SECTION 45 – Table of Contents

45 Lake Rufus Woods Subbasin Overview

Section 45 Lake Rufus Woods Subbasin Overview is adapted from the Lake Rufus Woods Subbasin Summary Report (2000).

45.1 Regional Context for Lake Rufus Woods Subbasin

The Lake Rufus Woods Subbasin is one of six subbasins within the IMP and is bounded in the west by the Okanogan Subbasin within the Columbia Cascade Province and to the east by the San Poil and Upper Columbia subbasins. The Subbasin is differentiated by the portion of the Columbia River and tributaries from Chief Joseph Dam to Grand Coulee Dam in north central Washington state.

45.2 Lake Rufus Woods Subbasin Description

45.2.1 General Location

Lake Rufus Woods is a 51-mile long Columbia River mainstem impoundment located in north central Washington. Lake Rufus Woods is bounded by Chief Joseph Dam at river mile (RM) 545.1 at its lower end, and Grand Coulee Dam at RM 596.6 at its upper end. The Colville Indian Reservation borders the entire north shoreline of the lake in Okanogan County and the southern portion of the Subbasin is located in Douglas County. The Nespelem River is the major tributary and enters Lake Rufus Woods at RM 582 (Figure 1). Several lakes and small tributary streams also provide fish habitat, most of which are located on the Colville Indian Reservation.

45.2.2 Drainage Area

The Lake Rufus Woods Subbasin encompasses approximately 915 square miles of Douglas and Okanogan counties. The watershed for the Nespelem River consists of 224 square miles and exists entirely on the Colville Confederated Tribes (CCT) (EPA 2000). A natural waterfall located at RM 1.5 historically blocked anadromous fish and continues to block adfluvial resident species from the majority of the Nespelem watershed. Coyote Creek is the only other watershed that could have sustained anadromous fish, but access was blocked to fish with the completion of Chief Joseph Dam.

45.2.3 Climate

The Subbasin has a continental climate that is influenced by maritime air masses from the Pacific coast. The average annual temperature is 9° C (49° F), with July being the warmest month and January being the coldest. The annual precipitation for the area is 27 cm (10.5 inches) with approximately 5 cm (21 inches) of snowfall (Weather Underground 2000).

45.2.3 Geology

The Lake Rufus Woods Subbasin lies on three geologic provinces: (1) the Kootenay Arc that the Nespelem River flows through, (2) the Okanogan subcontinent to the north, and (3) the Columbia Plateau to the south. The Kootenay Arc was the old coastal plain of North America in the Paleozoic period. The Okanogan subcontinent was a small island about the size of California off the west coast in the Mesozoic period. Both of these

collided into the Old North American continent to form the Okanogan highland area, which is mostly old granite folded in layers. The Plateau is a product of numerous volcanic eruptions that created the Miocene basalt flows and is comprised of fine-grained black basalt. A series of flood cannels, known as the Channeled Scablands, were created by floodwaters from glacial Lake Missoula (Alt and Hyndman 1984).

