believed to have occurred as a result of inundation of lands under Lake Roosevelt; a total of 76 birds were estimated to have been lost on the Spokane Reservation (Creveling and Renfrow 1986). However, no specific Habitat Unit mitigation requirement was established for the Spokane Tribe, as little sagebrush-steppe habitat was thought to have been affected on the Spokane Reservation (Creveling and Renfrow 1986). Currently, there are two known breeding populations in the state, both are located in counties west of the Spokane Subbasin (Schroeder et al. 2003).

Sharp-tailed grouse. In 1998, the Washington Fish and Wildlife Commission listed the sharp-tailed grouse, Columbian subspecies, as threatened. Although historically present within the Spokane River Subbasin, no populations of sharp-tailed grouse are currently known to exist in the Subbasin (Schroeder and Tirhi 2003; WDFW 2003b). Habitat for the species has been reduced 76 percent since the late 1800s due to conversion of native habitats to agricultural uses (Schroeder and Tirhi 2003). The overall population declined almost continually between 1960 and 2001, but particularly during the 1960s and 1970s when populations are estimated to have fallen from about 10,000 birds to less than 1,000. The overall estimated decline was 95.7 percent between 1960 and 2001; the current distribution of sharp-tailed grouse covers approximately 2.8 percent of their historic range. The primary factor resulting in loss of native habitat was conversion of native habitat to dryland farming (Yocom 1952; Buss and Dziedzic 1955). Dams along the Columbia River resulted in additional loss of habitat due to flooding and indirect loss of habitat due to expansion of irrigated farming (Schroeder 2001).

Potential habitat for sharp-tailed grouse was inundated by construction of the Grand Coulee Dam. Creveling and Renfrow (1986) note 2,609 HUs for sharp-tailed grouse were lost on the Spokane Reservation; this was the greatest single species loss incurred on the Reservation. Sharp-tailed grouse habitat inundation would have occurred within and/or adjacent to the Spokane River Subbasin as defined for this analysis.

State of Washington management is directed at 1) species monitoring via winter and lek surveys, 2) habitat protection and enhancement via acquisition, incentives, seedings, and plantings, 3) population reintroduction and augmentation, 4) protection enforcement, and 5) public awareness (Schroeder and Tirhi 2003). Currently, the Spokane Tribe is conducting a feasibility assessment for the reintroduction of sharp-tailed grouse on the Spokane Reservation; the study is scheduled for completion in summer 2004 (K.Singer, Spokane Tribe, personal communication, October 16, 2003). The Coeur d' Alene Tribe management goal is to reintroduce sharp-tailed grouse to the Coeur d' Alene Reservation by 2010 (B. Kinkead, Coeur d' Alene Tribe, personal communication, October 16, 2003).

Upland Sandpiper. The upland sandpiper was classified as an endangered species by the Washington Wildlife Commission in 1981. Upland sandpiper is not known to have reproduced in Spokane County since 1993 (Iten et al. 2001). In the Washington portion of the Subbasin, upland sandpipers were seen during the nesting season of 1984, 1986, 1987, and 1992 on private land south of Newman Lake (WDFW 2003b). During 2002 and 2003 birds were observed west of Spokane from the end of May up to the middle of June; an intensive survey will be conducted during the 2004 breeding season to determine status of these birds (H. Ferguson, WDFW, personal communication, April 2, 2004).

24.2.2.2 Grand Coulee HEP Species

Canada goose. Canada goose was selected for the HEP loss assessment of Grand Coulee Dam to show the effects of reservoir impoundment on small islands in the Columbia River that provided secure breeding habitat for geese. A loss of 20 secure island nest sites was estimated for the Spokane Reservation portion of Lake Roosevelt (Creveling and Renfrow 1986); some portion of these would likely have been within the Spokane Subbasin as delineated for this analysis. Data from the WDFW shows that the Spokane Subbasin accounts for about five percent of the state's goose hunting harvest and four percent of its goose hunting recreation (Appendix G). That statistic combines all goose species (Canada goose, snow goose, Brandt, etc.).

Mourning dove. The mourning dove is a Grand Coulee Dam HEP assessment species, widespread in the Subbasin but closely associated with riparian habitat. Mourning dove was used in the HEP study to represent wildlife using riparian and agricultural lands, particularly orchards and open ground (Creveling and Renfrow 1986). The Subbasin accounts for approximately three percent of the Washington total for dove hunting harvest and recreation. The Grand Coulee Project caused the loss of 9,316 mourning dove Habitat Units. A total of 653 mourning dove Habitat Units were lost on the Spokane Reservation, which is located partially within the Spokane River Subbasin.

Mule deer and white-tailed deer. In the Spokane Subbasin, white-tailed deer are more closely associated with agriculture, pasture, and woodland habitats than upland forests (WDFW 2003a). In Washington, the most recent data (1996-99) shows that post-hunting herd composition for both white-tailed deer (16-29 bucks:100 does) and mule deer (15-37 bucks:100 does) in GMUs 127 and 130 consistently exceeded the management guideline of 15:100 (WDFW 2001). The post hunting ratio between females and young remained high, indicating good or very good habitat and weather conditions for white-tails especially. Current habitat conditions are expected to support increased population growth until a severe winter or significant drought. White-tailed deer experienced significant losses in GMU 121 from epizootic hemorrhagic disease (EHD). Collisions between vehicles and deer in GMU 127 are a public concern.

The WDFW's harvest management objective is to maintain both white-tailed deer and mule deer numbers that (1) are compatible with landowners and urban expansion, (2) provide as much hunting and viewing recreation as possible, (3) meet a post-hunting-season buck:doe ratio of at least 15:100, and (4) maintain healthy buck:doe:fawn ratios in areas with deer damage to agriculture.

In the Idaho portion of the Spokane Subbasin, white-tailed deer management objectives are to maintain a harvest of at least 30 percent bucks with 4 or more antler points per side, and at least 7 percent bucks with 5 or more antler points per side. The most recent data (years 2000-2002) varied from 58 to 61 percent bucks with 4 or more antler points per side, and from 20 to 27 percent bucks with 5 or more antler points per side. The Idaho mule deer management objective is to maintain a harvest of at least 30 percent bucks with 4 antler points or better for a three-year running average. The most recent data (years 2000-2002) averaged 43 percent (range 42 to 45) with 4 points or better, significantly exceeding the minimum.

An estimate of deer hunting harvest and recreation in the Subbasin is presented in Table 24.7 for mule and white-tailed deer combined. These statistics show that the Washington side of the Subbasin produces approximately 9 percent of the state's deer hunting harvest and 7 percent of its deer hunting recreation. The small portion in Idaho contributes a relatively insignificant amount to that state's deer harvest and hunting recreation.

Table 24.7. Mule deer and white-tailed deer hunting harvest and recreation within the Spokane Subbasin[1]

	Harvest						Hunter-Days					
	Quantity			% of State Total			Quantity			% of State Total		
Year	ID	WA	Total	ID	WA	Total	ID	WA	Total	ID	WA	Total
1999	119	2,980	3,098	0.3	9.3	4.6	2,198	101,166	103,364	0.3	7.0	4.5
2000	129	4,196	4,325	0.4	11.2	5.9	n.d.	75,416	-	-	7.9	-
2001	134	3,010	3,144	0.3	8.3	4.0	1,664	54,276	55,940	0.3	6.5	4.0
2002	110	2,976	3,086	0.3	8.8	4.3	2,113	56,582	58,694	0.3	6.8	3.7
Average	123	3,290	3,413	0.3	9.4	4.7	1,992[2]	71,860	72,666[2]	0.3	7.0	4.1[2]

(*Source*: Appendix G)

[1] Includes portions of Idaho Big Game Unit 5, plus Washington Game Management Units 121, 124. 127,and 130.
[2] 3-year average instead of 4-years due to no data (n.d.).

Ruffed grouse. Hunting for forest grouse (ruffed grouse, blue grouse, and spruce grouse) occurs in all Washington counties of this Subbasin, but most birds are harvested in Stevens and Pend Oreille counties. Spokane County harvests fewer than 20 percent of the number for Stevens County. The agency estimates that ruffed grouse comprise 75 to 80 percent of the total grouse harvest. The Spokane Subbasin accounts for about seven percent of Washington's grouse hunting harvest and five percent of its grouse hunting recreation (Table 24.8). Idaho grouse hunting data is not reported at a hunting unit or county level for Subbasin proportioning, so that state's statistics are not included here.

Table 24.8. Forest grouse (guffed grouse, blue grouse, and spruce grouse) hunting harvest and recreation within the Washington portion of the Spokane Subbasin[1]

	Harvest		Hunter-Days	
Year	Quantity	% of State Total	Quantity	% of State Total
1999	6,249	8.5	12,528	6.6
2000	10,004	6.8	20,854	5.2
2001	6,191	5.6	12,495	4.2
2002	7,124	5.1	13,800	4.2
Average	7,392	6.5	14,919	5.0

(*Source*: Appendix G)

[1] Subbasin includes portions of Lincoln, Pend Oreille, Spokane, and Stevens counties in Washington, plus Kootenai County in Idaho.

Sage grouse. Refer to preceding discussion under Federal and State Threatened and Endangered Species.

Sharp-tailed grouse. Refer to preceding discussion under Federal and State Threatened and Endangered Species.

24.2.2.3 Other Priority Species

American beaver. Beaver was selected as a priority species for the Spokane Subbasin due to its close association with forested wetland and riparian habitats. The beaver is present in all Washington counties of this Subbasin. Trapping harvest is several times higher in the counties of Pend Oreille or Stevens than in Lincoln or Spokane. The Subbasin harvest during 1999-2002 averaged about nine beaver per year and is less than one percent of the state total. Harvest declined during those years, but it is not clear whether this was due to a population reduction, the passing of State Initiative 713 in 2000 (which banned the use of leg or body gripping traps), or other reasons such as a weak fur market, or drop in nuisance complaints.

Columbia spotted frog. The Columbia spotted frog is a federal species of concern and a Washington State candidate species under evaluation for possible listing as endangered, threatened, or sensitive. It was selected as a priority species for the Subbasin because of its close association with wetland and riparian habitats. In the Washington portion of the Spokane Subbasin, this amphibian has a close association with wetland and riparian habitats and adjacent uplands, and is known to occur (1) patchily along the Spokane River, (2) consistently along the Little Spokane River, (3) in the tributaries of Mud Creek and Thompson Creek, and (4) in the small ponds and lakes just southwest of Spokane (WDFW 2003b; H. Ferguson, WDFW, personal commmunication, April 2, 2004). In Idaho, the species occurs in appropriate habitat throughout the Subbasin (IDFG 2001). Management in Washington is directed at protecting native wetland vegetation, avoiding the introduction of nonnative species, controlling run-off, and using alternatives to pesticides.

Golden eagle. This raptor was selected as a Spokane Subbasin priority species due to its close association with cliffs and rock outcrops for nesting. It is a candidate for state listing as threatened/endangered in Washington. Within the Washington portion of the Subbasin, no sightings are reported in the Priority Habitats and Species database (WDFW 2003b).

Mink. This carnivore was selected as a Subbasin priority species for its close association with herbaceous wetland and riparian habitats, and for its economic value as a furbearer. Within the Washington portion of the Subbasin, no sightings are reported in the Priority Habitats and Species database (WDFW 2003b). Trapping records during 1999-2002 show an estimated average of one mink taken per year in the Subbasin (Appendix G).

Pileated woodpecker. The pileated woodpecker was selected as a priority species to represent species using mature and old-growth upland forest, montane coniferous wetland, and wooded riparian habitats of the Subbasin. For the Washington portion of the Subbasin, one sighting occurred in the Rattlesnake Hills area of the Little Spokane River (WDFW 2003b). No detailed information on the species occurrence is available, but it likely occurs in many forested locations within the Subbasin.

Sage sparrow. The Washington Gap Analysis Project (Smith et al. 1997) reports no evidence of breeding in the Spokane Subbasin, and the WDFW (2003b) has no records of occurrence here. General references such as Sibley (2003) indicate the species is absent, but occurs west of the Subbasin during breeding.

Snowshoe hare. The snowshoe hare was selected as a Subbasin priority species for its key ecological function as primary prey to the Canada lynx, and for its close association with upland forest habitats, especially those with a densely-treed understory. These habitats occur on the Subbasin's north, east, and southeast peripheries. No detailed information on snowshoe hare occurrence is available. Within the Washington portion of the Subbasin, no sightings are reported in the Priority Habitats and Species database (WDFW 2003b).

White-headed woodpecker. This woodpecker was selected as a Spokane Subbasin priority species closely associated with upland forest habitats in the Subbasin, especially large patches of old-growth ponderosa pine or mixed conifer. The Washington Gap Analysis Project (Smith et al. 1997) reports no evidence of breeding in the Spokane Subbasin, and the WDFW (2003b) has no records here at all. General references such as Sibley (2003) indicate the species is rare.

Yellow warbler. The yellow warbler was selected as a Subbasin priority species for its close association with riparian habitat, especially the sub-canopy foliage in riparian woodlands.

Habitat loss due to hydrological diversions and control of natural flood regimes (for example, dams), inundation from impoundments, cutting and spraying riparian woody vegetation for water access, gravel mining, and urban development have negatively affected yellow warbler in the region. Similarly, yellow warblers have been impacted by habitat degradation including: (1) loss of vertical stratification of riparian vegetation; (2) lack of recruitment of young cottonwoods, ash, willows, and other subcanopy species; (3) stream bank stabilization which narrows stream channels, reduces the flood zone, and reduces extent of riparian vegetation; (4) invasion of exotic species such as reed canary grass and blackberry; (5) overgrazing, which can reduce overstory cover; and (6) reductions in riparian corridor widths which may decrease suitability of the habitat and increase encroachments of nest predators and nest parasites (Ashley and Stovall 2004). The Grand Coulee HEP study didn't specifically identify yellow warbler habitat losses, but did report a loss of 1,632 riparian forest Habitat Units and 27 riparian shrub Habitat Units. Since the yellow warbler is closely associated with these two habitat types, it would have been affected.

24.3 Summary of Terrestrial Resource Limiting Factors

24.3.1 Direct Effects of Federal Hydrosystem Projects

The direct effects of construction of the Grand Coulee Project on terrestrial resources included loss of animals living within the inundated area as well as long-term conversion of vegetated habitats to reservoir. The construction losses were evaluated through a HEP completed in 1986 (Creveling and Renfrow 1986). The HEP evaluation species were selected based on their use of specific habitat types and structural elements, and to represent other wildlife species that use those habitats. The HEP study results are provided in terms of Habitat Units, which are units of value based on both quality and quantity of habitat.

The habitat losses were mapped by Creveling and Renfrow (1986) and are summarized in Table 24.9. The loss of wildlife habitat value for individual species, as determined through the HEP study and expressed in Habitat Units (HUs), is summarized in Table 24.10. The current status of completed mitigation for the Grand Coulee Project is also presented; approximately 49 percent of the mitigation remains to be implemented.

Table 24.9. Acres of habitat types affected by Grand Coulee Dam project construction and inundation

Project	Habitat Type	Acres of Habitat Inundated
Grand Coulee		
	Islands	1,000
	Riparian lands	2,000
	Shrub-steppe uplands	14,000
	Forested uplands	25,000
	Agricultural lands	15,000
	Barren lands	13,000
Total		**70,000**[1]

(*Source*: Creveling and Renfrow 1986)

[1] This figure includes the rivers' shorelines between the high and low water levels. USBR revised its figure for lands inundated by FDR Reservoir to include only lands above the mean high water level. This revised figure is approximately 56,000 acres (Creveling and Renfrow 1986).

Table 24.10. Status of mitigation for construction and inundation wildlife habitat losses, Grand Coulee project.[1]

Grand Coulee Project	Species	Habitat Units lost	Habitat Units acquired	Percent complete
	Mourning dove	9,316	1,001	10.7%
	Mule deer	27,133	19,056	70.2%
	Riparian forest	1,632	234	14.3%
	Riparian shrub	27	131	100.0%
	Ruffed grouse	16,502	2,908	17.6%
	Sage grouse	2,746	7,432	100.0%
	Sharp-tailed grouse	32,723	16,854	51.5%
	White-tailed deer	21,632	9,064	41.9%
	Canada goose (nesting)	74 (islands)	-	0.0%
Total all species		111,785	56,680	50.7%

(*Sources*: BPA 2002; WDFW 2004b, CCT 2004)

[1] Note: This table shows the total HUs lost at the Grand Coulee Project; mitigation of this loss is to be coordinated between the San Poil, Spokane, and Upper Columbia subbasins.

The majority of habitat losses associated with the Grand Coulee Project occurred within the Upper Columbia Subbasin; portions of the San Poil and Spokane subbasins (as delineated for this plan) were also affected by creation of Lake Roosevelt. Terrestrial resources mitigation required for the Grand Coulee Project in the Upper Columbia is to be coordinated between the three wildlife management jurisdictions in the three subbasins: the Colville Confederated Tribes, Spokane Tribe, and WDFW. The total number of HUs to be acquired as mitigation for the Grand Coulee Project (111,785) is presented in corresponding tables in each of the three subbasin chapters. Note that this is a single, coordinated mitigation target rather than three independent subbasin targets.

The Grand Coulee construction losses for terrestrial resources were apportioned between the three wildlife management jurisdictions in these subbasins: the Colville Tribe, Spokane Tribe, and WDFW (Creveling and Renfrow 1986). To date, WDFW has acquired the greatest number of HUs (50,678 HUs acquired, approximately 89 percent complete per WDFW 2004b); the Colville and Spokane tribes each have a substantial number of HUs remaining to be acquired. Wildlife mitigation projects are described in the Province and Spokane Subbasin Inventory chapters.

24.3.2 Operational Effects of Federal Hydrosystem Projects

Ongoing operation of the Grand Coulee Project affects terrestrial resources of the Spokane Subbasin through:

1) continued erosion of shoreline habitats along the Spokane Arm of Lake Roosevelt;
2) ongoing absence of riparian vegetation, particularly woody species, along portions of the reservoir subjected to sustained drawdowns;
3) ongoing disturbance of wildlife and habitats (for example, nest sites, amphibian breeding sites) in the fluctuation zone of the reservoir;
4) periodic disturbance of habitats and species within transmission line rights-of-way due to maintenance activities;
5) ongoing absence of anadromous fish in the Subbasin, resulting in loss of key food item for numerous wildlife species and important nutrient input for the riverine ecosystem; and
6) fragmentation of habitat, discontinuity of important wildlife corridors and linkages thereby preventing immigration and emigration, and elimination of sand bars and islands suitable for establishing cottonwood galleries.