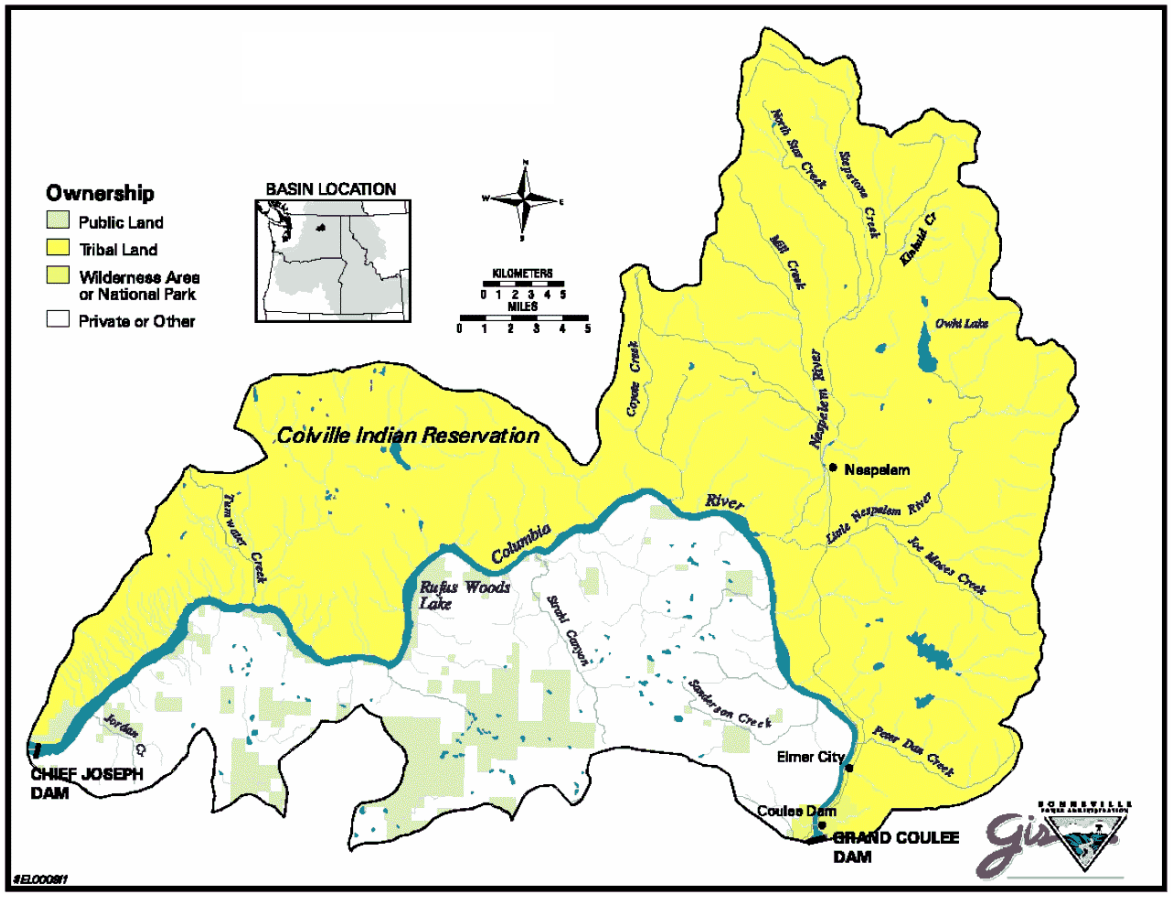


Figure 45.1. Lake Rufus Woods Subbasin

45.2.4 Soils

Soils in these areas are tied to elevation. In mountainous areas, the soil is mostly stony or gravelly sandy loams of one meter or less in depth. At lower elevations the soils are mostly glacial till consisting of glacial out-wash, sands, and gravels that are well drained. The Columbia Plateau has little to no soil on top of the basalt, thus the soil that is found here is mostly loess, a light brown silt loam (Alt and Hyndman 1984).

45.2.5 Vegetation

Shrub-steppe habitats dominate the western and southern portions of the Subbasin. Forested habitats of ponderosa pine and interior mixed conifer forest occur in the higher elevations of the northeastern portion of the Subbasin. Agriculture and related land uses

comprise over 16 percent of the area, primarily south of Lake Rufus Woods. The largest urban centers include Nespelem, Elmer City, and Coulee Dam.

Figure 45.2 shows the current distribution of wildlife-habitat types in the Lake Rufus Woods Subbasin based on IBIS (2003). A map of the historic vegetation of the IMP, including the Lake Rufus Woods Subbasin, is provided in Section 4, Terrestrial Resources in the Intermountain Province (Figure 4.1).