Erosion sites along Lake Roosevelt have been inventoried and described by USBR (1984) and continue to be monitored (USBR 2000). The effects of erosion on wildlife and other terrestrial resources have not been determined. Other ongoing effects of operation of the Grand Coulee Project have not been assessed. Assessment and mitigation of the operational effects of the project are required under the Northwest Power Act, and these activities are considered a high priority by the Spokane River Subbasin Planning Team.

24.3.3 Secondary Effects of Federal Hydrosystem Projects and Other Limiting Factors

The federal hydropower system contributed to development in the Spokane River Subbasin primarily by providing an inexpensive source of power. The Spokane River Subbasin supports the highest level of urbanization and agricultural development in the Intermountain Province, with over 45 percent of native habitats converted to agricultural and urban uses. Factors currently limiting terrestrial resources in the Subbasin are dominated by loss of habitat through conversion and modification, disturbance of wildlife species by humans and human acitivites, and interactions with nonnative plant and animal species.

24.4 Interpretation and Synthesis

Overall, the Spokane Subbasin has been highly modified from historic conditions due to development and agriculture, which have converted about 45 percent of native habitat. Road densities are high, protected lands are low in acreage, and large tracts of protected lands are virtually nonexistent. The direct impacts of the federal hydropower system are relatively localized to the Spokane Arm of Lake Roosevelt; however the effects of extirpation of salmonids influence habitats and wildlife throughout the historically accessible reaches of the basin, including the Little Spokane River and portions of the mainstem Spokane River. Operation of the project continues to affect wildlife and wildlife habitats through altered hydrology; detailed assessments of operational effects have not been performed. Secondary effects of the project continue to impact wildlife of the Subbasin through human land uses and disturbance. Secondary effects of the power projects on development of the Subbasin are wide-reaching, as the Spokane is the most populated Subbasin in the province.

Wildlife mitigation related to the federal hydropower project at Grand Coulee is approximately 51 percent complete. Completion of the wildlife mitigation is the highest terrestrial resources priority of the Spokane Subbasin Work Team, followed by assessment and mitigation of operational impacts of the hydrosystem projects.

SECTION 25 – Table of Contents

25 Spokane Subbasin Inventory of Existing Programs – Terrestrial

25.1 Current Management Directions

The states of Washington, Idaho, and the Native Tribal governments each have planning and management functions for fish and wildlife resources in the Spokane Subbasin. State and federal agencies with management authority over wildlife resources in the subbasin include the U.S. Fish and Wildlife Service (USFWS), U.S. Forest Service (USFS), Washington Department of Fish and Wildlife (WDFW), and Idaho Department of Fish and Game (IDFG). The Spokane Tribe of Indians (STOI) and the Coeur d'Alene Tribe are the primary Tribal entities with fish and wildlife management authority in the subbasin. Other state and federal agencies, including, but not limited to, the U.S. Army Corps of Engineers (USACE), Environmental Protection Agency (EPA), the Natural Resources Conservation Service (NRCS), Idaho Department of Environmental Quality (IDEQ) and Washington Department of Ecology (WDOE) are involved in programs that affect the land or water that provide habitat for fish and wildlife. A complete list of state, federal, and Tribal entities that are involved in management of fish and wildlife or their habitats is included in section 2.4.1, along with a description of each agency's management direction.

The Spokane Tribe of Indians manages wildlife resources on the Spokane Reservation. The Wildlife Program is directly responsible for the management of over 6,000 acres of wildlife lands that were acquired through BPA and Avista Utilities mitigation projects in the Spokane Subbasin.

The Coeur d' Alene Tribe's Natural Resources Department is dedicated to the management of all natural resources within the historical and cultural territories of the Tribe. A small portion of the Coeur d'Alene Indian Reservation is located within the Spokane Subbasin, in the Hangman Creek drainage. Other areas in the subbasin were traditionally used by the Tribe. The Tribal fish and wildlife programs operate under a mission to restore, protect, expand, and re-establish native fish and wildlife populations to sustainable levels to provide harvest opportunities.

25.1.1 Local Government

25.1.1.1 Washington: Lincoln County Conservation District (LCCD)

The LCCD's current management strategies can be summarized from excerpts of the District's updated Long Range Plan. The goals and objectives include:

<u>Water Quality</u>

- Address water quality concerns in streams and lakes in Lincoln County
- Address groundwater issues in Lincoln County
- Implement restoration projects that would improve water quality
- Work with Natural Resources Conservation Service (NRCS), USFW, WDOE and Lincoln County to address water quality complaints

Wildlife

- Establish wildlife habitat and enhance forest/wetland resources through NRCS programs that include: Conservation Reserve Program (CRP), Environmental Quality Incentive Program (EQIP), and Wildlife Habitat Incentive Program (WHIP)

Education/Information/Communication

- Increase public awareness of District activities
- Provide educational conservation information to the public through newsletters, public meetings, newspaper articles, etc.

District Operations and Management

- Maintain an active and effective LCCD board
- Promote district programs and activities
- Insure adequate funding for LCCD operations

In the last five years, LCCD has been involved in a minimal number of projects in Spokane and Columbia Upper subbasins. Many landowners in these subbasins have taken advantage of NRCS programs that include CRP, EQIP, and WHIP. Currently, funding sources are focused on finding solutions to improve water quality in the Upper Crab/Wilson Creek Watershed WRIA #43.

25.1.1.2 Washington: Spokane County Conservation District (SCCD)

In Washington State, the SCCD has taken the lead role in facilitation and implementation of watershed management activities within the Hangman Creek and Little Spokane River watersheds, and to a lesser extent the Spokane River watershed. A large number of research, planning, and implementation projects have been conducted over the last decade. The SCCD has developed working relationships with many of the local landowners, governmental entities, and interest groups to improve the long-term conditions within the watersheds. The SCCD is the lead facilitator of watershed planning for the Hangman Creek watershed and is currently working with the Pend Oreille Conservation District on a water quality management plan for the Little Spokane River. Under ESHB 2514, the work focuses on water quantity issues in the basin, but does address other issues such as water quality, habitat, and instream flow.

25.1.1.3 Washington: Pend Oreille Conservation District (POCD)

The POCD sponsored a WDOE grant on the Little Spokane Watershed in 1998. Information was collected in partnership with SCCD. Data was collected for quantity, field and laboratory water quality parameters. Currently POCD is working with SCCD on a water quality management plan for the Little Spokane River.

25.1.1.4 Idaho: Kootenai-Shoshone Soil and Water Conservation District

The current management strategies of Kootenai-Shoshone Soil and Water Conservation District (KSSWCD) can be summarized from excerpts of the District’s current five-year plan. The goals and objectives include:

Water Quality

Goal: Improve water quality in streams and lakes that do not meet state water quality standards.

Objective: Administer programs and projects that accelerate Best Management Practice (BMP) implementation.

Objective: Represent private land interests on local committees and groups.

Information and Education

Goal: Increase public awareness of KSSWCD activities.

Objective: Provide conservation information to youth and adults.

Urban

Goal: Maintain agricultural base within District.

Objective: Protect farmland from urban encroachment.

Woodland

Goal: Insure healthy, productive woodlands within the district

Objective: Assist producers with woodland planning and implementation of forestland BMPs, including forest road remediation.

Objective: Strengthen partnerships with other agencies and groups working on forestland issues.

Objective: Stimulate reforestation with private landowners on large- and small-scales by providing low-cost tree stock through the District's tree sales program.

District Operations

Goal: Maintain an active and effective KSSWCD board.

Objective: Seek training for KSSWCD members and staff.

Objective: Insure adequate funding for KSSWCD operations.

Although not specifically addressed with goals and objectives within the five-year plan, other important resource concerns are mentioned in the introduction. These concerns include riparian, recreation, rangeland, and fish and wildlife.

25.2 Existing and Imminent Protections

Refer to Section 2.4 for a description of the natural resources management agencies and organizations and their primary authorities at the federal, state, and regional levels. Many State and Federal laws and regulations protect natural resources within the IMP. Tribal governments and local governments also have regulations that protect specific areas or locations within the IMP. The following section summarizes the existing and imminent protections for federal and state threatened and endangered wildlife species known or potentially occurring in the Spokane Subbasin. Refer to the Spokane Subbasin Terrestrial

Resources Assessment, Section 24, for detailed description of the occurrence and status of federal and state threatened and endangered species in the subbasin.

25.2.1 Endangered Species Act

Bald Eagle

Bald eagles are currently listed as threatened under the federal Endangered Species Act (ESA). This provides protection from "take" (i.e., harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect…). Bald eagles were proposed for removal from the endangered species list in 1999. That action has not been taken, in part because one prerequisite for delisting, a nationwide monitoring plan, has not yet been met. If a development project occurs on federal land or involves federal funding (i.e., nexus), an endangered species consultation may be required by the USFWS.

Bald eagles are classified as threatened in Washington and endangered in Idaho.

In 1984, Chapter 77.12.655 RCW was adopted by the Washington State Legislature, requiring the establishment of rules defining buffer zones around bald eagle nests and roost sites. The law states that the rules shall take into account the need for variation of the extent of the buffer zone on a case by case basis.

In 1986, the Bald Eagle Protection Rules (WAC 232-12-292) were adopted by the Washington Wildlife Commission. The rules require permitting agencies (i.e., Department of Natural Resources, counties, cities) to review the database of bald eagle nest and communal roost locations prior to issuing permits for timber harvest, clearing land, residential development, etc. If the activity is within ½ mile of an eagle nest, the permitting agency notifies WDFW, who works with the applicant to develop a Bald Eagle Management Plan (see WAC 232-12-292 (4.4)).

Deliberate harassment of eagles is prohibited by state and federal law (Chapter 77.15.130 RCW; Bald Eagle Protection Act; Endangered Species Act; and, Migratory Bird Treaty Act).

Canada Lynx

The lynx was listed as a state threatened species in Washington in 1993 and was listed as a federally threatened species under ESA in April 2000. Lynx is not given special management status in Idaho.

Legal take of lynx in Washington ceased in 1991 and consequent designation as a threatened species presently provides complete protection from hunting or trapping at both the state (Chapter 77.16.120 RCW) and federal level.

The Spokane Subbasin is outside of the designated Management Zones (LMZ) in Washington and does not provide quality lynx habitat. Few lynx sightings have been recorded in recent years in the Washington portion of the Subbasin, and none are recorded in the Idaho portion.

Fisher
The fisher is will become a candidate for federal listing under the ESA in the near future (USFWS 2004). Fisher is a state endangered species in Washington; it is not given special management designation in Idaho.

In Washington, fisher is managed based on the findings of the WDFW status report (Lewis and Stinson 1998). Protection of fisher in Washington from hunting, possession, or control is provided under Chapter 77.16.120 RCW. Washington further charges those convicted of illegal take of state endangered species with a $2,000 reimbursement for each animal taken or possessed (Chapter 77.21.070 RCW).

Gray Wolf
The gray wolf is listed as a federally threatened species under the ESA and classified as endangered in Washington. In Idaho, gray wolf is classified as endangered in Kootenai, Shoshone, Bonner, and Boundary counties; elsewhere in the state, the species is considered an experimental non-essential population.

In Washington, protection of gray wolf from hunting, possession, or control is provided under Chapter 77.16.120 RCW. Washington further charges those convicted of illegal take of state endangered species with a $2,000 reimbursement for each animal taken or possessed (Chapter 77.21.070 RCW).

No federally designated wolf recovery areas are located within the Spokane Subbasin, and few sightings are recorded (WDFW 2003b).

Grizzly Bear
The grizzly bear listed as a threatened species under ESA, as a threatened species in the state of Idaho, and as an endangered species in the state of Washington.

Protection of grizzly bear in Washington from hunting, possession, or control is provided under Chapter 77.16.120 RCW. Washington further charges those convicted of illegal take of state endangered species with a $2,000 reimbursement for each animal taken or possessed (Chapter 77.21.070 RCW).

The Spokane Subbasin is outside of the seven federal grizzly bear Recovery Plan zones, although the Selkirk Zone is located in the Pend Oreille Subbasin to the north. The Washington portion of the subbasin has a single confirmed grizzly sighting in 1996 from the Dragoon Creek drainage (WDFW 2003b).

American White Pelican
The American white pelican is listed as an endangered species in Washington; it is not given special management status in Idaho. Protection of American white pelican in Washington from hunting, possession, or control is provided under Chapter 77.16.120 RCW. Washington further charges those convicted of illegal take of an American white

pelican with a $2,000 reimbursement for each animal taken or possessed (Chapter 77.21.070 RCW).

Northern Leopard Frog
The northern leopard frog is classified as an endangered species in Washington; it is not provided special management status in Idaho. Protection of northern leopard frog in Washington from hunting, possession, or control is provided under Chapter 77.16.120 RCW. Washington further charges those convicted of illegal take of northern leopard frog with a $2,000 reimbursement for each animal taken or possessed (Chapter 77.21.070 RCW).

Peregrine Falcon
Peregrine falcon is classified as an endangered species in Idaho.

The Washington portion of the subbasin contains one eyrie and another hack site only a few miles apart in the Hangman Creek drainage (WDFW 2003b). The Idaho portion of the Subbasin has no record of peregrine sightings (IDFG 2003).

Upland Sandpiper
The upland sandpiper is classified as an endangered species in Washington (WAC 232-12-014); it is not given special management status in Idaho. Protection of upland sandpiper in Washington from hunting, possession, or control is provided under Chapter 77.16.120 RCW. Washington further charges those convicted of illegal take of upland sandpiper with a $2,000 reimbursement for each animal taken or possessed (Chapter 77.21.070 RCW).

Sage Grouse
The sage grouse is classified as a threatened species in Washington; it is not given special management status in Idaho. Protection of sage grouse in Washington from hunting, possession, or control is provided under Chapter 77.16.120 RCW. Washington further charges those convicted of illegal take of sage grouse with a $2,000 reimbursement for each animal taken or possessed (Chapter 77.21.070 RCW).

Sharp-tailed Grouse
The sharp-tailed grouse is classified as a threatened species in Washington; it is not given special management status in Idaho. Protection of sharp-tailed grouse in Washington from hunting, possession, or control is provided under Chapter 77.16.120 RCW. Washington further charges those convicted of illegal take of sharp-tailed grouse with a $2,000 reimbursement for each animal taken or possessed (Chapter 77.21.070 RCW).

The Spokane Tribe is nearing the completion of a Sharp-Tailed Grouse Reintroduction Feasibility Study for the Spokane Indian Reservation (Spokane Subbasin). If the study indicates that sufficient habitat (quality and quantity) exists or would wxist with the proper habitat enhancement activites, the Spokane Tribe will then work with other management agencies within the western U.S. to identify populations of Columbian sharp-tailed grouse that may be used for the reintroduction effort.

25.3 Inventory of Restoration and Conservation Projects

Below is a summary of some BPA and non-BPA funded projects identified within the Subbasin. Projects that are relevant to both terrestrial and aquatic resources may be presented in the aquatic inventory section for this Subbasin (see Section 15). Refer to Section 2.4, Inventory of Projects in the IMP, for description of projects involving more than one subbasin. Major Grand Coulee Dam wildlife mitigation projects are located and managed in more than one subbasin. Refer to Appendix H for a more comprehensive list of the BPA and non-BPA funded projects conducted in this Subbasin and the entire IMP.

25.3.1 BPA Funded Projects

Project #200103300 Wildlife Habitat Protection and Restoration on the Coeur d' Alene Indian Reservation: Hangman Watershed

Protect and/or restore riparian, wetland and priority upland wildlife habitats within the Hangman Watershed on the Coeur d' Alene Indian Reservation as part of mitigation efforts in the Spokane River Subbasin.

<u>Associated Monitoring:</u>
Produced a Draft Wildlife Monitoring Plan that defines:

- Protocols to monitor trends of specific wildlife species and assemblages to reflect effectiveness of management on acquired properties.
- Protocols to monitor broad scale vegetation patterns throughout the Hangman Watershed east of the Washington-Idaho border.
- Protocols to monitor changes in vegetative communities that occur as a result of protection/restoration.

<u>Adaptive Management:</u>
Continue adaptive management in project implementation through:

- Annual noxious weed monitoring of project site.
- Evaluations of survival and growth of restoration stock within one year of planting.
- Landscape photography on a five-year cycle.

<u>Accomplishments:</u>

- Developed a GIS database of land ownership and areas currently managed to provide some measure of wildlife habitat protection or restoration.
- Assembled a list of native or desired plants for target restoration sites.
- Prepared a draft Habitat Prioritization Plan that uses landscape and fisheries data to select parcels that offer the greatest potential to improve wildlife and fish habitats.
- Initiated an Instream Flow/Hydrology study that is expected to:
    - Predict available fish habitats for specific flow regimes.

- Produce estimates for changes in stream flow for specific changes in land management.
- Identify areas that are important to establishing and monitoring annual flow patterns in streams that support native species and minimize erosion.

Project # 199106200 Spokane Tribe Wildlife Mitigation: Blue Creek Winter Range

Project Description:

Protect wildlife habitat as partial mitigation for the Grand Coulee Dam construction and inundation wildlife loss assessment through fee title and tribal allotment title acquisition on or adjacent to the Spokane Indian Reservation. The project was initially started as acquiring land within the Blue Creek Winter Range area, but has come to include all wildlife mitigation land acquisitions. The current priority areas include McCoy Lake Watershed, Wellpinit Mt., and the Peaks (shrub-steppe/steppe habitat). The Spokane Tribes wildlife projects can be acquired in both the Spokane and Upper Columbia Subbasins.

Accomplishments:

- Between 1996 and 1999, the Spokane Tribe acquired 1863 acres of wildlife lands of which 1663 acres are located within the Spokane Subbasin.
- The project was approved for a total of $4.5 million in acquisitions for FY02-03, but no projects were funded due to the BPA financial crisis.
- To date in FY04, the Tribe has acquired 1151 additional acres of mitigation lands all in the Spokane Subbasin.

Project # 199800300 Spokane Tribe Wildlife Mitigation Operation and Maintenance

Project Description:

Operate and Maintain wildlife lands that have been acquired through Project # 199106200. Management activities include fencing, noxious weed control, road maintenance, site clean-up and etc.. The habitat enhancement activities that are occurring on these lands are being conducted with tribal funds. During the 2000 Rolling Review Process the project included the Sharp-tailed Grouse Re-introduction Feasibility Study that has been delayed due to the BPA financial crisis, but should be completed in 2004.

Associated Monitoring:

- Conduct initial HEP analysis on projects within 1 year of acquisition and then every 5 years there after.
- Habitat Monitoring includes tree and shrub survival surveys, native grass/forb restoration establishment surveys and photo point monitoring.
- Wildlife Population Monitoring includes Ruffed Grouse Drum Counts, Bird Point Counts, Small Mammal Trapping, Big Game Counts, Bald Eagle Surveys, and Incidental Wildlife Observations.