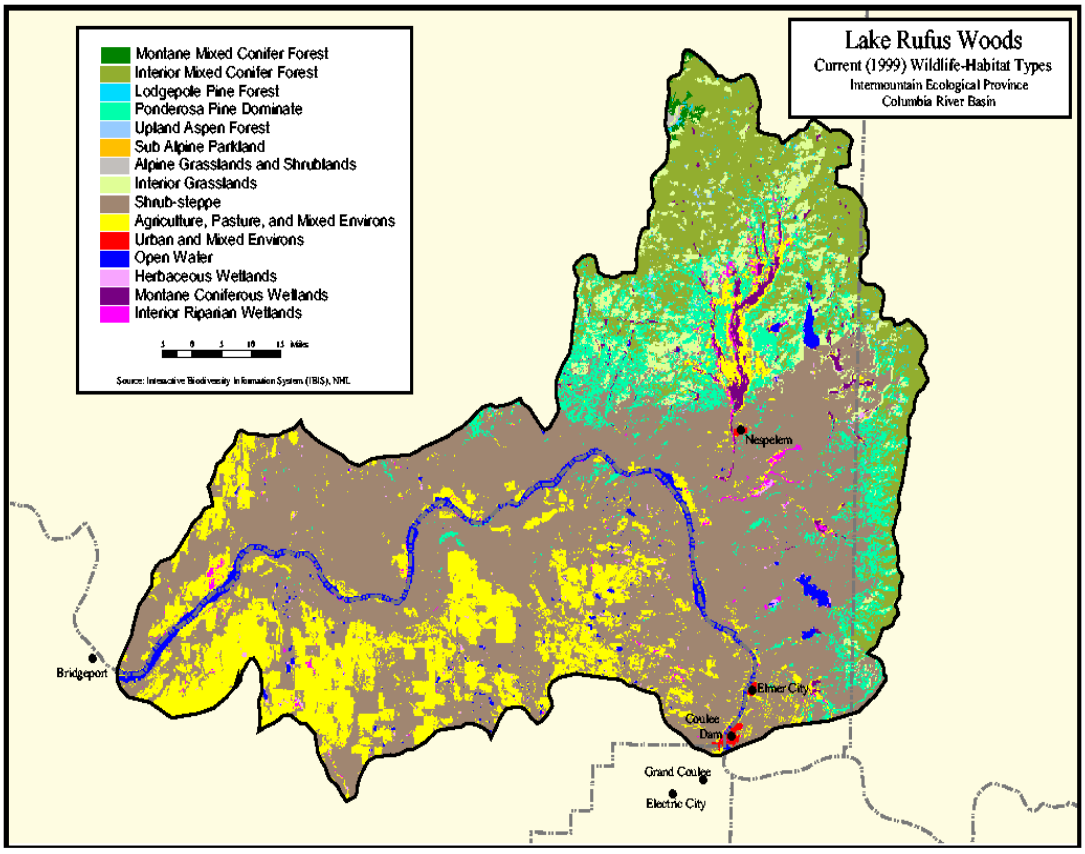


Figure 45.2. Habitat types in the Lake Rufus Woods Subbasin (*Source*: IBIS 1999)

45.2.6 Major Land Uses

The region north of the Columbia River is situated within the Colville Indian Reservation, while south of the Columbia River is mostly comprised of private or public lands (Figure 45.1).

Land uses include ranching, farming, and timber harvest. Private and Tribal lands at lower elevation are used to graze cattle mainly in the winter months. Agriculture (mostly hay fields) is common within the broad floodplains of the Nespelem River Valley.

Timber harvest is limited to the forested headwaters and tributary reaches. Human development in this area and along the Little Nespelem River has resulted in a highly altered river with considerable artificial confinement and water withdrawals. The United States Army Corps of Engineers (USACOE) has several land holdings along Lake Rufus Woods and has developed recreation sites mostly on the western end of the lake near Chief Joseph Dam. An improved boat ramp is available at Seton's Grove located 4 miles downstream of Grand Coulee Dam and two other unimproved boat ramps are located downstream of the Nespelem River mouth on the Colville Indian Reservation. Camping and boat lunch facilities maintained by the USACOE are located 3 miles upstream of the dam. Several shore fishing access sites are provided by the CCT along the northern shoreline but no public access is available along the southern shore of Lake Rufus Woods. With the development of a destination fishery at Lake Rufus Woods, managing people and access has become a larger issue recently and efforts to increase access and reduce impacts will be important to consider when evaluating for future fisheries management efforts.

Chief Joseph and Grand Coulee dams have severely altered the landscape of the Lake Rufus Woods Subbasin. Before construction of Grand Coulee Dam, the Columbia River flowed through the present day Lake Rufus Woods in a near natural state. The construction of Grand Coulee Dam has altered the quantity and timing of the Columbia River throughout much of the mainstem Columbia River, including the present day area of Lake Rufus Woods. In addition, the construction of Chief Joseph Dam changed much of the former large riverine system into the present day reservoir (Lake Rufus Woods). Both Grand Coulee and Chief Joseph dams and their lack of fish passage facilities have completely eliminated all anadromous forms of fishes that once migrated from the Pacific Ocean into the mainstem and tributaries of the Columbia River above the present day site of Chief Joseph Dam. The complete lack of passage has also impacted resident fish, especially adfluvial life history forms and wildlife that historically traveled along the Columbia River corridor.

The large amount of energy produced by Grand Coulee and Chief Joseph dams, along with the increased irrigation capabilities, has helped promote the development of the landscape into a heavily managed area. Agriculture, orchards, logging, and aquaculture operations all currently preside in the Lake Rufus Woods Subbasin (Jeff Korth, District Fish Biologist, WDFW, personal communication, 2003).

Road density in the Subbasin ranges from low to high, with much of the area in the moderate category. Figure 45.3 shows road density, by density class, for each sixth order watershed in the Lake Rufus Woods Subbasin. Road densities are highest on the Colville Reservation within the Smith Creek, Kincaid Creek, Coyote Creek, and upper Nespelem River watersheds, all having road densities greater than 3 mile/square mile (CCT 2000).