Accomplishments:

- Since 2001, over 16,000 riparian trees and shrubs have been planted within the McCoy Lake Watershed (non-BPA funding).
- McCoy Creek Stream Channel Restoration: 1000' of the stream channel was constructed to near original characteristics. Riparian tree and shrub planting will be conduct on the site in 2005 (non-BPA funding).
- Conversion of over 60 acres of old agricultural land to native grass.

25.3.2 Non-BPA Funded Projects

Spokane Tribes Little Falls Wildlife Mitigation Agreement (Avista Utilities)

Project Description:

Protect wildlife habitat as mitigation for Little Falls Dam construction and inundation through fee title and tribal allotment title acquisition on or adjacent to the Spokane Indian Reservation. The primary focus was on acquisition of land with in the Chimokane Creek Watershed and all projects were acquired in the Spokane Subbasins.

Accomplishments:

- The final land acquisitions took place in 2000 and a total of 3,223 acres of land have been protected.

Channeled Scablands Focus Area Phase I Project

Project Description:

Acquire, restore, and enhance important wetlands and uplands within the Channeled Scablands Focus Area of the North American Waterfowl Management Plan's Intermountain West Joint Venture. This project will acquire, restore, and/or enhance a total of 12,370 acres of wetlands and associated uplands, focusing on emergent marshes occurring in riverine and depressional wetland systems. Wetlands within the project area provide important migratory and breeding habitat for waterfowl, particularly some 1,700 pairs of ducks, including 400 pairs each of mallards and redheads. This project is sponsored by the National Wetland Conservation Act ended in 2003. There were many collaborators on this project.

Accomplishments:

The grant includes money to protect over 12,000 acres of wetland and migratory bird habitat in the channeled scablands of the Inland Northwest. It received nearly $1 million from the North American Wetlands Conservation Act (NAWCA). This grant initiates Phase I of a multi-year effort to acquire, restore, and enhance over 12,000 acres of important wetlands and uplands within the channeled scablands. Conservation partners, such as Ducks Unlimited (DU), USFWS, WDFW, Avista Corporation, Friends of Turnbull National Wildlife Refuge, and the Spokane Audubon Society, are contributing over $5 million. The NAWCA grant will purchase historic wetlands and re-create the lost habitat by plugging the drainage ditches, planting native shrubs and trees, and providing nesting habitat for waterfowl and other water dependent birds such as bald eagles, osprey, terns, and cormorants.

As part of its effort to improve habitat throughout the Pacific Flyway, DU has several important projects underway in the Pacific Northwest. DU is trying to complete construction on several projects in the channeled scablands area of eastern Washington before the winter snows. The Natural Resources Conservation Service is funding restoration activities on two of these projects, the Slavin Wetlands Reserve Program (WRP) easement now owned by Spokane County, and the Holmquist WRP easement in Stevens County. On the Slavin WRP easement, DU will be installing an earthen ditch plug and water control structure to restore hydrology to a 100-acre cattail/bulrush marsh. On the Holmquist WRP easement DU has hired a contractor to install several log drop structures that will help restore the high water table in what was once a mountain meadow. Construction will begin shortly as well on the WDFW's Revere Ranch in Whitman County. An earthen ditch plug and water control structure will restore hydrology to a 100-acre marsh. This project is being partially funded by a grant DU received from the NAWCA program, as well as funds generated by the State migratory bird stamp program.

In Oregon, a unique partnership has been initiated to protect and restore a portion of the rare peat wetland in the Willamette Valley. A cooperative agreement recently was signed by Ducks Unlimited, Inc. and Marion County, Oregon. The agreement will result in the purchase of conservation easements on approximately 120 acres within this important wetland area. Under this agreement, DU will complete all of the real estate services required to purchase the easements and Marion County will hold and manage the easements in perpetuity. The easements will be purchased using a combination of Title III funds received by the county and NAWCA funds received by DU in 2001. Also in Oregon, DU met with landowners and NRCS biologists to develop a wetland restoration plan for a ranch on the Sprague River. This ranch applied for WRP with DU to be involved in the project design and delivery. DU is seeking matching funds to increase the project ranking and assist with restoration costs.

Funds were also used to purchase the INLT-DU Preserve [see "It's Great for the Ducks"], restore the James T. Slavin Family conservation area, and purchase 54 acres along Deadman Creek on Peone Prairie that is adjacent to the Feryn Conservation Futures property.

Federal Energy Regulatory Commission (FERC) Re-licensing of the Spokane River Hydropower Project

<u>Project Description:</u>
Re-licensing of AVISTA dams on mainstem of Spokane River.

<u>Associated Monitoring:</u>
Initial studies using radiotelemetry are intended to track fish to determine seasonal fish distribution, habitat preference, and critical spawning areas for the mainstem Spokane River.

Accomplishments:
This project is just beginning; negotiations are still in progress.

Intermountain Joint Ventures

Project Description:
Joint Ventures' mission is to provide for the long-term conservation of key avian habitats to plan, fund, and develop habitat projects, which benefit all biological components of Intermountain ecosystems. The Joint Venture promotes the restoration and maintenance of migratory bird populations; fosters the protection, restoration, and enhancement of wetlands, riparian habitats, and the widely diverse uplands characteristic of the region; and champions broader understanding of all avian habitat issues, functions, and values. The project is funded by a grant from the North American Conservation Act and is ongoing.

Accomplishments:
More than 241,000 acres of wetlands and associated uplands, which provide secure habitat for a myriad of species were protected, restored, and/or enhanced through the project.

Rocky Mountain Elk – WDFW Monitoring Project

Project Description:
To monitor and track radio-collared elk just north and south of Spokane and around Turnbull National Wildlife Refuge.

Accomplishments:
Have over 250 radio locations to use for determining use and home range. Also, has contributed toward two Eastern Washington University graduate students' theses. One involved the impact of elk upon browse on Turnbull National Wildlife Refuge, the other is looking at landowner characteristics of land used by elk bordering Turnbull National Wildlife Refuge.

Spokane County Conservation Futures Program

Project Description:
Spokane County's Conservation Futures Program is intended to protect, preserve, maintain, enhance, restore, and limit the future use of or otherwise conserve selected open space land, farmland, forests, wetlands, wildlife habitats, and other lands having significant recreational, social, scenic, or aesthetic values within the boundaries of Spokane County. Acquired properties will not be developed but kept in an enhanced natural area consistent with RCW 84.34. The project is funded by a tax levy and is ongoing.

Associated Monitoring:
None.

Accomplishments:

During the last nine years, over 6,800 acres have been purchased or donated into the program. Most recently, Spokane County voters supported an additional five-year extension (through 2007) of the Conservation Futures Tax.

Late last year, the County in a cooperative venture with Ducks Unlimited got a $975,000 grant to restore wetland habitat on parcels previously farmed. This money will be spent locally, providing local jobs, and will leave a lasting legacy of quality habitat for wildlife viewing.

On July 22, 2003 the Commissioners finalized Spokane County's 2003 Conservation Futures Program selections. The program currently has about $2.5 million to spend on land to preserve open space for natural areas, parks, trails, and river access. The following projects, totaling over 760 acres of land, lakeshore, riverbanks and wetlands, have been included on the potential to buy list:

- Newman Lake – nesting bald eagles on 380 acres of gorgeous woods, wetlands and lakeshore
- Little Spokane River – 3,000 ft of river meandering through 152 acres of wet meadows and forest near Chattaroy
- Palisades/Independent Mortgage – 107 acres of a larger wildlife and recreational corridor that will connect Riverside State Park with Palisades Park
- "Granger Farm" on Lake Spokane – wetlands and forest land bordered by Riverside State Park on the south and 2,000 ft of lakeshore on the north (approximately 65 acres)
- Deadman Creek on Peone Prairie – one of the top three migratory bird stopover points in Spokane County, includes a quarter mile of Deadman Creek, 17 acres of wetlands and rich riparian habitat (50 acres total)
- Spokane River/State Line – 12 acres of sensitive riparian habitat between the southerly bank of the Spokane River and the Centennial Trail near the Washington-Idaho state line
- Drumheller Springs
- Lincoln Heights Wetlands
- Austin Ravine
- Palisades parcel which will, with the Independent Mortgage property and the Gusman property (selected for acquisition in the last CF round), help complete the corridor between Palisades Park and Riverside State Park

Inland Northwest Land Trust

Project Descriptions:

Inland Northwest Land Trust (INLT) has entered into a three-year agreement with Avista Utilities to manage the Avista Revolving Trust Fund (Revolving Fund). This $60,000 Fund will help protect important lands and wetlands along the Coeur d' Alene Lake/Spokane River corridor. During the 1990s the Revolving Fund was used to purchase options on three important properties until they could be publicly acquired. These properties include:

- McClellan - 410 wooded acres and 1.5 miles of shoreline on the south bank of Lake Spokane (also known as Long Lake). Spokane County later bought the land through the Conservation Futures Program.
- Fisk - Over 600 acres and more than a mile of shoreline on the south bank of Lake Spokane toward the west end. This land is now part of Riverside State Park.
- Blackwell Island - About 32 acres on the northern end of Blackwell Island, five minutes west of downtown Coeur d' Alene. The Bureau of Land Management now owns the land, which provides much needed public lake access.

1. INLT and Avista have teamed up to protect 7,000 feet of stream bank for bull trout habitat in the Lower Clark Fork River/Lake Pend Oreille basin. INLT will continue to collaborate with Avista to protect the lakes and rivers of eastern Washington and northern Idaho.

2. INLT acquired a 238-acre tract near Cheney, to hold as a wildlife refuge and to begin restoration of its overgrazed, degraded wetlands. The new INLT-DU Preserve adjoins the 100-acre Cheney wetlands and is just two short miles from Turnbull National Wildlife Refuge. Protecting this property helps preserve the integrity of the Cheney wetlands and the uplands that provide vital forage and nesting areas for ducks and other birds. It provides a buffer to Turnbull and extra habitat for the migrating birds that are attracted to the refuge.

3. Inland Northwest Land Trust donated 48 acres of parkland to Spokane County. Mirabeau Point, formerly the Walk in the Wild zoo, is a quiet place of woodland, meadow, park, springs and open spaces. Located in the heart of the Spokane Valley, it will serve as a public recreational, educational, and cultural center.

4. Spokane County Parks has plans to utilize state grant funds to develop the "Meadows" portion of the park, at an estimated cost of $1.2 to $1.4 million. The 10-acre Meadows will include restroom facilities, parking, and pedestrian paths, as well as improvements to support community events such as "Munch in the Meadows."

5. In 1993 INLT worked with the owner to protect the 86 acres, negotiating an interim agreement to forestall logging until the Conservation Futures program could purchase the land for the county park system.

6. "Threads of Hope" is INLT's conservation strategy in Spokane County. "Threads of Hope" was designed to help focus land protection efforts in regions that are ecologically valuable and in threat of being developed. These regions are the vital links, the greenways and wildlife corridors winding across Spokane County. With the help of scientists from WDFW and UW, planners, and neighbors, the land trust mapped these linkages tying together larger protected areas, such as Turnbull National Wildlife Refuge, Mount Spokane State Park, and Riverside State Park. Now

that these parcels and landowners have been identified, the land trust is teaming up with neighborhood groups in each of the "threads" to promote land saving action. These Threads partners are critical to the outreach strategy because they contribute local knowledge about which parcels make their region most unique. This "Threads of Hope" project includes three corridors spanning Spokane County and six partner groups.

Inland Northwest Wildlife Council (INWC)

Project Description:

The mission of the INWC is to act in accordance with what is best for all fish and wildlife species while emphasizing and maintaining responsible sportsmanship; to work for the betterment of fish and wildlife; to create a positive sportsmanlike image; to protect, create and enhance fish and wildlife habitat and the environment, with special attention given to the immediate geographical area.

Associated Monitoring:

Works closely with WDFW Research projects run by Woody Myers. Has helped monitor elk and moose in the Spokane area.

Accomplishments:

1. Winter bird feeders: Build, maintain, and fill 35 winter bird feeders at the cost of $1,000 annually. 1993 to present.
2. Fund planning of 18-20 acres of food plots on 12-15 different properties in Whitman County. Planning done by WDFW staff at the cost of $2,000 annually. 1994 to present.
3. Revere area habitat: Planted 30-acre plot to grass and alfalfa, 1,500 shrubs along edge of new field. $2,500 in 1997. Planted 3,000 shrubs and trees on bluffs above grass/alfalfa field. $2,400 in 1998. Planted 8,700 shrubs and trees on 1,500 acres. $3,000 in 2000.
4. Whitman County shrub and tree plantings: Planted 12,875 trees and shrubs on several private properties in Whitman County. $6,000 in 1999. Planted 12,000 shrubs on 24 acres on three separate private properties. $6,000 in 2000. Planted 6,700 shrubs and trees on 24 acres on two separate properties at the cost of $3,000 in 2001.

Well Closure in the Hawk Creek Watershed

Project Description:

LCCD and WSU Cooperative Extension collaborated to raise awareness about nitrate contamination through abandoned wells. This project was funded by Washington State University and ended in 1999.

Associated Monitoring:

In 1995 and 1996 LCCD evaluated well water in the Hawk Creek watershed and found areas where nitrate in drinking water exceeded federal standards.

Accomplishments:
LCCD and WSU Cooperative Extension worked together to educate landowners on nitrate contamination in well water. In addition, they were able to work with four landowners to close several abandoned wells within the Hawk Creek watershed.

Conservation Reserve Program (CRP), Environmental Quality Incentives Program (EQIP) and Wildlife Habitat Incentives Program (WHIP)

Project Description:
These programs help eligible participants implement structural and management practices to address soil, water and related natural resources concerns on their lands. These programs encourage landowners to convert environmentally sensitive acreage to vegetative cover, such as native grasses, wildlife plantings, trees, filterstrips, or riparian buffers. These projects are funded by the USDA and are continuing.

Associated Monitoring:
The implementation projects are periodically inspected to insure the effectiveness of the new conservation practices.

Accomplishments:
CRP, EQIP, and WHIP aid in reducing soil erosion, reduce sedimentation in streams and lakes, improve water quality, establish wildlife habitat, and enhance forest and wetland resources.

Road Surface Treatment

Project Description:
The Lincoln County Public Works has used a magnesium chloride dust suppressant and road base stabilizer in Lincoln County. The dust guards attract moisture and are used for dust and erosion control. This project is funded through a Lincoln County tax assessment and is ongoing.

Associated Monitoring:
None.

Accomplishments:
Applying dust control treatments will help maintain natural surfaces. In addition, it will help prevent wind blown dust and eroded soils from entering any water system.

MAPS Bird Banding Project – WDFW Monitoring Project

Project Description:
Monitoring vital rates (primary demographic parameters such as productivity and survivorship) of a relatively undisturbed riparian avian population. Estimating primary demographic parameters is critical for understanding population dynamics and is directly applicable to population models that can be used to assess land management practices by examining the effects of the landscapes they produce on vital rates. This project is part of Monitoring Avian Productivity and Survivorship (MAPS) International program which is a cooperative effort among public agencies, private organizations, and individual bird

ringers in North and South America to operate a network of over 500 constant-effort mist netting and banding stations during the breeding season (DeSante et al. 1995). MAPS was established in 1989 by The Institute for Bird Populations (IBP) and was patterned to a large extent after the British Constant Effort Sites (CES) scheme operated by the British Trust for Ornithology.

Accomplishments:
To date over 2,500 birds have been captured and almost 1,900 have been banded including 1,500 adults and almost 900 juveniles with over 550 recaptures.

25.4 Strategies Currently Being Implemented Through Existing Projects

25.4.1 Limiting Factors and Strategies

Refer to Figure 23.1 of the Aquatic Inventory section for a graph displaying the percent of all fish and wildlife mitigation projects in the Subbasin that respond to specific limiting factors. Wildlife mitigation projects in the Subbasin respond primarily to the limiting factors of habitat quantity and quality; in addition, the sharp-tail reintroduction and cougar DNA projects addressed lack of information on the species.

Figure 23.2 of the Aquatic Inventory section shows the types of management strategies used in the fish and wildlife mitigation projects in the Subbasin. Wildlife mitigation projects in the Subbasin have used primarily the habitat acquisition and habitat improvement/restoration strategies. Other strategies include watershed planning/recovery planning, RM&E, and education.

25.4.2 Gaps Between Actions Taken and Actions Needed

The primary terrestrial resources mitigation need in the subbasin, with respect to the FCRPS, is completion of the construction loss mitigation for the Grand Coulee Project. The construction loss assessment was completed in 1986 (Creveling and Renfrow 1986). Currently, the mitigation for the construction wildlife losses in terms of Habitat Units (HUs) is about 51 percent complete (refer to Section 24). Acquisition of HUs for the Washington State threatened sage grouse has been completed; future enhancement and monitoring funding will be necessary to improve and maintain habitat values. Acquisition of HUs for the Washington State threatened sharp-tailed grouse is approximately 52 percent complete. Populations of this species are considered at very high risk in the state and continued action to enhance habitats and populations in the province is needed.

Additional funding for habitat acquisitions, enhancement and/or restoration measures, and maintenance funding will be necessary to meet the existing construction loss mitigation obligation.

SECTION 26 – Table of Contents

26 Spokane Subbasin Management Plan

The Spokane Subbasin Management Plan was developed by the Spokane Subbasin Work Team. Detailed information describing the membership and formation of the Subbasin Work Teams and the process used to develop and adopt the management plan can be found in Section 1.2. In general, the components of the management plan, including the subbasin vision, guiding principles, and prioritized biological objectives and strategies were developed in a series of six meetings between June 2003 and March 2004.

The Oversight Committee (OC), Technical Coordination Group, and the Spokane Subbasin Work Team worked collaboratively to establish technically sound objectives and strategies that respond to the limiting factors identified in the subbasin assessment. The management plan was developed in several iterations between the OC and Subbasin Work Teams and the Technical Coordination Group.

Biological objectives were developed using a tiered approach. The Council developed the Columbia River Basin biological goals based on the scientific principles identified in the 2000 Fish and Wildlife Plan. The OC established the province level objectives under the Columbia River Basin level goals by responding to recommendations from the GEI Team, the Technical Coordination Group, and the Subbasin Work Teams. The Subbasin Work Teams developed the subbasin level biological objectives and strategies under the Province objectives, with assistance from the Technical Coordination Group and the GEI Team.

26.1 Summary of Spokane Assessment and Limiting Factors

The vision and biological objectives of the management plan reflect what is learned in the assessment and inventory work. In the Spokane Subbasin, the aquatic and terrestrial assessments and inventories are described in detail in sections 22 to 25 of this document. A brief overview of the key limiting factors that are addressed in this management plan is included below.

26.1.1 Spokane Aquatic Assessment and Limiting Factors

Focal species selected for the Spokane Subbasin include redband/rainbow trout, mountain whitefish, kokanee, Chinook, and largemouth bass. Redband/rainbow trout, mountain whitefish, kokanee and Chinook are all native to at least some portions of the Subbasin. Chinook have been eradicated from the Subbasin since the construction of Grand Coulee Dam without fish passage facilities. Largemouth bass are a nonnative species that is an important component of the fishery of Lake Spokane and is used as a substitute species in those habitats that can no longer support native fishes.

QHA modeling was used to help assess the limiting factors in the rivers and streams of the Subbasin. The most significant stream habitat limiting factors for the salmonid focal species are listed in tables 26.1-1, 26.1-2, and 26.1-3. In parentheses is the number of reaches or watersheds within the Spokane Subbasin where that particular habitat attribute is the worst habitat-related limiting factor. The numbers in the Objective column correspond to the subbasin objectives that were developed in this management plan to address this limiting factor. Aquatic objectives for the Spokane Subbasin are described in more detail in Section 26.3.

Within the Spokane Subbasin, fine sediment was the variable most commonly problematic for the salmonid focal species. Other limiting factors identified included pollutants, obstructions, channel stability, and flow issues.

Table 26.1-1. Stream habitat conditions that currently most deviate from the reference for mountain whitefish, Spokane Subbasin. The number in parenthesis is the number of reaches or watersheds within the Spokane Subbasin where that particular habitat attribute is the worst habitat-related limiting factor. The numbers in the Objective column correspond to the subbasin objective that was developed to address this limiting factor in Section 26.3.

Mountain Whitefish	
Habitat Condition	**Objective**
Fine Sediment (30)	1B1, 1B2, 1B3, 1B5, 1B7
High Flow (5)	1B4
Pollutants (4)	1B3, 1B6, 1B7
Obstructions (2)	1B1, 1B2
Low Flow (1)	1B4
Channel Stability (1)	1B1,1B2

Table 26.1-2. Stream habitat conditions that currently most deviate from the reference for kokanee, Spokane Subbasin. The number in parenthesis is the number of reaches or watersheds within the Spokane Subbasin where that particular habitat attribute is the worst habitat-related limiting factor. The numbers in the Objective column correspond to the subbasin objective that was developed to address this limiting factor in Section 26.3.

Kokanee	
Habitat Condition	**Objective**
Fine Sediment (7)	1B1, 1B2, 1B3, 1B5, 1B7
Obstructions (3)	1B1, 1B2
Pollutants (2)	1B3, 1B6, 1B7
Channel Stability (1)	1B1,1B2
Low Flow (1)	1B4

Table 26.1-3. Stream habitat conditions that currently most deviate from the reference for rainbow trout, Spokane Subbasin. The number in parenthesis is the number of reaches or watersheds within the Spokane Subbasin where that particular habitat attribute is the worst habitat-related limiting factor. The numbers in the Objective column correspond to the subbasin objective that was developed to address this limiting factor in Section 26.3.

Rainbow	
Habitat Condition	**Objective**
Fine Sediment (26)	1B1, 1B2, 1B3, 1B5, 1B7
Habitat Diversity (18)	1B1,1B2
Low Flow (15)	1B4

Pollutants (5)	1B3, 1B6, 1B7
Channel Stability (3)	1B1,1B2

While widespread habitat degradation has occurred in the Spokane Subbasin, other factors have negatively impacted the native fish assemblages of the Subbasin. Permanent mainstem river fish barriers have resulted in the loss of the anadromous life history in the Spokane Subbasin. Objectives that were developed to address the impacts of the loss of anadromous fish include objectives 2A1. 2A2. 2A3, 2B1, 2C1, 2C2, 2C3, and 2D1. In addition, urbanization and agricultural development have negatively impacted populations of focal species within the Spokane Subbasin. Management plan objectives developed to address limiting factors resulting from agriculture and urbanization include objectives 1A1, 1B2, 1C4, 2B1, 2C1, 1A2, 1C1, 1C2, and 2A3.

Managers are often left with an unnatural environment where habitat for native species is limited. Therefore, nonnative species management is substituted to fill the void in the recreational fishery, which is accomplished through hatchery stocking and directly managing for nonnative fishes. While the current nonnative fishes provide recreational opportunities throughout the Subbasin, they also pose a threat to the remaining native fish assemblages from direct predation, competition, and hybridization, depending on specifics and locations. Objectives that are designed to address the positive and negative impacts of nonnative fish species include 2A2, 1C4, 2C1, 2A1, 2C2, and 2C3.

26.1.2 Spokane Terrestrial Assessment and Limiting Factors

Wildlife in the Spokane Subbasin are limited by habitat quantity and quality. Construction of the Grand Coulee Project affected inundated lands located along the lowermost 29 miles of the Spokane River. In addition, the project has had a number of secondary effects to terrestrial resources within the Pend Oreille Subbasin, including accelerated rates of industrial, agricultural, and residential development leading to loss of habitat; increased hunting pressure on wildlife; and loss of salmonid nutrients to the ecosystem.

Factors that currently limit terrestrial resources in the Spokane Subbasin are dominated by habitat loss and modification of habitat quality as a result of human land uses. Development, including urban, suburban, and agricultural land uses, has converted a total of 45 percent of native habitats to other cover types. Road densities are high throughout most of the Subbasin and large tracts of protected lands are virtually nonexistent.

Management plan objectives that address the losses from the construction of and inundation from Grand Coulee Dam are Objective 1A and associated sub-objectives. Management plan objectives that address the operational impacts to terrestrial species and habitats are Objective 1B and associated sub-objectives. Objectives 2A and 2B address secondary impacts of the hydropower system and other subbasin effects to terrestrial resources.

26.2 Subbasin Vision

The Spokane Subbasin vision is:

> *We envision the Spokane Subbasin as having functionally intact habitats that support viable native fish and wildlife populations that meet the social, cultural, recreational, and economic needs of the Subbasin.*

In addition to the vision statement, Spokane Subbasin Work Team members drafted the following guiding principles:

1. The Spokane Subbasin plan will be consistent with the Northwest Power Act, Northwest Power and Conservation Council's Fish and Wildlife Program, and Technical Guidance for Subbasin Planning, while complementing existing plans, policies, and planning efforts.
2. Fish and wildlife species and habitat should be managed in perpetuity based on scientific, ecological, and biological principles, not political interests or boundaries.
3. We have a responsibility to future generations.
4. Public education and outreach is essential for successful plan development and implementation.
5. The Spokane Subbasin plan will consider community and cultural issues.
6. The Spokane Subbasin plan will consider the economic and cultural wellbeing of the area along with fish and wildlife.

26.3 Aquatic Objectives and Strategies

The subbasin objectives and strategies are prioritized. The Category 1 and 2 Province level objectives were agreed by the Work Team to be of equal priority. The Subbasin objectives are grouped into priority classes, but there is not a sequential ranking of the objectives within each priority group. The ranking of the objectives (priority group) is given in parentheses after the objective. Strategies are listed in priority order, except when the strategies are of equal priority, in which case this is noted.

Objectives and strategies also included in the research, monitoring, and evaluation plan are marked with an asterisk.

Columbia River Basin Level Category 1: Mitigate for resident fish losses.

Columbia River Basin Level Goal 1A:
Complete assessments of resident fish losses throughout the Columbia River Basin resulting from the federal and federally-licensed hydrosystem, expressed in terms of the various critical population characteristics of key resident fish species.

Province Level Objective 1A:
Fully mitigate fish losses related to construction and operation of federally-licensed and federally operated hydropower projects.

Subbasin Objective 1A1*: Complete assessments of resident fish losses throughout the Spokane Subbasin resulting from the FCRPS construction and operation, expressed in terms of the various critical population characteristics of key resident fish species, through the evaluation of altered habitat, carrying capacity, and competition by year 2020. (Priority 1)

Strategy a*: Using existing databases, identify data gaps and critical information needs for the Spokane Subbasin.

Strategy b*: Continue filling data gaps in the Subbasin through ongoing investigations (such as JSAP) and new investigations.

Strategy c: Reduce entrainment at Grand Coulee Dam where desirable.

Strategy d*: Monitor entrainment.

Subbasin Objective 1A2: Fully mitigate and compensate for resident fish losses related to construction and operation of FCRPS by the year 2050. (Priority 2)

Strategy a*: Following the completion of baseline data gathering as proposed by the Resident Fish Stock Status above Chief Joseph and Grand Coulee dams project and other similar assessment tools, current baseline conditions can be established to propose projects to address limiting factors for restoration, protection and enhancement for resident fish species in the Spokane Subbasin.

Strategy b: Achieve subbasin objectives 1B1 through 1C4.

Columbia River Basin Level Goal 1B:
Maintain and restore healthy ecosystems and watersheds, which preserve functional links among ecosystem elements to ensure the continued persistence, health and diversity of all species including game fish species, non-game fish species, and other organisms. Protect and expand habitat and ecosystem functions as the means to significantly increase the abundance, productivity, and life history diversity of resident fish at least to the extent that they have been affected by the development and operation of the federal and federally-licensed hydrosystem.

Province Level Objective 1B:
Protect and restore instream and riparian habitat to maintain functional ecosystems for resident fish, including addressing the chemical, biological, and physical factors influencing aquatic productivity.

Subbasin Objective 1B1*: Evaluate instream and riparian habitat quality and quantity (at least 50 miles per year) for resident fish with primary emphasis on native salmonid habitats by year 2010. (Priority 2)

Strategy a: Continue stream and riparian habitat surveys and initiate new surveys as appropriate.

Strategy b: Inventory fish passage barriers by year 2010.

Strategy c: Continue populating existing databases and develop new databases as appropriate.

Strategy d: Develop and utilize consistent barrier criteria and inventory methodology to be used province-wide by agencies/managers.

Strategy e: Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Subbasin.

Subbasin Objective 1B2: Develop and implement projects directed at protecting, restoring, and enhancing fish habitat for both native and nonnative resident fish, through improvements in riparian conditions, fish passage, and aquatic conditions. (Priority 1)

Strategy a: Using appropriate assessment tools, develop and prioritize projects for implementation. (Priority 1, equal to b)

Strategy b: Conduct riparian restoration, reduce fine sediment inputs, and increase channel complexity to address known limiting factors for salmonid species. (Priority 1, equal to a)

Strategy c: Develop management plans with federal, state, Tribal, and private landowners to protect critical salmonid habitat. (Priority 2, equal to d and e)

Strategy d: Create or use existing incentive programs for private landowners to implement strategies to achieve this objective. (Priority 2, equal to c and e)

Strategy e: Implement projects aimed at improving aquatic conditions in both lotic and lentic habitats. (Priority 2, equal to c and d)

Strategy f: Where possible, acquire Priority properties that currently support native fish through fee title acquisition, conservation easements, and/or long-term leases by year 2020. (Priority 3)

Strategy g: Manage livestock grazing within riparian zones to maximize native habitats. (Priority 4, equal to h and i)

Strategy h: Implement projects for removal of fish passage barriers. (Priority 4, equal to g and i)

Strategy i: Use vegetation enhancements, annual seeding, and water retention in backwater areas to increase near-shore fish production, increase shoreline stability, and reduce erosion. (Priority 4, equal to g and h)

Strategy j: Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Subbasin. (Priority 5)

Subbasin Objective 1B3: Meet or exceed applicable water quality standards by year 2015. (Priority 4)

Strategy a: Identify point and non-point source pollution. (Priority 1, equal to b)

Strategy b: Conduct riparian restoration, reduce fine sediment inputs, and increase channel complexity to address known limiting factors for salmonid species. (Priority 1, equal to a)

Strategy c: Create or use existing incentive programs for private landowners to implement strategies to achieve this objective. (Priority 2, equal to d, e, and f)

Strategy d: Where possible, acquire Priority properties through fee title acquisition, conservation easements, and/or long-term leases by year 2020. (Priority 2, equal to c, e, and f)

Strategy e: Use vegetation enhancements, annual seeding, and water retention in backwater areas to increase near-shore fish production, increase shoreline stability, and reduce erosion. (Priority 2, equal to c, d, and f)

Strategy f: Manage livestock grazing within riparian zones to maximize native habitats. (Priority 2, equal to c, d, and e)

Strategy g: Decommission roads wherever possible and develop road abandonment plans for federal, state, and Tribal lands to reduce road densities below three miles of road per square mile. (Priority 3)

Strategy h*: Develop TMDL subbasin assessments, pollution reduction allocations and implementation plans for impaired water bodies by 2015. Carry out actions identified in TMDL implementation plans. (Priority 4, equal to i and j)

Strategy i: Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Subbasin. (Priority 4, equal to h and j)

Strategy j: Monitor TDG levels at fixed sites and in fish, in addition to TMDL-mandated monitoring. (Priority 4, equal to h and i)

Subbasin Objective 1B4: Determine a range of flows suitable for protection and enhancement of native resident fish species in the Subbasin. (Priority 3)

Strategy a: Complete or initiate flow studies on Spokane River, Little Spokane River, Hangman Creek, and other tributaries to determine flows suitable for protection and enhancement of native resident fish species. (Priority 1, equal to b)

Strategy b: Develop and implement projects to achieve flows suitable for protection and enhancement of native resident fish species. (Priority 1, equal to a)

Strategy c: Where possible, acquire and enhance priority properties that historically functioned as riparian/wetland habitat but now are contributing to the flashy hydrology of the watershed due to drainage installed for agricultural production. Acquire priority properties through fee title acquisition, conservation easements, and/or long-term leases. (Priority 2)

Strategy d: Create or use existing incentive programs for private landowners to remove/modify tile and drainage systems within potential riparian and wetland habitats, and/or to implement other strategies that achieve this objective. (Priority 3, equal to e)

Strategy e: Implement measures to initiate plant succession toward ecologic potential within wetland and riparian habitats. (Priority 3, equal to d)

Strategy f: Reclaim, reuse, conserve, store and/or recharge ground water so as to improve, or at a minimum, maintain, the ground water/aquifer resource. (Priority 4, equal to g)

Strategy g: Construct ponds and catchment basins within intermittent drainages to function as both 1) June-September low flow period water sources, and 2) as sediment catchment basins. (Priority 4, equal to f)

Strategy h: Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Subbasin. (Priority 5)

Subbasin Objective 1B5: Reduce persistent bioaccumulating toxin concentrations in the waters of the Spokane Subbasin to acceptable levels, as defined by the applicable regulatory authorities by year 2015. (Priority 7)

Strategy a: Work with EPA and other agencies to remove contaminated sediments from the upper Spokane River (Post Falls to Upriver dam) or other highly contaminated areas.

Strategy b: Reduce sediment collection in Lake Spokane by 75 percent of current year aggradation rates by year 2020.

Strategy c: Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Subbasin.

Subbasin Objective 1B6*: Evaluate heavy metal/organic/inorganic contamination as a limiting factor on native, culturally, and economically important species. (Priority 6)

Strategy a*: Conduct the evaluations as needed to fill data gaps.

Strategy b: Implement the assessment recommendations.

Subbasin Objective 1B7: Expand stable littoral zones along Lake Roosevelt by 10 percent of lake surface area. (Priority 5)

Strategy a: Modify dam operations to reduce erosion. (Priority 1, equal to b)

Strategy b: Increase water retention time in reservoirs to increase zooplankton production and reduce entrainment of juveniles. (Priority 1, equal to a)

Strategy c: Use vegetation enhancements, annual seeding, and water retention in backwater areas to increase near-shore fish production, increase shoreline stability, and reduce erosion. (Priority 2, equal to d and e)

Strategy d: Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Subbasin. (Priority 2, equal to c and e)

Strategy e: Manage livestock grazing within riparian zones to maximize native habitats. (Priority 2, equal to c and d)

Columbia River Basin Level Goal 1C:
Restore resident fish **s**pecies (subspecies, stocks and populations) to near historic abundance throughout their historic ranges where suitable habitat conditions exist and/or where habitats can be restored.

Province Level Objective 1C1:
Protect, enhance, restore, and increase distribution of native resident fish populations and their habitats in the IMP with primary emphasis on sensitive, native salmonid stocks.

Province Level Objective 1C2:
Maintain and enhance self-sustaining, wild populations of native game fish, and subsistence species, to provide for harvestable surplus.

Province Level Objective 1C3:
Minimize negative impacts (for example, competition, predation, introgression) to native species from nonnative species and stocks.

Province Level Objective 1C4:
Increase cooperation and coordination among stakeholders throughout the province.

In the Spokane Subbasin, objectives that address the topics listed in Province level objectives 1C1 – 1C4 are covered in Category 2, below.

Province Level Objective 1C5:
Meet and exceed the recovery plan goals for federally-listed threatened and endangered fish species.

Subbasin Objective 1C1*: Assess the distribution and relative abundance of threatened or endangered species within the Spokane River Subbasin by year 2010. (Priority 2, equal to 1C2)

Strategy a: Complete assessments of threatened and endangered species.

Subbasin Objective 1C2: Within five years of identification of threatened and endangered species, implement activities for protection and restoration. (Priority 2, equal to 1C1)

Strategy a: Implement protection and restoration of threatened and endangered species.

Subbasin Objective 1C3: Maintain and implement restoration activities consistent with Upper Columbia White Sturgeon Recovery Plan by 2005. (Priority 1, equal to 1C4)

Strategy a: Implement Upper Columbia White Sturgeon Recovery Plan. Implement protection and restoration of threatened and endangered species.

Subbasin Objective 1C4: Develop and meet recovery plan goals for sensitive native resident fish species. (Priority 1, equal to 1C3)

Strategy a: Implement restoration, protection, and enhancement methods for native salmonids. (Priority 1)

Strategy b: Increase the number of miles of streams within the Spokane River watershed that support native redband rainbow trout. (Priority 2, equal to c and d)

Strategy c: Increase the number of miles of streams within the Spokane River watershed that support native mountain whitefish. (Priority 2, equal to b and d)

Strategy d: Increase the number of spawning adult kokanee in the Chain

Lakes to 5000 individuals. (Priority 2, equal to b and c)

Province Level Objective 1C6:
Restore resident fish **s**pecies (subspecies, stocks and populations) to near historic abundance throughout their historic ranges where suitable habitat conditions exist and/or where habitats can be restored

In the Spokane Subbasin, objectives that address the topics listed in Province level objective 1C6 are covered in Category 2, below.

Columbia River Basin Level Category 2: Substitute for anadromous fish losses.