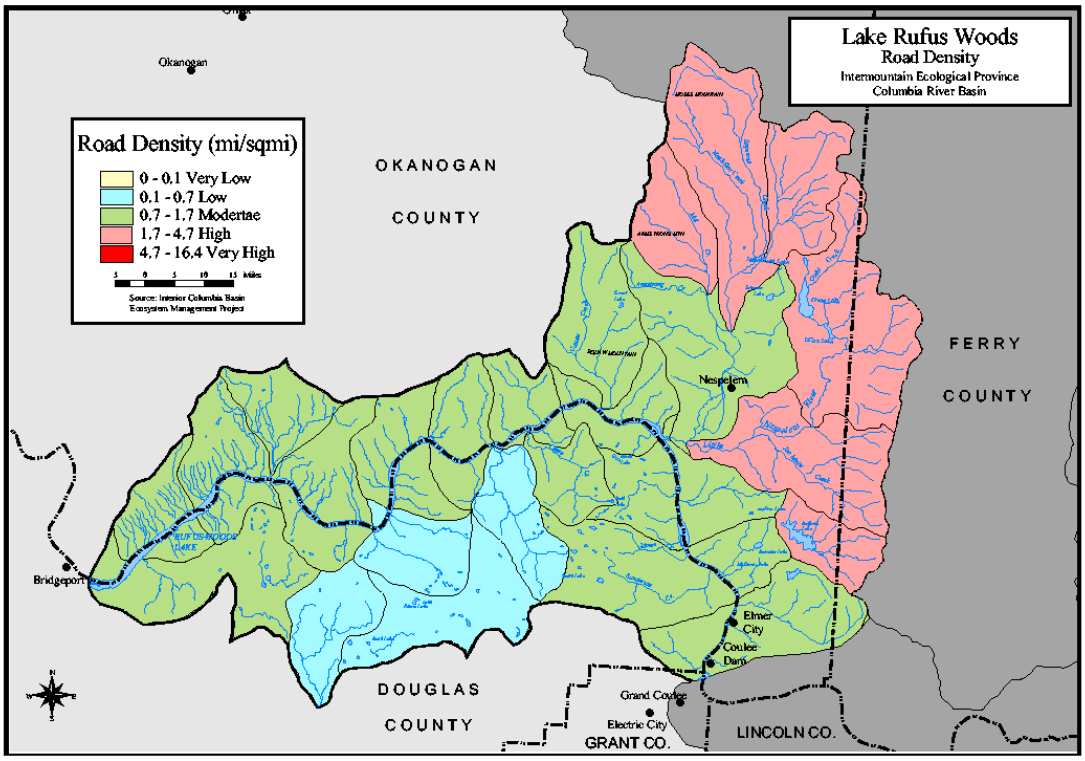


Figure 45.3. Road density in the Lake Rufus Woods Subbasin

45.3 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 46: Aquatic Assessment Lake Rufus Woods 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 50 Lake Rufus Woods Subbasin Management Plan. The terrestrial assessment, provided in Section 49, 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 50: Lake Rufus Woods Subbasin Management Plan.

SECTION 46 – Table of Contents

46 Lake Rufus Woods Subbasin Assessment – Aquatic[1]

46.1 Species Characterization and Status

Aquatic species that are potentially present within the Lake Rufus Woods Subbasin are listed in Table 46.1. All native anadromous salmon and Pacific lamprey have been extirpated from the region. Seven species listed as native to Washington have ranges that occur within the Lake Rufus Woods Subbasin but have not been recorded as present. The status of these species is listed as "within range." The remaining native species that have been observed above Grand Coulee are listed as "known upstream of Grand Coulee Dam." Bull trout and Chinook salmon are not currently present in this area (CCT 2000).

46.1.1 Lake Rufus Woods

Entrainment through Grand Coulee Dam from Lake Roosevelt has likely influenced the fish assemblage currently present in Lake Rufus Woods. Results of a 42-month entrainment study at Grand Coulee Dam confirmed that entrainment of fish from Lake Roosevelt significantly influence the fish populations in both Lake Roosevelt and Lake Rufus Woods (LeCaire 1999). Between 1996 and 1999 the average entrainment through Grand Coulee Dam was estimated using single-beam hydroacoustics at nearly 403,000 fish annually, totaling over 1.6 million fish throughout the study. Catch composition of fish observed in Lake Rufus Woods (Council 2000) are listed as "known" and presented in Table 46.1. Many of the fish present in Table 46.1 were not intentionally introduced into Lake Rufus Woods, but established populations after being entrained from Lake Roosevelt.

46.1.2 Nespelem River

Fish present in the Nespelem River represent a largely nonnative assemblage of naturalized salmonid species that have persisted in altered habitat conditions (Hunner and Jones 1996). These species include brook trout (*Salvelinus fontinalis*), brown trout (*Salmo trutta)*, and rainbow trout (*O. mykiss*) (Hunner and Jones 1996). Other species present include bridgelip sucker (*Catastomus columbianus*), sculpin (*Cottus sp*.), dace (*Rhinichthys sp*.) and mountain whitefish (*Prosopium williamsoni*) (Hunner and Jones 1996).