Columbia River Basin Level Goal 2A:
Restore resident fish **s**pecies (subspecies, stocks and populations) to near historic abundance throughout their historic ranges where suitable habitat conditions exist and/or where habitats can be feasibly restored.

Province Level Objective 2A1:
Protect, enhance, restore, and increase distribution of native resident fish populations and their habitats in the IMP with primary emphasis on sensitive, native salmonid stocks.

Province Level Objective 2A2:
Maintain and enhance self-sustaining, wild populations of native game fish, and subsistence species, to provide for harvestable surplus.

Province Level Objective 2A3:
Minimize negative impacts (for example, competition, predation, introgression) to native
species from nonnative species and stocks.

Province Level Objective 2A4:
Increase cooperation and coordination among stakeholders throughout the province.

The following subbasin objectives address province objectives 2A1 – 2A4:

Subbasin Objective 2A1*: Conduct baseline investigations to determine native resident and resident fish stock composition, distribution, and relative abundance in the Subbasin by year 2010. (Priority 1)

Strategy a *: Perform assessment of native salmonid stocks composition using DNA analysis or other appropriate techniques by 2010. (Priority 1, equal to b)

Strategy b *: Continue surveys to determine fish species distribution and relative abundance. (Priority 1, equal to a)

Strategy c: Continue populating existing databases and develop new databases as appropriate. (Priority 2)

Subbasin Objective 2A2: Minimize negative impacts (for example, competition, predation, introgression) to native species from nonnative species and stocks. (Priority 3)

Strategy a: Utilizing appropriate assessment tools, prioritize native fish populations for restoration, protection and enhancement. (Priority 1, equal to b and c)

Strategy b: Decrease the number of miles of stream within the Little Spokane River watershed with nonnative species by 50 percent by year 2025. (Priority 1, equal to a and c)

Strategy c: Decrease the number of miles of stream within the Hangman Creek watershed with nonnative species by 50 percent by year 2025. (Priority 1, equal to a and b)

Strategy d: Utilize sport fishing regulation to control number of nonnative species through harvest. (Priority 2)

Strategy e: Utilize mechanical removal techniques to control number of nonnative species. (Priority 3)

Strategy f: Utilize chemical removal techniques to control number of nonnative species. (Priority 4)

Subbasin Objective 2A3: Double the number of miles of stream within the Spokane Subbasin that support native game fish, including redband trout and native mountain whitefish, and subsistence species by 2020 through strategies addressing habitat and management of game species. (Priority 2)

Strategy a: Utilizing appropriate assessment tools, prioritize habitats for restoration, protection and enhancement. (Priority 1, equal to b and c)

Strategy b: Restore, protect or enhance riparian corridors and wetlands. (Priority 1, equal to a and c)

Strategy c: Restore, protect or enhance instream habitats. (Priority 1, equal to a and b)

Strategy d: Coordinate with landowners to develop leases, conservation easements, management agreements, and implementation of Best Management Practices or purchase critical aquatic, riparian, or upland habitats. (Priority 2)

Strategy e: Augment stream flows with water purchased, leased, or acquired from water trusts to restore, protect, or enhance resident fish populations in the Subbasin. (Priority 3)

Strategy f: Establish harvest quotas and/or regulations within streams that produce native resident game and subsistence fish populations that promote the expansion of those populations by 2007. (Priority 4, equal to g)

Strategy g: Liberalize catch limits and seasons for fish species that compete with native game and subsistence fish species by 2007. (Priority 4, equal to f)

Strategy h: Remove barriers found to be detrimental to fish populations. (Priority 5)

Columbia River Basin Level Goal 2B:
Provide sufficient populations of fish and wildlife for abundant opportunities for Tribal trust and treaty right harvest and for non-Tribal harvest.

Province Level Objective 2B
Focus restoration efforts on habitats and ecosystem conditions and functions that will allow for expanding and maintaining diversity within, and among, species in order to sustain a system of robust populations in the face of environmental variation.

Subbasin Objective 2B1: Protect, restore, and enhance existing terrestrial and aquatic resources in order to meet the increased demands (cultural, subsistence, and recreational) on these resources associated with the extirpation of anadromous fisheries.

Strategy a: Where possible, acquire management rights to priority properties that can be protected or restored to support native ecosystem/watershed function through title acquisition, conservation easements, and/or long-term leases. (Priority 1, equal to b)

Strategy b: Create or use existing incentive programs for private landowners to protect and/or restore habitats to support native ecosystem/watershed function. (Priority 1, equal to a)

Strategy c: Where management rights are acquired, identify the current condition and biological potential of the habitat, and then protect or restore those properties to the extent that their condition is consistent with the biological objectives of the 2000 Fish and Wildlife Program. (Priority 2)

Columbia River Basin Level Goal 2C:
Administer and increase opportunities for consumptive and non-consumptive resident fisheries for native, introduced, wild, and hatchery reared stocks that are compatible with the continued persistence of native resident fish species and their restoration to near historic abundance (includes intensive fisheries within closed or isolated systems).

Province Level Objective 2C1:
Artificially produce sufficient salmonids to supplement consistent harvest to meet

management objectives.

Province Level Objective 2C2:
Provide both short and long-term harvest opportunities that support both subsistence activities and sport-angler harvest.

The following subbasin objectives address province objectives 2C1 – 2C2:

Subbasin Objective 2C1: Use artificial production to provide recreational and subsistence fisheries of white sturgeon, rainbow trout, kokanee salmon, and or other species consistent with the NPCC Resident Fish Substitution Policy. (Priority 1, equal to 2C2 and 2C3)

Strategy a: Use genetically appropriate native stocks when possible.

Strategy b: Use artificial production to produce sufficient quantities and better quality fish to drive recreational and subsistence fisheries.

Subbasin Objective 2C2*: Assess need for conservation aquaculture facilities to assist with enhancing or re-establishing healthy, self-sustaining native fish populations for reproduction, recreation, and subsistence by year 2012. (Priority 1, equal to 2C1 and 2C3)

Strategy a: Enhance populations of sensitive native resident fish (for example, white sturgeon) through habitat improvements and artificial production, in concert with recovery plans (for example, the Upper Columbia White Sturgeon Recovery Plan).

Strategy b: Use artificial production and habitat improvements to establish/enhance non-anadromous populations of Chinook salmon and steelhead range wherever appropriate. See footnote 2.

Strategy c: Develop technical and policy working groups that meet regularly to identify problems and implement solutions.

Subbasin Objective 2C3: Supplement non-self sustaining fish species to provide a recreational and subsistence fishery (Priority 1, equal to 2C1 and 2C2)

Strategy a: By 2015, maintain and increase the number of trout fishing opportunities in ponds, lowland lakes, and reservoirs to provide anglers with the following catch rates and species. (Priority 1, equal to b):

Put and take: 5 fish per angler per trip, utilizing rainbow trout
Harvest oriented: 3 fish per angler per trip, utilizing rainbow, cutthroat, tiger, brown, and brook trout

Catch and release: 8 fish per angler per trip utilizing rainbow, cutthroat, tiger, brown, and brook trout
Quality trout (trout greater than 40 cm in length): 1 fish per angler per trip utilizing rainbow, cutthroat, tiger, brown, and brook trout
Trophy trout (trout greater than 50 cm in length): 0.5 fish per angler per trip utilizing rainbow, cutthroat, tiger, brown, and brook trout

Strategy b: Increase hatchery production capabilities to produce sufficient quantities and better quality gamefish to drive harvest and subsistence oriented fisheries by year 2015. (Priority 1, equal to a)

Strategy c: Increase put and take warm water fisheries (walleye, crappie, sunfish) with angler catch rates of 7 fish per angler per trip by year 2020. (Priority 2, equal to d and e)

Strategy d: Increase catch rates of largemouth bass in Lake Spokane to 8 fish per angler trip by 2020. (Priority 2, equal to c and e)

Strategy e: Increase catch rates of rainbow trout in Lake Spokane to 5 fish per angler per trip by year 2010. (Priority 2, equal to c an d)

Strategy f: Develop technical and policy working groups that meet regularly to identify problems and implement solutions. (Priority 3)

Columbia River Basin Level Goal 2D:
Reintroduce anadromous fish into blocked areas where feasible[1].

Province Level Objective 2D1:
Develop an anadromous fish re-introduction feasibility analysis by 2006 for Chief Joseph and by 2015 for Grand Coulee[2].

Province Level Objective 2D2:
Develop an implementation plan within five years of feasibility determination for each facility.

Subbasin Objective 2D1*: In the event anadromous fish return to the Spokane arm of Lake Roosevelt, the appropriate tribes, agencies, and stakeholders will

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[1] OC notes that "where feasible" is actual language from Council's Program.

[2] At this time the WDFW has no formal agency position, pro or con, on possible reintroduction and/or establishment of anadromous Chinook or steelhead above Grand Coulee Dam. Consideration for re-establishment of anadromous salmonid stocks above Grand Coulee Dam should be carefully evaluated in light of local habitat conditions and potential impacts upon existing resident fish substitution programs currently in place to partially mitigate for the loss of historic anadromous fish resources.

assess the feasibility of restoration of access and habitat throughout the remainder of the Spokane River Subbasin. (Priority 1)

Strategy a*: Conduct the study.

Strategy b: Expand Chinook salmon and steelhead range and habitat where appropriate.

Subbasin Objective 2D2*: Upon the three-year review cycle of the Subbasin plan, assess the status of anadromous fish in Lake Roosevelt and the Spokane Subbasin. (Priority 2)

26.3.1 Prioritization of Aquatic Objectives

A detailed discussion of the methods used to prioritize the objectives and strategies is found in Section 1.2. In the Spokane Subbasin, the members of the Subbasin Work Team contributed to the development of ranking criteria which were based largely on the criteria in the Council's 2000 Fish and Wildlife Program. These criteria were reviewed and discussed at the fifth Work Team meeting. The Work Team used the criteria to rank each objective from one to ten. An average ranking was calculated for each respondent for each objective, and then an overall Work Team average was calculated. Strategies were rated high, medium and low. These categories were converted to numeric values: 3, 2, and 1 respectively. The average ranking for each strategy was calculated for each respondent and for the Work Team as a whole.

The Work Team discussed the preliminary prioritization results for the objectives and strategies at the sixth Work Team meeting, and based on a consensus decision agreed to the final prioritization of the objectives and strategies.

The final prioritization of the aquatic objectives for the Spokane Subbasin is displayed in Table 26.3-1.

Table 26.3-1. Ranking of objectives in the Spokane Subbasin, with the limiting factor(s) that the objective was designed to address

Objectives in Priority Order	Strategies in Priority Order	Limiting Factor(s) Addressed
Priority 1		
Subbasin Objective 1A1*: Complete assessments of resident fish losses throughout the Spokane Subbasin resulting from the FCRPS construction and operation, expressed in terms of the various critical population characteristics of key resident fish species, through the evaluation of altered habitat, carrying capacity, and competition by year 2020.	**Strategy a***: Using existing databases, identify data gaps and critical information needs for the Spokane Subbasin. **Strategy b*:** Continue filling data gaps in the Subbasin through ongoing investigations (such as JSAP) and new investigations. **Strategy c:** Reduce entrainment at Grand Coulee Dam where desirable. **Strategy d*:** Monitor entrainment.	Lack of information, habitat degradation
Subbasin Objective 1B2: Develop and implement projects directed at protecting, restoring, and enhancing fish habitat for both native and nonnative resident fish, through improvements in riparian conditions, fish passage, and aquatic conditions.	**Strategy a:** Using appropriate assessment tools, develop and prioritize projects for implementation. **Strategy b**: Conduct riparian restoration, reduce fine sediment inputs, and increase channel complexity to address known limiting factors for salmonid species. **Strategy c:** Develop management plans with federal, state, Tribal, and private landowners to protect critical salmonid habitat. **Strategy d:** Create or use existing incentive programs for private landowners to implement strategies to achieve this objective. **Strategy e:** Implement projects aimed at improving aquatic conditions in both lotic and lentic habitats. **Strategy f:** Where possible, acquire Priority properties that currently support native fish through fee title acquisition, conservation easements, and/or long-term leases by year 2020. **Strategy g:** Manage livestock grazing within riparian zones to maximize native habitats. **Strategy h:** Implement projects for removal of fish passage barriers. **Strategy i:** Use vegetation enhancements, annual seeding, and water retention in backwater areas to increase near-shore fish production, increase shoreline stability, and reduce erosion. **Strategy j**: Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Subbasin.	Degraded riparian conditions, fish passage barriers, and degraded aquatic habitat.
Subbasin Objective 1C3: Maintain and implement restoration activities consistent with Upper Columbia White Sturgeon Recovery Plan by 2005.	**Strategy a:** Implement Upper Columbia White Sturgeon Recovery Plan. Implement protection and restoration of threatened and endangered species.	Loss of anadromous life history, fish passage barriers, modified flow regimes
Subbasin Objective 1C4: Develop and meet recovery plan goals for sensitive native resident fish species.	**Strategy a:** Implement restoration, protection, and enhancement methods for native salmonids. **Strategy b:** Increase the number of miles of streams within the	Lack of information, habitat degradation

Objectives in Priority Order	Strategies in Priority Order	Limiting Factor(s) Addressed
	Spokane River watershed that support native redband rainbow trout. **Strategy c**: Increase the number of miles of streams within the Spokane River watershed that support native mountain whitefish. **Strategy d:** Increase the number of spawning adult kokanee in the Chain Lakes to 5000 individuals.	
Subbasin Objective 2A1*: Conduct baseline investigations to determine native resident and resident fish stock composition, distribution, and relative abundance in the Subbasin by year 2010.	**Strategy a *:** Perform assessment of native salmonid stocks composition using DNA analysis or other appropriate techniques by 2010. **Strategy b *:** Continue surveys to determine fish species distribution and relative abundance. **Strategy c**: Continue populating existing databases and develop new databases as appropriate.	Lack of information, nonnative species impacts
Subbasin Objective 2B1: Protect, restore, and enhance existing terrestrial and aquatic resources in order to meet the increased demands (i.e., cultural, subsistence, and recreational) on these resources associated with the extirpation of anadromous fisheries.	**Strategy a**: Where possible, acquire management rights to priority properties that can be protected or restored to support native ecosystem/watershed function through title acquisition, conservation easements, and/or long-term leases. **Strategy b**: Create or use existing incentive programs for private landowners to protect and/or restore habitats to support native ecosystem/watershed function. **Strategy c**: Where management rights are acquired, identify the current condition and biological potential of the habitat, and then protect or restore those properties to the extent that their condition is consistent with the biological objectives of the 2000 Fish and Wildlife Program.	Loss of fishing opportunity, loss of anadromous life history
Subbasin Objective 2C1: Use artificial production to provide recreational and subsistence fisheries of white sturgeon, rainbow trout, kokanee salmon, and or other species consistent with the NPCC Resident Fish Substitution Policy.	**Strategy a:** Use genetically appropriate native stocks when possible. **Strategy b:** Use artificial production to produce sufficient quantities and better quality fish to drive recreational and subsistence fisheries.	Loss of anadromous life history, lack of spawning habitat, habitat degradation
Subbasin Objective 2C2*: Assess need for conservation aquaculture facilities to assist with enhancing or re-establishing healthy, self-sustaining native fish populations for reproduction, recreation, and subsistence by year 2012.	**Strategy a**: Enhance populations of sensitive native resident fish (e.g., white sturgeon) through habitat improvements and artificial production, in concert with recovery plans (e.g., the Upper Columbia White Sturgeon Recovery Plan). **Strategy b:** Use artificial production and habitat improvements to establish/enhance non-anadromous populations of Chinook salmon and steelhead range wherever appropriate. **Strategy c:** Develop technical and policy working groups that meet regularly to identify problems and implement solutions.	Loss of fishing opportunity, loss of anadromous life history, habitat degradation

Objectives in Priority Order	Strategies in Priority Order	Limiting Factor(s) Addressed
Subbasin Objective 2C3: Supplement non-self sustaining fish species to provide a recreational and subsistence fishery.	**Strategy a**: By 2015, maintain and increase the number of trout fishing opportunities in ponds, lowland lakes, and reservoirs to provide anglers with the following catch rates and species: **Put and take:** 5 fish per angler per trip, utilizing rainbow trout **Harvest oriented:** 3 fish per angler per trip, utilizing rainbow, cutthroat, tiger, brown, and brook trout **Catch and release:** 8 fish per angler per trip utilizing rainbow, cutthroat, tiger, brown, and brook trout **Quality trout** (trout greater than 40 cm in length): 1 fish per angler per trip utilizing rainbow, cutthroat, tiger, brown, and brook trout **Trophy trout** (trout greater than 50 cm in length): 0.5 fish per angler per trip utilizing rainbow, cutthroat, tiger, brown, and brook trout **Strategy b:** Increase hatchery production capabilities to produce sufficient quantities and better quality gamefish to drive harvest and subsistence oriented fisheries by year 2015. **Strategy c:** Increase put and take warm water fisheries (i.e. walleye, crappie, sunfish) with angler catch rates of 7 fish per angler per trip by year 2020. **Strategy d:** Increase catch rates of largemouth bass in Lake Spokane to 8 fish per angler trip by 2020. **Strategy e:** Increase catch rates of rainbow trout in Lake Spokane to 5 fish per angler per trip by year 2010. **Strategy f:** Develop technical and policy working groups that meet regularly to identify problems and implement solutions.	Loss of fishing opportunity, loss of anadromous life history, habitat degradation
Subbasin Objective 2D1*: In the event anadromous fish return to the Spokane arm of Lake Roosevelt, the appropriate tribes, agencies, and stakeholders will assess the feasibility of restoration of access and habitat throughout the remainder of the Spokane River Subbasin.	**Strategy a*:** Conduct the study. **Strategy b:** Expand Chinook salmon and steelhead range and habitat where appropriate.	Loss of anadromous life history

Objectives in Priority Order	Strategies in Priority Order	Limiting Factor(s) Addressed
	Priority 2	
Subbasin Objective 1A2: Fully mitigate and compensate for resident fish losses related to construction and operation of FCRPS by the year 2050.	**Strategy a*:** Following the completion of baseline data gathering as proposed by the Resident Fish Stock Status above Chief Joseph and Grand Coulee dams project and other similar assessment tools, current baseline conditions can be established to propose projects to address limiting factors for restoration, protection and enhancement for resident fish species in the Spokane Subbasin. **Strategy b:** Achieve subbasin objectives 1B1 through 1C4	Habitat degradation as a result of FCRPS construction and operation
Subbasin Objective 1B1*: Evaluate instream and riparian habitat quality and quantity (at least 50 miles per year) for resident fish with primary emphasis on native salmonid habitats by year 2010.	**Strategy a:** Continue stream and riparian habitat surveys and initiate new surveys as appropriate. **Strategy b:** Inventory fish passage barriers by year 2010. **Strategy c:** Continue populating existing databases and develop new databases as appropriate. **Strategy d**: Develop and utilize consistent barrier criteria and inventory methodology to be used province-wide by agencies/managers. **Strategy e:** Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Subbasin.	Degraded riparian habitat and instream flows
Subbasin Objective 1C1*: Assess the distribution and relative abundance of threatened or endangered species within the Spokane River Subbasin by year 2010.	**Strategy a:** Complete assessments of threatened and endangered species.	Lack of information
Subbasin Objective 1C2: Within five years of identification of threatened and endangered species, implement activities for protection and restoration.	**Strategy a:** Implement protection and restoration of threatened and endangered species.	Habitat degradation, loss of fishing opportunity