46.1.3 Lakes

Numerous lakes that support fisheries are located within the Lake Rufus Woods Subbasin. A majority of these lakes are located within the boundary of the Colville Reservation. Many of the lakes within the Subbasin support either naturalized or continuously stocked populations of rainbow trout and/or eastern brook trout, while Buffalo Lake is the only lake within the Subbasin that contains population of kokanee salmon. Largemouth bass fisheries are also present in some lakes within the Subbasin. Management of the lakes primarily consists of stocking and monitoring naturalized salmonids to support subsistence and recreational fishing opportunities and managing

[1] Portions of Section 46 were contained within the Lake Rufus Woods Subbasin Summary Report (2000) p. 2.

self-sustaining warmwater sport fishes where habitats are not conducive to salmonid management.

Table 46.1. List of Fish Species Occurring Within the Lake Rufus Woods Subbasin

Species	Common Name	Origin	Status
Acipenser transmontanus	white sturgeon	native	known[1]
Acrocheilus alutaceus	chiselmouth	native	known above Grand Coulee[3]
Catostomus catostomus	longnose sucker	native	known[2]
Catostomus columbianus	bridgelip sucker	native	known[2]
Catostomus macrocheilus	largescale sucker	native	known[2]
Catostomus platyrhynchus	mountain sucker	native	within range[5]
Coregonus clupeaformis	lake whitefish	introduced	known above Grand Coulee[3]
Cottus asper	prickly sculpin	native	known[6]
Cottus bairdi	mottled sculpin	native	not identified to spp.[2]
Cottus beldingi	piute sculpin	native	known above Grand Coulee[3]
Cottus cognatus	slimy sculpin	native	not identified to spp.[2]
Cottus confusus	shorthead sculpin	native	not identified to spp.[2]
Cottus rhotheus	torrent sculpin	native	not identified to spp.[2]
Couesius plumbeus	lake chub	native	within range[5]
Cyprinus carpio	common carp	introduced	known[2]
Esox lucius	northern pike	introduced	within range
Gasterosteus aculeatus	three-spine stickleback	native	within range[5]
Ictalurus melas	black bullhead	introduced	within range
Ictalurus nebulosus	brown bullhead	introduced	known[2]
Ictalurus punctatus	channel catfish	introduced	within range
Lampetra tridentata	Pacific lamprey	native	within range[5]- extirpated
Lepomis cyanellus	pumpkinseed	introduced	known[7]
Lepomis macrochirus	bluegill sunfish	introduced	within range
Lota lota	burbot	native	known[2]
Micropterus dolomieui	smallmouth bass	introduced	known[2]
Micropterus salmoides	largemouth bass	introduced	known[7]
Mylocheilus caurinus	peamouth	native	known[2]
Oncorhynchus clarki	cutthroat trout	native	known above Grand Coulee[6]
Oncorhynchus gorbuscha	pink salmon	native	within range[5] - extirpated
Oncorhynchus keta	chum salmon	native	within range[5]- extirpated
Oncorhynchus kisutch	coho salmon	native	within range[5] - extirpated
Oncorhynchus mykiss	rainbow trout	native	known[2]
Oncorhynchus nerka	sockeye salmon	native	within range[5] - extirpated
Oncorhynchus nerka	kokanee salmon	native	known[2]
Oncorhynchus tshawytscha	Chinook salmon	native	known[4] - extirpated

Species	Common Name	Origin	Status
Perca flavescens	yellow perch	introduced	known[2]
Percopsis transmontanus	sandroller	native	within range[5]
Pomoxis annularis	white crappie	introduced	known above Grand Coulee[3]
Pomoxis nigromaculatus	black crappie	introduced	known above Grand Coulee[3]
Prosopium williamsoni	mountain whitefish	native	known[2]
Ptychocheilus oregonensis	northern squawfish	native	known[2]
Rhinichthys cataractae	longnose dace	native	within range[5]
Rhinichthys falcatus	leopard dace	native	within range[5]
Rhinichthys osculus	speckled dace	native	within range[5]
Richardsonius balteatus	redside shiner	native	known[2]
Salmo trutta	brown trout	introduced	known[2]
Salvelinus confluentus	bull trout	native	known[3]
Salvelinus fontinalis	brook trout	introduced	known[2]
Salvelinus namaycush	lake trout	introduced	introduced range[5]
Stizostedion vitreum	walleye	introduced	known[2]
Tinca tinca	tench	introduced	known[2]

[1] Anders and Powell 1999
[2] D. Venditti pers. Comm. 1999
[3] Griffith and McDowell 1996
[4] Fish and Hanavan 1948
[5] Wydoski and Whitney 1979
[6] Powell et al. 2002
[7] Arterburn 2003

46.2 Focal Species Selection

Five focal species were selected in the Lake Rufus Woods Subbasin. These species include Chinook salmon, kokanee salmon, brook trout, rainbow trout, and white sturgeon. The rationale for selection, historic and current status, and current management for each focal species is provided in Sections 46.3, 46.4, 46.5, and 46.6. Three other species, Pacific lamprey, burbot, and walleye were chosen as species of interest. Species of interest were chosen due to their historic, current, or the future possibility of being an important ecological, subsistence, or recreational fish species within the Lake Rufus Woods Subbasin. Although these species were not chosen by the technical team as focal species, strategies and objectives derived by the Lake Rufus Woods work team included these species.

46.3 Focal Species – Chinook Salmon

Chinook salmon were selected as a focal species for the Lake Rufus Woods Subbasin because of their cultural significance to the Colville Confederated Tribes (CCT), their potential recreational value as a sport fish, and to address concerns regarding native species conservation. Chinook salmon were also included as a focal species because of the possibility that they will be reintroduced into the Subbasin. Currently the CCT

are evaluating the potential for the reintroduction of Chinook salmon in the Lake Rufus Woods Subbasin.

Chinook salmon are sometimes referred to as king, tyee, spring, and quinnat salmon. Chinook salmon are indigenous to the northern half of the Pacific Coast of North America (Meehan and Bjornn 1991), and are of great commercial and recreational importance within this area. Chinook salmon are most abundant in the large river systems, although they may be present in various sized rivers and streams. Although they have been stocked into many lakes and reservoirs throughout North America, they are usually not self-sustaining in these systems.

Chinook salmon display a great deal of variation in the timing of adult migration, juvenile migration, and spawning. One hundred eight stocks of Chinook salmon were identified in the State of Washington alone (Wydoski and Whitney 2003). Historically, Chinook salmon migrated to the headwaters of the Columbia River in Canada, but since the construction of Grand Coulee Dam and the subsequent construction of Chief Joseph Dam, their upstream terminus is river mile 545 (Wydoski and Whitney 2003).

46.3.1 Historic Status

Prior to hydroelectric development, Chinook salmon migrated up the Columbia River as far inland as British Columbia, with estimates of several million adults making annual migrations (Behnke 2002). The Lake Rufus Woods Subbasin is considered to be within the historic habitat area for Chinook salmon in the Upper Columbia River basin (Thurow et al. 2000).

Spring Chinook salmon are known to have existed in the areas above Chief Joseph Dam. As part of the Grand Coulee Fish Maintenance Project, it called for combining the gene pool for spring Chinook from the Wenatchee, Entiat, Methow, and upper Columbia River tributaries upstream of Grand Coulee Dam (Chapman et al. 1995). The “June Hogs” that historically existed within the upper Columbia River are thought to have been spring Chinook, based on the timing of the run. The peak of the spring Chinook run occurs at Rock Island Dam around mid-May and spring Chinook would likely arrive above Grand Coulee Dam after this time and be available for harvest at Kettle falls and other noted fisheries until spawning in July. Analysis of available genetic information indicates that spring Chinook and summer/fall Chinook differ substantially. Each group belongs to a different distinct evolutionary lineage within the Columbia River. Non-overlapping allele frequencies at many loci contributed to the distinction of these two groups (Chapman et al. 1995). Current listings (NMFS 1998) indicate fish from upriver areas above Chief Joseph and Grand Coulee dams are considered within the Upper Columbia Spring or Summer/Fall Chinook ESU. Chief Joseph Dam located at river kilometer (RK) 879 was built within a major historic fall Chinook spawning area identified in 1946 from RK 809-960 the present site of Grand Coulee Dam is RK 960 (Dauble et al. 2003; Fish and Hanavan 1948).

46.3.2 Current Status

The construction of Chief Joseph and Grand Coulee dams and their lack of fish passage facilities blocked migration of all anadromous salmon and steelhead and extirpated them from the Subbasin. Current trends in abundance and distribution of resident Chinook salmon above Chief Joseph Dam is unknown, but presumed to be extinct. Genetic variation and diversity historically present within Chinook salmon stocks above Chief Joseph and Grand Coulee dams are presumed to have been lost. Recent studies compared current habitat conditions upstream of Chief Joseph Dam with those found within the Hanford reach. Current habitat conditions were found to be the most similar of any Columbia River reach and therefore represent the best available habitat for restoring fall Chinook salmon in the Upper Columbia ESU. However, passage issues still need to be addressed at Chief Joseph Dam (Dauble et al. 2003).