Objectives in Priority Order	Strategies in Priority Order	Limiting Factor(s) Addressed
Subbasin Objective 2A3: Double the number of miles of stream within the Spokane Subbasin that support native game fish, including redband trout and native mountain whitefish, and subsistence species by 2020 through strategies addressing habitat and management of game species.	**Strategy a**: Utilizing appropriate assessment tools, prioritize habitats for restoration, protection and enhancement. **Strategy b:** Restore, protect or enhance riparian corridors and wetlands. **Strategy c:** Restore, protect or enhance instream habitats. **Strategy d**: Coordinate with landowners to develop leases, conservation easements, management agreements, and implementation of Best Management Practices or purchase critical aquatic, riparian, or upland habitats. **Strategy e:** Augment stream flows with water purchased, leased, or acquired from water trusts to restore, protect, or enhance resident fish populations in the Subbasin. **Strategy f:** Establish harvest quotas and/or regulations within streams that produce native resident game and subsistence fish populations that promote the expansion of those populations by 2007. **Strategy g:** Liberalize catch limits and seasons for fish species that compete with native game and subsistence fish species by 2007. **Strategy h:** Remove barriers found to be detrimental to fish populations.	Habitat degradation, loss of fishing opportunity

Objectives in Priority Order	Strategies in Priority Order	Limiting Factor(s) Addressed
Priority 3		
Subbasin Objective 1B4: Determine a range of flows suitable for protection and enhancement of native resident fish species in the Subbasin.	**Strategy a:** Complete or initiate flow studies on Spokane River, Little Spokane River, Hangman Creek, and other tributaries to determine flows suitable for protection and enhancement of native resident fish species. **Strategy b:** Develop and implement projects to achieve flows suitable for protection and enhancement of native resident fish species. **Strategy c:** Where possible, acquire and enhance priority properties that historically functioned as riparian/wetland habitat but now are contributing to the flashy hydrology of the watershed due to drainage installed for agricultural production. Acquire priority properties through fee title acquisition, conservation easements, and/or long-term leases. **Strategy d:** Create or use existing incentive programs for private landowners to remove/modify tile and drainage systems within potential riparian and wetland habitats, and/or to implement other strategies that achieve this objective. **Strategy e:** Implement measures to initiate plant succession toward ecologic potential within wetland and riparian habitats. **Strategy f**: Reclaim, reuse, conserve, store and/or recharge ground water so as to improve, or at a minimum, maintain the ground water/aquifer resource. **Strategy g:** Construct ponds and catchment basins within intermittent drainages to function as both 1) June-September low flow period water sources, and 2) as sediment catchment basins. **Strategy h**: Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Subbasin.	Instream flows

Objectives in Priority Order	Strategies in Priority Order	Limiting Factor(s) Addressed
Subbasin Objective 2A2: Minimize negative impacts (e.g., competition, predation, introgression) to native species from nonnative species and stocks.	**Strategy a:** Utilizing appropriate assessment tools, prioritize native fish populations for restoration, protection and enhancement. **Strategy b:** Decrease the number of miles of stream within the Little Spokane River watershed with nonnative species by 50 percent by year 2025. **Strategy c**: Decrease the number of miles of stream within the Hangman Creek watershed with nonnative species by 50 percent by year 2025. **Strategy d:** Utilize sport fishing regulation to control number of nonnative species through harvest. **Strategy e:** Utilize mechanical removal techniques to control number of nonnative species. **Strategy f**: Utilize chemical removal techniques to control number of nonnative species.	Nonnative species impacts

Objectives in Priority Order	Strategies in Priority Order	Limiting Factor(s) Addressed
	Priority 4	
Subbasin Objective 1B3: Meet or exceed applicable water quality standards by year 2015.	**Strategy a:** Identify point and non-point source pollution. **Strategy b:** Conduct riparian restoration, reduce fine sediment inputs, and increase channel complexity to address known limiting factors for salmonid species. **Strategy c**: Create or use existing incentive programs for private landowners to implement strategies to achieve this objective. **Strategy d:** Where possible, acquire Priority properties through fee title acquisition, conservation easements, and/or long-term leases by year 2020. **Strategy e**: Use vegetation enhancements, annual seeding, and water retention in backwater areas to increase near-shore fish production, increase shoreline stability, and reduce erosion. **Strategy f:** Manage livestock grazing within riparian zones to maximize native habitats. **Strategy g:** Decommission roads wherever possible and develop road abandonment plans for federal, state, and Tribal lands to reduce road densities below three miles of road per square mile. **Strategy h*:** Develop TMDL subbasin assessments, pollution reduction allocations and implementation plans for impaired water bodies by 2015. Carry out actions identified in TMDL implementation plans. **Strategy i**: Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Subbasin. **Strategy j:** Monitor TDG levels at fixed sites and in fish, in addition to TMDL-mandated monitoring.	Water quality

Objectives in Priority Order	Strategies in Priority Order	Limiting Factor(s) Addressed
Priority 5		
Subbasin Objective 1B7: Expand stable littoral zones along Lake Roosevelt by 10 percent of lake surface area.	**Strategy a:** Modify dam operations to reduce erosion. **Strategy b**: Increase water retention time in reservoirs to increase zooplankton production and reduce entrainment of juveniles. **Strategy c:** Use vegetation enhancements, annual seeding, and water retention in backwater areas to increase near-shore fish production, increase shoreline stability, and reduce erosion. **Strategy d:** Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Subbasin. **Strategy e**: Manage livestock grazing within riparian zones to maximize native habitats.	Productivity, rearing habitat in Lake Roosevelt
Priority 6		
Subbasin Objective 1B6*: Evaluate heavy metal/organic/inorganic contamination as a limiting factor on native, culturally, and economically important species.	**Strategy a*:** Conduct the evaluations as needed to fill data gaps. **Strategy b:** Implement the assessment recommendations.	Water quality, sedimentation
Priority 7		
Subbasin Objective 1B5: Reduce persistent bioaccumulating toxin concentrations in the waters of the Spokane Subbasin to acceptable levels, as defined by the applicable regulatory authorities by year 2015.	**Strategy a**: Work with EPA and other agencies to remove contaminated sediments from the upper Spokane River (Post Falls to Upriver dam), or other highly contaminated areas. **Strategy b:** Reduce sediment collection in Lake Spokane by 75 percent of current year aggradation rates by year 2020. **Strategy c**: Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Subbasin.	Water quality, sedimentation

* = Objectives and strategies that are included in the RM&E plan.

26.3.2 Discussion of Aquatic Prioritization

The Spokane Subbasin Work Team based its preliminary prioritization process on the criteria ranking worksheets. The results of the preliminary ranking were used during the sixth Work Team meeting as a starting point for discussion. The Work Team based its final prioritization process on the assumption that Category 1 and 2 and Province level objectives are of equal importance, reflecting the OC decision not to prioritize these objectives at the Province level. Although the preliminary ranking resulted in objectives with different priorities, the Work Team consensus process resulted in the decision that the Province level objectives could not be prioritized, but that individual subbasin objectives within them could be rank ordered. The result is a prioritized list with objectives from categories 1 and 2 grouped by priority. The objectives within priority groups are listed in alphanumeric order, since all are of equal priority.

In general, objectives addressing loss of anadromous and resident fish habitats due to the FCRPS were ranked higher than those addressing flows and other aspects of water quality.

26.4 Terrestrial Objectives and Strategies

Columbia River Basin-level terrestrial resource objectives were developed by the Northwest Power and Conservation Council in their 2000 Fish and Wildlife Program. The IMP subbasin planners have developed province level terrestrial resource objectives that are tiered to the Columbia River Basin level goals. These objectives were prioritized by the OC. In addition, planners in the six subbasins in the IMP developed subbasin specific objectives and strategies, which are tiered to both the Columbia River Basin and IMP goals.

The Columbia River Basin, Province, and Spokane Subbasin terrestrial objectives are prioritized and listed in order of their priority. Strategies are listed in order of priority beneath each Subbasin objective. Objectives and strategies also included in the research, monitoring, and evaluation plan are marked with an asterisk.

Columbia River Basin Level Category 1:

A primary overarching objective of the Columbia River Basin 2000 Fish and Wildlife Program is the completion of mitigation for the adverse effects to wildlife caused by the development and operation of the hydrosystem.

Priority 1: **Columbia River Basin Level Goal 1A:**

Complete the current Wildlife Mitigation Program for construction and inundation losses of federal hydrosystem as identified in Appendix C, Table 11-4 of the Columbia River Basin 2000 Fish and Wildlife Program.

> **Province Level Objective 1A**:
>
> Fully mitigate for construction and inundation losses incurred from the Chief Joseph Dam, Grand Coulee Dam, and Albeni Falls projects per the requirements of the Northwest Power Act and the current Wildlife Mitigation Program (Appendix C, Table 11-4 of the Columbia River Basin 2000 Fish and Wildlife Program) by 2015. This includes developing and implementing projects within the IMP that protect, enhance, or restore Habitat Units for HEP evaluation species and habitats as

specified in the construction loss assessments for Chief Joseph, Grand Coulee, and Albeni Falls dams (Kuehn and Berger 1992; Creveling and Renfrow 1986; Martin et al. 1988); coordinated planning; provision of adequate funding for long-term Operations and Maintenance (O&M); and effectiveness monitoring of projects.

Spokane Subbasin Objective 1A: Fully mitigate for terrestrial resource losses incurred from construction and inundation of the Grand Coulee Project per the requirements of the Northwest Power Act. Complete the compensation mitigation for construction losses at Grand Coulee Dam for wildlife and wildlife habitat consistent with the HEP loss assessment (Appendix C, Table 11-4 of the Columbia River Basin 2000 Fish and Wildlife Program) by year 2015. (These requirements will be met in coordination with San Poil and Upper Columbia subbasins, which also are influenced by Lake Roosevelt).

Strategy a (**for Objectives 1A1-1A9)*:** Identify and evaluate parcels for potential use in mitigation.

Strategy b (**for Objectives 1A1-1A9):** Protect habitat through fee title acquisition, conservation easements, lease, or management plans that address access management, livestock management, soil, vegetation and unwanted species, fire and fuels, nonnative wildlife, etc.

Strategy c (**for Objectives 1A1-1A9):** Develop and implement management plans that specify habitat/vegetation enhancements as well as management of access, livestock, soil, vegetation and unwanted species, fire and fuels, nonnative wildlife, etc.

Objective 1A1: Protect, enhance, or restore secure riverine island Canada goose nest sites to address riverine island/bar habitat losses resulting from construction of the Grand Coulee Project.

Objective 1A2: Protect enhance, or restore mourning dove Habitat Units to address riparian and agricultural habitat losses resulting from construction of the Grand Coulee Project.

Objective 1A3: Protect, enhance, or restore mule deer Habitat Units to address shrub-steppe and river break habitat losses resulting from construction of the Grand Coulee Project.

Objective 1A4: Protect, enhance, or restore riparian forest Habitat Units to address habitat losses resulting from construction of the Grand Coulee Project.

Strategy d: Protect, restore, and provide connectivity of cottonwood galleries.

Strategy e: Protect, restore, and provide connectivity of key riparian habitats.

Objective 1A5: Protect, enhance, or restore riparian shrub Habitat Units to address habitat losses resulting from construction of the Grand Coulee Project.

Objective 1A6: Protect, enhance, or restore ruffed grouse Habitat Units to address riparian/hardwood forest habitat losses resulting from construction of the Grand Coulee Project.

Objective 1A7: Protect, enhance, or restore sage grouse Habitat Units to address shrub-steppe habitat losses resulting from construction of the Grand Coulee Project.

Objective 1A8: Protect, enhance, or restore sharp-tailed grouse Habitat Units to address grasslands, shrub-steppe, and riparian draw habitat losses resulting from construction of the Grand Coulee Project.

Objective 1A9: Protect, enhance, or restore white-tailed deer Habitat Units to address seral forest habitat losses resulting from construction of the Grand Coulee Project.

Strategy e: Replace Habitat Units for white-tailed deer at low elevation sites.

Objective 1A10: Maintain wildlife values, Habitat Units (HUs), for the life of the project on existing and newly acquired mitigation lands through adequate long-term Operations and Maintenance (O&M) funding.

Strategy a: Develop and implement O&M funding mechanism to ensure maintenance of wildlife values, HUs, for the life of the project on existing and newly acquired mitigation lands.

Objective 1A11*: Evaluate effectiveness of mitigation by monitoring and evaluating species and habitat responses to mitigation actions.

Strategy a: Develop and implement monitoring program on existing and newly acquired mitigation lands.

Priority 2: **Columbia River Basin Level Goal 1B:**
Quantify the operational effects of federal hydrosystem projects on terrestrial resources, develop mitigation plan in coordination with other resource mitigation and resource

planning efforts, and implement projects to mitigate the impacts, including maintenance and monitoring.

Province Level Objective 1B:
Quantitatively assess and mitigate operational impacts of the Chief Joseph, Grand Coulee Dam, and Albeni Falls projects per the requirements of the Northwest Power Act and the current Wildlife Mitigation Program. Complete assessment of operational impacts by 2008; develop mitigation plan by 2010; implement initial mitigation by 2015; incorporate formal methods for review and update of effects assessment and mitigation plan on a three-year cycle, to respond to changes in operation and to effectiveness of mitigation actions.

Spokane Subbasin Objective 1B*: Assess and mitigate the operational effects of the Grand Coulee Project in the Spokane Subbasin.

Objective 1B1*: Using an impartial third party contractor, perform assessment of operational impacts of the Grand Coulee Project on terrestrial resources by year 2008.

Strategy a*: Have an impartial third party contractor conduct the assessment and consider fluctuation zone, loss of nutrients in watershed from loss of salmon, identify recreational effects to terrestrial resources, BPA transmission lines, connectivity, and erosion.

Objective 1B2: Develop mitigation plan for operational effects by year 2010.

Objective 1B3: Implement initial mitigation plan by 2015, incorporating an ongoing revision and review cycle and adequate O&M funding.

Columbia River Basin Level Category 2:
In consideration of the primary overarching objectives of the Columbia River Basin 2000 Fish and Wildlife Program, provide: 1) sufficient populations of wildlife for abundant opportunities for Tribal trust and treaty right harvest and for non-Tribal harvest; 2) recovery of wildlife species affected by the development and operation of the hydrosystem that are listed under the Endangered Species Act; and 3) a Columbia River ecosystem that sustains an abundant, productive, and diverse community of fish and wildlife.

Priority 3: **Columbia River Basin Level Goal 2**:
Mitigate for wildlife losses that have occurred through secondary effects of hydrosystem development, including assessment, development of mitigation plan in coordination with other resources and resource managers, implementation, maintenance, and monitoring.

Province Level Objective 2A:
Mitigate for wildlife losses that have occurred through secondary effects of hydrosystem development by protecting, enhancing, restoring, and sustaining

populations of wildlife for aesthetic, cultural, ecological, and recreational values. Objective includes assessment of secondary impacts, development of mitigation plan in coordination with other resources and resource managers, implementation, maintenance, and monitoring. Because the secondary effects of hydrosystem development are tightly intermingled with the effects of other activities in the province, this objective also incorporates other actions to maintain or enhance populations of federal, state, and Tribal species of special concern, and other native and desirable nonnative wildlife species, within their present and/or historical ranges in order to prevent future declines and restore populations that have suffered declines or been extirpated.

Spokane Subbasin Objectives:

Objective 2A1: Maintain bald eagle at or above present levels (2004) in the Spokane Subbasin.

Strategy a: Maintain secure bald eagle breeding and wintering habitats. (Secure nesting habitat has full protection within 400 feet of nests and conditional protection within 800 feet of nests per WDFW definition.)

Strategy b*: Identify, map, and provide long-term protection to current and potential winter perching and foraging habitat.

Strategy c*: Continue or increase monitoring of nesting and wintering bald eagles.

Objective 2A2: Increase sharp-tailed grouse populations within the Intermountain Province and associated subbasins to a minimum of 800 grouse by 2010; over the long-term, improve and maintain the habitats necessary to support self-sustaining, persistent populations of grouse, estimated to consist of a minimum of 2,000 birds. (This objective shared with Lake Rufus Woods, Spokane, and Upper Columbia subbasins.)

Strategy a*: Determine limiting factors on, and size of, sharp-tailed grouse populations within the IMP and associated subbasins by 2006.

Strategy b*: Develop, prioritize, and implement projects and/or research to address identified sharp-tailed grouse limiting factors by year 2007.

Strategy c*: Assess current versus historical habitat availability and quality and if needed implement habitat restoration/conversion to address concerns.

Strategy d*: Assess and if deemed needed limit/restrict nonnative invasive species interaction/competition and habitat degradation.

Objective 2A3: Increase blue grouse populations by 20 percent within the Spokane Subbasin and adjacent subbasins/provinces by year 2010.

Strategy a*: Determine limiting factors on blue grouse populations within the Spokane Subbasin and associated subbasins by 2006.

Strategy b*: Develop, prioritize, and implement projects and/or research to address identified blue grouse limiting factors by year 2007.

Strategy c*: Assess current versus historical habitat availability and quality and if needed implement habitat restoration/conversion to address concerns.

Strategy d*: Assess and if deemed needed limit/restrict nonnative invasive species interaction/competition and habitat degradation.

Objective 2A4: Maintain or increase golden eagle populations at or above 2004 levels.

Strategy a*: Determine limiting factors for golden eagles by 2006.

Strategy b*: Develop, prioritize, and implement projects and/or research to address identified limiting factors for golden eagles by 2007.

Objective 2A5: Identify specific projects to protect, restore, and/or enhance populations of game species in the Subbasin reflecting federal, state, and Tribal management objectives (white-tailed deer, elk, moose).

Strategy a: Identify and implement projects to enhance populations of game species in the Subbasin.

Objective 2A6: Maintain raptor populations at or above present levels (2004) in the Spokane Subbasin in accordance with federal, state, and Tribal management plans. Protect important raptor sites including active and alternate nest trees, preferred feeding sites, migratory corridors, wintering areas, and perch and roost trees.

Strategy a*: Identify specific factors limiting/affecting raptor populations in the Spokane Subbasin by year 2010.

Strategy b*: Determine present population levels and monitor for trends, including continued/increased monitoring of raptors and identification and mapping of new roosting sites.

Strategy c: Develop, prioritize, and implement projects and/or research to address identified raptor limiting factors by year 2012.

Objective 2A7: Maintain or enhance populations of federal, state, local and Tribal species of special concern, and other native and desirable nonnative wildlife species, within their present and/or historical ranges within the Spokane Subbasin in order to prevent future declines and restore populations that have suffered declines. Target species include: Townsend's big-eared bats, pallid bat, spotted bat, hoary bat, silver-haired bat, fringed myotis, golden eagle, yellow warbler, sage sparrow, pileated woodpecker, Lewis' woodpecker, white-headed woodpecker, beaver, river otter, mink, snowshoe hare, and Columbia spotted frog.

Strategy a*: Identify target species/guilds based on management needs and relationships to indicator species utilized in HEP loss assessments; identify specific factors limiting/affecting target species populations in the Spokane Subbasin by 2010.

Strategy b: Develop, prioritize, and implement projects and/or research to address identified target species limiting factors by year 2012, with consideration of benefits achieved through mitigation for HEP loss assessment indicator species.

Strategy c*: Determine present population levels and conduct trend monitoring.

Objective 2A8: Neo-tropical migrant birds. Maintain or enhance neo-tropical migrant bird populations relative to current levels within suitable habitat and identify limiting factors for these populations within the Subbasin.

Strategy a: Prioritize neo-tropical bird target species referring to Partners in Flight documents, USFWS Birds of Conservation Concern 2002, and WDFW documents.

Strategy b*: Identify specific factors limiting/affecting neo-tropical bird populations in the Spokane Subbasin by 2010.

Strategy c*: Determine present population levels and monitor for trends.

Strategy d: Develop, prioritize, and implement projects and/or research to address identified neo-tropical bird population limiting factors by 2012.

Objective 2A9: Amphibians and Reptiles. Maintain or enhance amphibian and reptiles populations at current levels within suitable habitat and identify limiting factors within the Subbasin.

Strategy a*: Identify specific factors limiting/affecting amphibian and reptile populations in the Spokane Subbasin by year 2010.

Strategy b*: Determine present population levels and monitor for trends.

Strategy c: Develop, prioritize, and implement projects and/or research to address identified amphibian and reptile limiting factors by year 2012.

Province Level Objective 2B:
Mitigate for wildlife losses that have occurred through secondary effects of hydrosystem development by protecting, enhancing, restoring, and sustaining native wildlife habitat function to maintain or enhance ecological diversity and security for native and desirable nonnative wildlife species. Objective includes assessment of secondary impacts, development of mitigation plan in coordination with other resources and resource managers, implementation, maintenance, and monitoring. Because the secondary effects of hydrosystem development are tightly intermingled with the effects of other activities in the province, this objective also incorporates other actions to identify, maintain, restore, and enhance priority habitats (wetlands, riparian areas, upland forests, steppe and shrub-steppe, cliffs and rock outcrops, caves, grasslands, and other priority habitats) including their structural attributes, ecological functions, and distribution and connectivity across the landscape to optimize conditions required to increase overall wildlife productivity of desired species assemblages. Strategies may include land acquisition, conservation easements, management contracts, and/or partnerships with other landowners.

Province Level Objective 2B1: Identify and implement strategies and opportunities for restoring the diversity, block size, and spatial arrangement of habitat types needed to sustain target wildlife species at ecologically sound levels.

Province Level Objective 2B2: Restore the connectivity of habitat types needed to sustain wildlife populations at the landscape level. Encourage and support the implementation of all forest practices, including road building and maintenance, as specified in the Washington Department of Natural Resources and Idaho Department of Lands Forest Practices Rules and Subbasin Forest Plans for all National Forests within the Subbasin.

Objective 2B1: Complete mitigation requirements consistent with approved agreements in applicable federal licenses.

Objective 2B2*: Identify, protect, maintain, restore, and enhance priority habitats (wetlands, riparian areas, upland forests, steppe and shrub-steppe, cliffs and rock outcrops (including caves and mines), in accordance with applicable agency, federal, state, local, and Tribal priority habitat designations), including their structural attributes, ecological functions, and distribution and connectivity across the landscape to optimize conditions required to increase overall wildlife productivity of desired species assemblages. Strategies may include land acquisition, conservation easements, management contracts, and/or partnerships with other landowners.

> **Strategy a**: Identify and map (using GIS) key habitat areas within focal habitats: upland forest, wetlands, riparian, shrub-steppe, and cliffs/rock outcrops/caves/mines.
>
> **Strategy b:** Acquire land management rights to key habitats through fee title acquisition, lease, conservation easement, or management agreement.
>
> **Strategy c:** Develop and implement management plans that address habitat protection, restoration, and/or enhancement, including access management, livestock management, soils and vegetation, nonnative species management, connectivity of habitats with other lands managed for terrestrial resources, and monitoring.
>
> **Strategy d:** Provide incentive program for private landowners to actively manage specific habitats to accomplish Objective 2B2.
>
> **Strategy e*:** Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Spokane Subbasin.
>
> **Strategy f:** Improve enforcement of existing state and Tribal hunting regulations and modify regulations as needed to increase protection/restoration of key wildlife populations.

Objective 2B3: Increase the quantity and quality of mule deer habitats, particularly winter and spring habitats.

> **Strategy a:** Identify key mule deer winter and spring range and acquire land management rights to through fee title acquisition, lease, conservation easement, or management agreement.

Strategy b*: Identify specific factors limiting/affecting mule deer populations; provide continuing funding to complete adequate inventory surveys and WDFW's Cooperative Mule Deer Project.

Strategy c: Develop and implement management plans and projects to protect, restore, and/or enhance mule deer habitats. Management plans should address:

- Vegetation management (manage forests for a variety of successional stages to meet mule deer habitat needs on a site-specific basis; use fire and forest management to increase quality and quantity of shrubs and mature forest cover; restore grasses and forbs where noxious weeds have impacted mule deer habitat; increase the area of hardwood (aspen) stands).
- Access management (especially management of motorized traffic in critical mule deer spring and winter ranges).
- Enforcement (improve enforcement of existing regulations; modify regulations as needed to achieve population targets).
- Monitoring of effectiveness of management activities.

26.4.1 Prioritization of Terrestrial Objectives and Strategies

A detailed discussion of the methods used to prioritize the objectives and strategies is found in Section 1.2. In Spokane Subbasin, the members of the Subbasin Work Team contributed to the development of ranking criteria which were based largely on the criteria in the Council's 2000 Fish and Wildlife Program.

The Work Team rated the criteria for each objective from one to ten. An average ranking was calculated for each respondent for each objective, and then an overall Work Team average was calculated. Strategies were rated high, medium and low. These categories were converted to numeric values: 3, 2, and 1 respectively. The average ranking for each strategy was calculated for each respondent and for the Work Team as a whole.

The Work Team discussed the preliminary prioritization results for the objectives and strategies at the sixth Work Team meeting, and based on a consensus decision agreed to the final prioritization of the objectives and strategies.

The final prioritization of the terrestrial objectives for the Spokane Subbasin is displayed in Table 26.4-1.

Table 26.4-1 Ranking of terrestrial objectives and strategies in the Spokane Subbasin, with the limiting factor(s) that the objective was designed to address

Objectives in Priority Order	Strategies	Limiting Factor(s) Addressed
Provincial Priority 1 – Mitigate for construction and inundation losses		
(1) Spokane Subbasin Objective 1A: Fully mitigate for terrestrial resource losses incurred from construction and inundation of the Grand Coulee Project per the requirements of the Northwest Power Act. Complete the compensation mitigation for construction losses at Grand Coulee Dam for wildlife and wildlife habitat consistent with the HEP loss assessment (Appendix C, Table 11-4 of the Columbia River Basin 2000 Fish and Wildlife Program) by year 2015. (These requirements will be met in coordination with San Poil and Upper Columbia subbasins, which also are influenced by Lake Roosevelt). **Objective 1A1:** Protect, enhance, or restore secure riverine island Canada goose nest sites to address riverine island/bar habitat losses resulting from construction of the Grand Coulee Project. **Objective 1A2:** Protect enhance, or restore mourning dove Habitat Units to address riparian and agricultural habitat losses resulting from construction of the Grand Coulee Project. **Objective 1A3:** Protect, enhance, or restore mule deer Habitat Units to address shrub-steppe and river break habitat losses resulting from construction of the Grand Coulee Project. **Objective 1A4:** Protect, enhance, or restore riparian forest Habitat Units to address habitat losses resulting from construction of the Grand Coulee Project. **Objective 1A5:** Protect, enhance, or restore riparian shrub Habitat Units to address habitat losses resulting from construction of the Grand Coulee Project. **Objective 1A6:** Protect, enhance, or restore ruffed grouse Habitat Units to address riparian/hardwood forest habitat losses resulting from construction of the Grand Coulee Project. **Objective 1A7:** Protect, enhance, or restore sage grouse Habitat Units to address shrub-steppe habitat losses resulting from construction of the Grand Coulee Project. O**bjective 1A8:** Protect, enhance, or restore sharp-tailed grouse Habitat Units to address grasslands, shrub-steppe, and riparian draw habitat losses resulting from construction of the Grand Coulee Project. **Objective 1A9:** Protect, enhance, or restore white-tailed deer Habitat Units to address seral forest habitat losses resulting from construction of the Grand Coulee Project.	**Strategy a** (**for Objectives 1A1-1A9)*:** Identify and evaluate parcels for potential use in mitigation. **Strategy b** (**for Objectives 1A1-1A9):** Protect habitat through fee title acquisition, conservation easements, lease, or management plans that address access management, livestock management, soil, vegetation and unwanted species, fire and fuels, nonnative wildlife, etc. **Strategy c** (**for Objectives 1A1-1A9):** Develop and implement management plans that specify habitat/vegetation enhancements as well as management of access, livestock, soil, vegetation and unwanted species, fire and fuels, nonnative wildlife, etc. **Strategy d (Objective 1A4):** Protect, restore, and provide connectivity of cottonwood galleries. **Strategy e (Objective 1A4):** Protect, restore, and provide connectivity of key riparian habitats. **Strategy e (Objective 1A9):** Replace Habitat Units for white-tailed deer at low elevation sites. **Strategy a (Objective 1A10):** Develop and implement O&M funding mechanism to ensure maintenance of wildlife values, HUs, for the life of the project on existing and newly acquired mitigation lands.	Terrestrial resource losses incurred from construction and inundation of the Grand Coulee Project

Objectives in Priority Order	Strategies	Limiting Factor(s) Addressed
Objective 1A10: Maintain wildlife values, HUs, for the life of the project on existing and newly acquired mitigation lands through adequate long-term Operations and Maintenance (O&M) funding.		
(2) Evaluate effectiveness of mitigation by monitoring and evaluating species and habitat responses to mitigation actions. **Objective 1A11***	**Strategy a:** Develop and implement monitoring program on existing and newly acquired mitigation lands.	Lack of information, adaptive management
Provincial Priority 2 – Quantify and mitigate for operational impacts		
(3) Using an impartial third party contractor, perform assessment of operational impacts of the Grand Coulee Project on terrestrial resources by year 2008. **Objective 1B1***	**Strategy a*:** Have an impartial third party contractor conduct the assessment and consider fluctuation zone, loss of nutrients in watershed from loss of salmon, identify recreational effects to terrestrial resources, BPA transmission lines, connectivity, and erosion.	Lack of data on operational impacts
(4) Develop mitigation plan for operational effects by year 2010. **Objective 1B2**	**Strategy a:** Develop mitigation plan.	Need to mitigate operational impacts
(5) Implement initial mitigation plan by 2015, incorporating an ongoing revision and review cycle and adequate O&M funding. **Objective 1B3**	**Strategy a:** Implement mitigation plan and review cycle.	Need to mitigate operational impacts
Provincial Priority 3 –Mitigate for secondary effects of FCRPS and other subbasin effects		
(6) Increase sharp-tailed grouse populations within the Intermountain Province and associated subbasins to a minimum of 800 grouse by 2010; over the long-term, improve and maintain the habitats necessary to support self-sustaining, persistent populations of grouse, estimated to consist of a minimum of 2,000 birds. (This objective shared with Lake Rufus Woods, Spokane, and Upper Columbia subbasins.) **Objective 2A2**	**Strategy a*:** Determine limiting factors on, and size of, sharp-tailed grouse populations within the IMP and associated subbasins by 2006. **Strategy b:** Develop, prioritize, and implement projects and/or research to address identified sharp-tailed grouse limiting factors by year 2007. **Strategy c*:** Assess current versus historical habitat availability and quality and if needed implement habitat restoration/conversion to address concerns. **Strategy d*:** Assess and if deemed needed limit/restrict nonnative invasive species interaction/competition and habitat degradation.	Secondary effects of FCRPS and other subbasin effects to sharp-tailed grouse populations

Objectives in Priority Order	Strategies	Limiting Factor(s) Addressed
(7) Maintain bald eagle at or above present levels (2004) in the Spokane Subbasin. **Objective 2A1**	**Strategy a:** Maintain secure Bald eagle breeding and wintering habitats. (Secure nesting habitat has full protection within 400 feet of nests and conditional protection within 800 feet of nests per WDFW definition.) **Strategy b*:** Identify, map, and provide long-term protection to current and potential winter perching and foraging habitat. **Strategy c*:** Continue or increase monitoring of nesting and wintering bald eagles.	Secondary effects of FCRPS and other subbasin effects to bald eagle populations
(8) Identify specific projects to protect, restore, and/or enhance populations of game species in the Subbasin reflecting federal, state, and Tribal management objectives (white-tailed deer, elk, moose). **Objective 2A5**	**Strategy a:** Identify and implement projects to enhance populations of game species in the Subbasin.	Secondary effects of FCRPS and other subbasin effects to game species populations
(9) Amphibians and Reptiles. Maintain or enhance amphibian and reptiles populations at current levels within suitable habitat and identify limiting factors within the Subbasin. **Objective 2A9**	**Strategy a*:** Identify specific factors limiting/affecting amphibian and reptile populations in the Spokane Subbasin by year 2010. **Strategy b*:** Determine present population levels and monitor for trends. **Strategy c:** Develop, prioritize, and implement projects and/or research to address identified amphibian and reptile limiting factors by year 2012.	Secondary effects of FCRPS and other subbasin effects to amphibians and reptile populations

Objectives in Priority Order	Strategies	Limiting Factor(s) Addressed
(10) Increase blue grouse populations by 20 percent within the Spokane Subbasin and adjacent subbasins/provinces by year 2010. **Objective 2A3**	**Strategy a*:** Determine limiting factors on blue grouse populations within the Spokane Subbasin and associated subbasins by 2006. **Strategy b*:** Develop, prioritize, and implement projects and/or research to address identified blue grouse limiting factors by year 2007. **Strategy c*:** Assess current versus historical habitat availability and quality and if needed implement habitat restoration/conversion to address concerns. **Strategy d*:** Assess and if deemed needed limit/restrict nonnative invasive species interaction/competition and habitat degradation.	Secondary effects of FCRPS and other subbasin effects to blue grouse populations
(11) Neo-tropical migrant birds. Maintain or enhance neo-tropical migrant bird populations relative to current levels within suitable habitat and identify limiting factors for these populations within the Subbasin. **Objective 2A8**	**Strategy a:** Prioritize neo-tropical bird target species referring to Partners in Flight documents, USFWS Birds of Conservation Concern 2002, and WDFW documents. **Strategy b*:** Identify specific factors limiting/affecting neo-tropical bird populations in the Spokane Subbasin by 2010. **Strategy c*:** Determine present population levels and monitor for trends. **Strategy d:** Develop, prioritize, and implement projects and/or research to address identified neo-tropical bird population limiting factors by 2012.	Secondary effects of FCRPS and other subbasin effects to neo-tropical migrant bird populations
(12) Maintain or increase golden eagle populations at or above 2004 levels. **Objective 2A4**	**Strategy a*:** Determine limiting factors for golden eagles by 2006. **Strategy b*:** Develop, prioritize, and implement projects and/or research to address identified limiting factors for golden eagles by 2007.	Secondary effects of FCRPS and other subbasin effects to golden eagle populations

Objectives in Priority Order	Strategies	Limiting Factor(s) Addressed
(13) Maintain raptor populations at or above present levels (2004) in the Spokane Subbasin in accordance with federal, state, and Tribal management plans. Protect important raptor sites including active and alternate nest trees, preferred feeding sites, migratory corridors, wintering areas, and perch and roost trees. **Objective 2A6**	**Strategy a*:** Identify specific factors limiting/affecting raptor populations in the Spokane Subbasin by year 2010. **Strategy b*:** Determine present population levels and monitor for trends, including continued/increased monitoring of raptors and identification and mapping of new roosting sites. **Strategy c:** Develop, prioritize, and implement projects and/or research to address identified raptor limiting factors by year 2012.	Secondary effects of FCRPS and other subbasin effects to raptor populations
(14) Maintain or enhance populations of federal, state, local and Tribal species of special concern, and other native and desirable nonnative wildlife species, within their present and/or historical ranges within the Spokane Subbasin in order to prevent future declines and restore populations that have suffered declines. **Objective 2A7**	**Strategy a*:** Identify target species/guilds based on management needs and relationships to indicator species utilized in HEP loss assessments; identify specific factors limiting/affecting target species populations in the Spokane Subbasin by 2010. **Strategy b:** Develop, prioritize, and implement projects and/or research to address identified target species limiting factors by year 2012, with consideration of benefits achieved through mitigation for HEP loss assessment indicator species. **Strategy c*:** Determine present population levels and conduct trend monitoring.	Secondary effects of FCRPS and other subbasin effects to species of special concern populations

Objectives in Priority Order	Strategies	Limiting Factor(s) Addressed
(15) Identify, protect, maintain, restore, and enhance priority habitats (wetlands, riparian areas, upland forests, steppe and shrub-steppe, cliffs and rock outcrops (including caves and mines), in accordance with applicable agency, federal, state, local, and Tribal priority habitat designations), including their structural attributes, ecological functions, and distribution and connectivity across the landscape to optimize conditions required to increase overall wildlife productivity of desired species assemblages. Strategies may include land acquisition, conservation easements, management contracts, and/or partnerships with other landowners. **Objective 2B2***	**Strategy a**: Identify and map (using GIS) key habitat areas within focal habitats: upland forest, wetlands, riparian, shrub-steppe, and cliffs/rock outcrops/caves/mines. **Strategy b:** Acquire land management rights to key habitats through fee title acquisition, lease, conservation easement, or management agreement. **Strategy c:** Develop and implement management plans that address habitat protection, restoration, and/or enhancement, including access management, livestock management, soils and vegetation, nonnative species management, connectivity of habitats with other lands managed for terrestrial resources, and monitoring. **Strategy d:** Provide incentive program for private landowners to actively manage specific habitats to accomplish **Objective 2B2**. **Strategy e*:** Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Spokane Subbasin. **Strategy f:** Improve enforcement of existing state and Tribal hunting regulations and modify regulations as needed to increase protection/restoration of key wildlife populations.	Secondary effects of FCRPS and other subbasin effects to priority habitats

Objectives in Priority Order	Strategies	Limiting Factor(s) Addressed
(16) Increase the quantity and quality of mule deer habitats, particularly winter and spring habitats. **Objective 2B3**	**Strategy a:** Identify key mule deer winter and spring range and acquire land management rights to through fee title acquisition, lease, conservation easement, or management agreement. **Strategy b*:** Identify specific factors limiting/affecting mule deer populations; provide continuing funding to complete adequate inventory surveys and WDFW's Cooperative Mule Deer Project. **Strategy c:** Develop and implement management plans and projects to protect, restore, and/or enhance mule deer habitats. Management plans should address: • Vegetation management (manage forests for a variety of successional stages to meet mule deer habitat needs on a site-specific basis; use fire and forest management to increase quality and quantity of shrubs and mature forest cover; restore grasses and forbs where noxious weeds have impacted mule deer habitat; increase the area of hardwood (aspen) stands. • Access management (especially management of motorized traffic in critical mule deer spring and winter ranges). • Enforcement (improve enforcement of existing regulations; modify regulations as needed to achieve population targets). • Monitoring of effectiveness of management activities.	Secondary effects of FCRPS and other subbasin effects to mule deer habitats
(17) Complete mitigation requirements consistent with approved agreements in applicable federal licenses. **Objective 2B1**	No specific strategies identified.	Other subbasin effects associated with hydropower development

* = Objectives and strategies that are included in the RM&E plan.