The Nespelem River barrier falls at RM 1.5 along with water temperatures and other factors could limit the carrying capacity of this system for Chinook salmon production. Effective strategies such as controlling lake elevations for increasing Chinook salmon habitat above Chief Joseph Dam should be investigated to maximize recovery potential.

46.3.3 Current Management

Incidental take of any resident Chinook salmon within the Lake Rufus Woods Subbasin falls under the guidelines outlined for "trout" by Washington Department of Fish and Wildlife (WDFW) and the CCT (WDFW 2003). Regulations for Colville Tribal members are set by the CCT Fish and Wildlife Department and provide for no daily or possession limits for trout in all waters of the Lake Rufus Woods Subbasin located on the Colville Indian Reservation. Non-Tribal members are allowed only 2 trout per day by both the CCT and State of Washington with a possession limit of two times the daily bag limit. The Nespelem River and all other tributary streams located on the Colville Reservation are closed to non-Tribal member anglers.

The CCT are currently studying the feasibility of reintroducing fall Chinook salmon back into areas of the mainstem Columbia River above Chief Joseph Dam. Evaluating the current spawning habitat available and identifying potential limiting factors are their first priority in evaluating the potential for the reintroduction of fall Chinook salmon in the Lake Rufus Woods Subbasin. Battelle Memorial Institute (2001) was contracted by the CCT to evaluate the physical characteristics of potential fall Chinook salmon spawning habitat in upper Lake Rufus Woods from Grand Coulee Dam tailrace (rkm 956) downstream to Coyote Creek (rkm 928). The objectives of this study were to estimate the quantity and location of potential spawning habitat and to estimate redd capacity of the area based on spawning habitat characteristics and lake level.

Although velocity and depth are possibly limiting many study areas from meeting the current criteria for Fall Chinook spawning habitat, results indicate there is available habitat under the current conditions. Conservative estimates of redd capacity within

the potential spawning habitat range from 79-1,599 redds, while less conservative methods estimate redd capacity between 207-6,951 redds. Although this study builds a foundation, further studies on other portions of Fall Chinook life cycle may be needed to evaluate the reintroduction of fall Chinook into the Lake Rufus Woods Subbasin. This study did not consider tributary areas that could be used by steelhead or spring Chinook when developing these estimates. Passage at Chief Joseph Dam may provide access to habitats beyond the current terminus for a wide variety of species. Further studies reviewing possible passage options at Chief Joseph Dam, species interactions, habitat use, survival of juveniles, and smolt out-migration would provide additional insight on the subject of Chinook reintroductions into the Lake Rufus Woods Subbasin.

46.3.4 Limiting Factors – Chinook Salmon

The lack of a fish passage program at Chief Joseph Dam is currently the primary factor eliminating Chinook salmon presence in the Lake Rufus Woods Subbasin. The CCT have evaluated the upper portions of Lake Rufus Woods and concluded that spawning habitat is available. The amount of Chinook salmon spawning habitat within the Subbasin was likely underestimated since the Nespelem River was not evaluated. Chinook salmon were not analyzed using the QHA model since they are not currently present within the Subbasin. Current strategies to improve tributary habitats may have benefits to Chinook salmon spawning and rearing habitat, although these habitats would not be utilized until fish passage is provided at Chief Joseph Dam.

46.4 Focal Species – Kokanee Salmon

Kokanee were selected as a focal species for this Subbasin because of their subsistence value, their recreational value as a sport fish, and their ecological significance among the aquatic habitat within the Subbasin.

The salmon *Oncorhynchus nerka* occurs in two forms: the anadromous sockeye salmon, and the nonanadromous or resident kokanee salmon. Kokanee are distributed from the Columbia River system in the South to northern Alaska (Meehan and Bjornn 1991). Kokanee are usually smaller than sockeye salmon, since adult rearing takes place in less productive lake environments rather than the productive Pacific Ocean.

Kokanee are fall spawners and spawn in either tributaries to nursery lakes or within suitable habitat along the shores of lakes. Substrate composition, cover, water quality, and water quantity are important habitat elements for spawning kokanee salmon (Meehan and Bjornn 1991). Planktonic crustaceans are the primary food source for juvenile and adult kokanee salmon (Meehan and Bjornn 1991).

Kokanee are a very popular game fish because of their excellent tasting flesh. Native stocks of kokanee salmon within the Columbia River system may be important for the conservation and the possible future reintroduction of sockeye salmon, since stocks of kokanee salmon may contain genetic material from stocks of extirpated sockeye salmon.

46.4.1 Historic Status

Prior to impoundment, the Columbia River provided a migration corridor for abundant stocks of sockeye salmon from as far upstream as British Columbia (Behnke 2002). Historically, the upper Columbia River likely supported large numbers of both life history types for *Oncorhynchus nerka*, resident or adfluvial kokanee and anadromous sockeye salmon (Fish and Hanavan 1948; Behnke 2002).