26.4.2 Discussion of Terrestrial Prioritization

The ranking of the terrestrial objectives directly reflects the priorities established in the Council's 2000 Fish and Wildlife Program. The overall top priority terrestrial objective for the Spokane Subbasin is to fully mitigate for terrestrial resource losses incurred from construction and inundation of the Grand Coulee Project per the requirements of the Northwest Power Act. Within this objective, there are ten sub-objectives that have not been prioritized. All ten sub-objectives are considered to be equally high priority.

The next level of priority is quantifying and mitigating for the operational impacts of the FCRPS per the requirements of the Northwest Power Act. In the Spokane Subbasin, no assessment of operational impacts has been conducted. Therefore, this is the first priority in this category of objectives. Once the impacts have been identified the next priority will be to develop a mitigation plan and to implement the mitigation plan. The objective is to implement the initial mitigation plan for operational impacts by 2015.

The third priority in the IMP is to mitigate for secondary effects of the hydrosystem development in combination with other subbasin effects to terrestrial resources. In this category of objectives, the Spokane Subbasin Work Team ranked increasing sharp-tailed grouse and maintaining and increasing bald eagles as the highest priority. Sharp-tailed grouse are a Washington State threatened species and bald eagles are a federally-listed threatened species.

Protecting, enhancing, or restoring game species is next on the priority list, with reptiles and amphibians ranked ninth. The remainder of the objectives address secondary FCRPS and other subbasin impacts on other important species and/or habitats including: blue grouse, neo-tropical migrant birds, golden eagles, raptors, species of special concern, priority habitats, and mule deer habitats. The last objective on the list says to complete mitigation requirements consistent with approved agreements in applicable federal licenses. Although this is an important objective, it addresses FERC rather than FCRPS hydropower and so was placed low on the priority list for this plan.

SECTION 27 – Table of Contents

27 Spokane Research, Monitoring and Evaluation Plan

In light of the various ongoing efforts to develop a regional monitoring plan, subbasin planners the Intermountain Province (IMP) have chosen to develop a monitoring plan based on existing monitoring methods described in the scientific literature. The IMP approach to the Research, Monitoring and Evaluation (RM&E) is as follows:

- Research is handled separately from the M&E design. A wish list of research needs is identified based on the biological objectives, strategies and critical uncertainties identified in the Subbasin management plans and subbasin assessments. Many of the subbasin work teams developed preliminary research needs lists. Although there is an extensive "wish list" of research questions in the IMP, the limitations of available funding made it important to prioritize the research questions into two categories: "need to know" and "would like to know."

- For the M&E component, subbasin planners in the IMP developed a framework to link specific objectives and strategies identified in the IMP subbasin management plans to a suite of M&E protocols and existing programs (an M&E "tool box"). To do this a subcommittee of the OC identified a broad list of existing M&E protocols and existing M&E programs, which represent: peer reviewed, scientifically validated approaches to M&E; are appropriate to range of geographic scales; and include the range of the Independent Science Review Panel's (ISRP) three tiers of RM&E. Specific M&E objectives and strategies from each of the subbasin management plans, and from the province level, were then linked in Table 27.1 to:

    - The type of generic approach to addressing limiting factors that is addressed by the strategy or objective (same list used to categorize the inventory of projects)
    - The type of M&E protocol that would be most appropriate
    - Which ISRP M&E tier level of RM&E would be appropriate
    - Which of the "tool box" tools would be used.

The complete tool box bibliography is found in Appendix I. More detailed information on the process for developing the RM&E plan is found in Section 2.

Table 27.1. Spokane Subbasin research, monitoring, and evaluation plan

AQUATIC					
Strategy & Objective	**Strategy Type[1]**	**Monitoring Type[2]**	**Tier[3]**	**Scale[4]**	**Tool Box Tool[5]**
Subbasin Objective 1A1: Complete assessments of resident fish losses	1, 2, 3, 4, 5, 9, 10			1, 2, 3	1, 3, 4, 6, 8, 11, 12, 14, 17, 22, 26, 28
Strategy a: identify data gaps and critical information needs	1, 2, 3, 4, 5, 9, 10			1, 2, 3	1, 3, 4, 6, 8, 11, 12, 14, 17, 22, 26, 28
Strategy b: Continue filling data gaps	1, 2, 3, 4, 5, 9, 10			1, 2, 3	1, 3, 4, 6, 8, 11, 12, 14, 17, 22, 26, 28
Proposed Strategy c: Monitor entrainment.	2, 10			1, 2	17, 22
Subbasin Objective 1A2: Fully mitigate and compensate for resident fish losses…					
Proposed Strategy a: Following the completion of baseline data gathering…	1, 2, 3, 4, 5, 6, 9			1, 2, 3	1, 4, 5, 6, 9, 10, 14, 15, 16, 17, 18, 19, 20, 21, 23, 25, 26, 28
Subbasin Objective 1B1: Evaluate instream and riparian habitat quality and quantity…					
Strategy a: Continue stream and riparian habitat surveys …	1, 5, 6, 10			1, 2, 3	1, 4, 5, 6, 9, 10 . . .
Strategy b: Continue populating existing databases and develop new	1, 2, 3, 4, 5, 9, 10			1, 2, 3	1, 3, 4, 6, 8, 11, 12, 14, 17, 22, 26, 28
Strategy c: Inventory fish passage barriers by year 2010.	1, 3, 4, 5			1, 2, 3	23
Strategy d: Develop and utilize consistent barrier criteria and inventory methodology.	1, 3, 4, 5			1, 2, 3	23
Subbasin Objective 1B3: Meet or exceed applicable water quality standards					
Strategy b: Develop TMDL subbasin assessments	1, 2, 5			1, 2, 3	5, 9, 10
Subbasin Objective 1B4: Determine a range of flows suitable for protection and enhancement	1, 2, 3, 4, 5, 9, 10			1, 2, 3	1, 4, 5, 6, 9, 10, 14, 15, 16, 18, 19, 20, 21, 23, 25, 26, 28

AQUATIC					
Strategy & Objective	**Strategy Type[1]**	**Monitoring Type[2]**	**Tier[3]**	**Scale[4]**	**Tool Box Tool[5]**
Strategy a: Complete or initiate flow studies	1, 2, 3, 4, 5, 9, 10			1, 2, 3	1, 4, 5, 6, 9, 10, 14, 15, 16, 18, 19, 20, 21, 23, 25, 26, 28
Subbasin Objective 1B6: Evaluate heavy metal/organic/inorganic contamination as a limiting factor	1, 2, 5			1, 2, 3	5, 9, 10
Proposed Strategy a: Conduct the evaluation	1, 2, 5			1, 2, 3	5, 9, 10
Subbasin Objective 1C1: Assess the distribution and relative abundance of threatened and endangered species within the Spokane River Subbasin by year 2010.	1, 2, 4, 5, 6, 9			1, 2, 3, 4	4, 5, 6, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 25, 26, 27, 28
Subbasin Objective 2A1: Conduct baseline investigations to determine native resident and resident fish stock composition, distribution, and relative abundance in the Subbasin by year 2010.	1, 2, 3, 4, 5, 6, 8, 9, 10			1, 2, 3, 4	1, 4, 5, 6, 7, 8, 12, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28
Strategy a: Perform assessment of native salmonid stocks composition using DNA analysis or other appropriate techniques by 2010.	1, 2, 3, 4, 5, 6, 8, 9, 10			1, 2, 3, 4	1, 4, 5, 6, 7, 8, 12, 14, 15, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28
Strategy b: Continue surveys to determine fish species distribution and relative abundance	1, 2, 3, 4, 5, 9, 10			1, 2, 3	1, 3, 4, 6, 8, 11, 12, 14, 17, 22, 26, 28
Strategy c: Continue populating existing databases and develop new databases as appropriate.	1, 2, 3, 4, 5, 9, 10			1, 2, 3	1, 3, 4, 6, 8, 11, 12, 14, 17, 22, 26, 28
Subbasin Objective 2B2: Assess need for conservation aquaculture facilities					
Subbasin Objective 2C1: In the event anadromous fish return to the Spokane arm of Lake Roosevelt, the appropriate Tribes, agencies, and stakeholders will assess the feasibility of restoration of access and habitat throughout the remainder of the Spokane	1, 2, 3, 4, 5, 6, 8, 9, 10			1, 2, 3	1, 4, 5, 7, 11, 17, 20, 21, 26, 27, 28
Proposed Strategy a: Conduct the study.	1, 2, 3, 4, 5, 6, 8, 9, 10			1, 2, 3	1, 4, 5, 7, 11, 17, 20, 21, 26, 27, 28

AQUATIC					
Strategy & Objective	**Strategy Type[1]**	**Monitoring Type[2]**	**Tier[3]**	**Scale[4]**	**Tool Box Tool[5]**
Subbasin Objective 2C2: Upon the three-year review cycle of the subbasin plan, assess the status of anadromous fish in Lake Roosevelt.	1, 2, 3, 4, 5, 6, 8, 9, 10			1, 2, 3	1, 4, 5, 7, 11, 17, 20, 21, 26, 27, 28

[1]Strategy types:

1) Habitat Assessments
2) Population Assessments
3) Instream Diversion
4) Instream Passage
5) Instream Habitat
6) Riparian Habitat
7) Upland Habitat
8) Education/Coordination
9) Population Management
10) Reservoir Operations

[2]Monitoring Protocol e.g. type of monitoring protocol [note: the specific reference to detailed monitoring protocol is identified in the "tool box"]):

- TMDL
- Survey
- Survey and mapping
- HEP
- P/A and trend surveys
- All habitat

[3]ISRP Tier Level:

1) Tier 1: trend or routine monitoring
2) Tier 2: statistical (status) monitoring
3) Tier 3: experimental research (effectiveness) monitoring

[4]Scale of Monitoring and Evaluation:

1) Project
2) Subbasin
3) Province
4) Columbia Basin

[5] Tool Box Tool

The Tool Box is found in Appendix I.

TERRESTRIAL					
Strategy & Objective	**Strategy Type[1]**	**Monitoring Type[2]**	**Tier[3]**	**Scale[4]**	**Tool Box Tool[5]**
Province Level and Spokane Subbasin Objectives 1A: Mitigate for construction and inundation losses. By 2015.					
Proposed Strategy a (for Objectives 1A1-1A9): Identify and evaluate parcels….	1, 6, 7			1, 2, 3	29, 32, 33
Objective 1A11: Evaluate effectiveness of mitigation by monitoring and evaluating species and habitat responses to mitigation actions.	1, 2			1, 2, 3	29, 32, 33
Spokane Subbasin Objective 1B: Assess and mitigate the operational effects of the Grand Coulee Project in the Spokane Subbasin.					
Objective 1B1: Using third party contractor, perform assessment of operational impacts by year 2008.	1, 2			1, 2, 3	29, 32, 33
Proposed Strategy a: Have a third party impartial contractor conduct the assessment.	1, 2			1, 2, 3	29, 32, 33
Objective 2A1 Maintain bald eagle at or above present levels…					
Proposed Strategy a: Maintain secure bald eagle...	1, 2			1, 2, 3	29, 32, 33
Proposed Strategy c: Continue or increase monitoring…	1,2			1, 2, 3	29, 32, 33
Objective 2A2 Restore sharp-tailed grouse populations…	1,2				
Proposed Strategy a: Determine limiting factors on sharp-tailed grouse.					
Proposed Strategy b: Develop, prioritize, and implement projects and/or research to address identified sharp-tailed grouse limiting factors by year 2007.	1,2				
Proposed Strategy c: Assess current versus historical habitat …	1			1, 2, 3	29, 32, 33

TERRESTRIAL					
Strategy & Objective	Strategy Type[1]	Monitoring Type[2]	Tier[3]	Scale[4]	Tool Box Tool[5]
Proposed Strategy d: Assess and if deemed needed limit/restrict nonnative …	1, 2			1, 2, 3	29, 32, 33
Proposed Objective 2A3: Restore blue grouse populations...					
Proposed Strategy a: Determine limiting factors...	1, 2			1, 2, 3	29, 32, 33
Proposed Strategy b: Develop, prioritize, and implement projects and/or research to address identified blue grouse limiting factors by year 2007.	1, 2			1, 2, 3	29, 32, 33
Proposed Strategy c: Assess current versus historical habitat	1,2			1, 2, 3	29, 32, 33
Proposed Strategy d: Assess and if deemed needed limit/restrict nonnative …	1,2			1, 2, 3	29, 32, 33
Proposed Objective 2A4: Maintain or increase golden eagle populations…					
Proposed Strategy a: Determine limiting factors...	1, 2			1, 2, 3	29, 32, 33
Proposed Strategy b: Develop, prioritize, and implement projects and/or research to address identified limiting factors for golden eagles by 2007.	1, 2			1, 2, 3	29, 32, 33
Objective 2A6: Maintain raptor populations...					
Proposed Strategy a: Identify specific factors limiting/affecting raptor …	1, 2			1, 2, 3	29, 32, 33
Proposed Strategy b: Determine present population levels and monitor for trends.	1			1, 2, 3	29, 32, 33
Proposed Strategy c: Develop, prioritize, and implement projects and/or research to address identified raptor limiting factors by year 2012	1, 2			1, 2, 3	29, 32, 33

TERRESTRIAL					
Strategy & Objective	**Strategy Type[1]**	**Monitoring Type[2]**	**Tier[3]**	**Scale[4]**	**Tool Box Tool[5]**
Objective 2A7: Maintain or enhance populations of federal, state, local and Tribal species…					
Proposed Strategy a: Identify target species/guilds...	1, 2			1, 2, 3	29, 32, 33
Proposed Strategy b: Develop, prioritize, and implement projects and/or research to address identified target species limiting factors by year 2012, with consideration of benefits achieved through mitigation for HEP loss assessment indicator species.	1, 2			1, 2, 3	29, 32, 33
Proposed Strategy c: Determine present population levels and monitor for trends.	1,2			1, 2, 3	29, 32, 33
Objective 2A8: Neo-tropical migrant birds…					
Proposed Strategy b: Identify specific factors limiting/affecting neo-tropical bird…	1, 2			1, 2, 3	29, 32, 33
Proposed Strategy c: Determine present population levels.	1,2			1, 2, 3	29, 32, 33
Proposed Strategy d: Develop, prioritize, and implement projects and/or research to address identified neo-tropical bird population limiting factors by 2012.	1, 2			1, 2, 3	29, 32, 33
Objective 2A9: Amphibians and Reptiles…					
Proposed Strategy a: Identify specific factors limiting/affecting amphibian…	1, 2			1, 2, 3	29, 32, 33
Proposed Strategy b: Determine present population levels…	1,2			1, 2, 3	29, 32, 33
Proposed Strategy c: Develop, prioritize, and implement projects and/or research to address identified amphibian and reptile limiting factors by year 2012.	1, 2			1, 2, 3	29, 32, 33

TERRESTRIAL					
Strategy & Objective	**Strategy Type[1]**	**Monitoring Type[2]**	**Tier[3]**	**Scale[4]**	**Tool Box Tool[5]**
Objective 2B2: Identify, *protect,* maintain, restore, and enhance priority habitats…					
Proposed Strategy a: Identify and map using GIS	1, 2			1, 2, 3	29, 32, 33
Objective 2B3: Increase the quantity and quality of mule deer habitats, particularly winter and spring habitats.	2			1, 2, 3	29, 32, 33
Proposed Strategy b: Identify limiting factors…	1, 2			1, 2, 3	29, 32, 33

[1]***Strategy types:***

1) Habitat Assessments (includes monitoring)
2) Population Assessments (includes monitoring)
3) Instream Diversion
4) Instream Passage
5) Instream Habitat
6) Riparian Habitat
7) Upland Habitat
8) Education/Coordination
9) Population Management
10) Reservoir Operations

[2]***Monitoring Protocol e.g., type of monitoring protocol [note: the specific reference to detailed monitoring protocol is identified in the "tool box"]):***

- TMDL
- Survey
- Survey and mapping
- HEP
- P/A and trend surveys
- All habitat

[3]***ISRP Tier Level:***

1) Tier 1: trend or routine monitoring
2) Tier 2: statistical (status) monitoring
3) Tier 3: experimental research (effectiveness) monitoring

[4]***Scale of Monitoring and Evaluation:***

1) Project
2) Subbasin

3) Province
4) Columbia Basin

[5]Tool Box Tool

The Tool Box is found in Appendix I.

SECTION – 28 Spokane Subbasin Tables and Figures

Tables and figures are embedded within the text in sections 21 through 27.