Passage for sockeye salmon was blocked with the construction and lack of fish passage facilities of both Chief Joseph and Grand Coulee dams, altering fish assemblages to resident and adfluvial forms. "Landlocked" or kokanee salmon currently persist in the Columbia River above Grand Coulee Dam. Stocking of kokanee salmon was initiated within the upper Columbia River to address declining fisheries. Kokanee stocks from various locations within Washington state and British Columbia have been used as broodstock sources for captive propagation (Spokane Tribal Hatchery HGMP). The primary hatchery stock of kokanee in this area that are released into Lake Roosevelt are derived from Lake Whatcom in western Washington. Kokanee derived from the Lake Whatcom stock were first introduced into the Subbasin in the 1930s and have been the primary source for the Lake Roosevelt Hatchery production program and are the parental origin of the self-sustaining Buffalo Lake population. The majority of naturalized kokanee salmon that occur in the Lake Rufus Woods spawn in the Nespelem River. An additional source of kokanee salmon found in Lake Rufus Woods are from entrainment through Grand Coulee Dam from Lake Roosevelt. Genetic analysis has identified the Nespelem River kokanee salmon stock as a similar stock to the San Poil River stock, located upstream of Grand Coulee Dam. Genetic analysis has identified the San Poil/Nespelem stock as divergent from other hatchery stocks used to supplement kokanee populations in Lake Roosevelt with limited success. The San Poil/Nespelem stock is phenotypically (obtain larger size than hatchery stocks) and genotypically different from hatchery stocks (John Arterburn, Fish Biologist, CCT, personal communication, 2003).

46.4.2 Current Status

Both naturalized and artificially propagated kokanee salmon are present in Lake Rufus Woods. The largest naturalized stocks originate from the lower Nespelem River, where the majority of kokanee spawning occurs. Although there are no current stocking programs for kokanee salmon in Lake Rufus Woods, a large number of kokanee entrain through Grand Coulee Dam into Lake Rufus Woods. Genetic analysis has indicated that the lower Nespelem stock of kokanee salmon are most similar to the San Poil River stock, located above Grand Coulee Dam (John Arterburn, Fish Biologist, CCT, personal communication, 2003). Although still in a developmental state, it is hypothesized that these two stocks of kokanee were sockeye salmon that changed their life history strategy with the completion of Grand Coulee and Chief Joseph dams. Although many hatchery origin stocks of kokanee salmon have been stocked into Lake Roosevelt, the lower Nespelem and San Poil River stocks are genetically and phenotypically different than the many hatchery origin stocks found in Lake Roosevelt.

Table 46.2. Percent of Total Catch, By Species, in Experimental Gill Nets Set in the Grand Coulee Dam Forebay

Species	Percent
Kokanee	53%
Rainbow trout	36%
Walleye	2%
Lake whitefish	4%
Chinook	1%
Yellow perch	<1%
Burbot	<1%

(*Source:* LeCaire 1999)

LeCaire (1999) summarized 1999 collection reports from the Rock Island Dam bypass facility, which captured 986 kokanee and 234 floy-tagged rainbow trout that were released behind Grand Coulee Dam in 1998 and 1999. Data suggest that fish entraining through Grand Coulee Dam may continue to entrain downstream (for example, Chief Joseph Dam), although estimates of total fish migrating to that point do not exist.

A self-sustaining population of kokanee salmon spawn in the Nespelem River (below the falls at RM 1.5) and migrate to rear in Lake Rufus Woods (LeCaire 1999). Preliminary genetic results suggest that this adfluvial population of kokanee salmon is a distinct stock. The Nespelem River kokanee are more similar to the Lake Roosevelt composite stock and North Arm Kootenay Lake stock than the main stock in Lake Rufus Woods and Lake Whatcom stock (LeCaire 1999).

Since 1995, adult kokanee returns have been monitored annually in the lower Nespelem River with adult returns ranging from 6 to 389 in 1997 and 1999, respectively (Table 46.3). Upstream migration into the Nespelem River begins as early as mid-July and spawning occurs between August and November (LeCaire 1999). However, behavior of juvenile fish is unknown. Redd capping attempts have been unsuccessful due to unusually high flows during the spring months (LeCaire 1999). It is hypothesized that juvenile fish migrate to the reservoir shortly after emergence in the spring (Council 2000).

Table 46.3. Lower Nespelem River Adult Kokanee Escapement 1995-1999

Year	Species	Number
1995	Kokanee	Est. 35-100
1996	Kokanee	18
1997	Kokanee	6
1998	Kokanee	70-100
1999	Kokanee	389

The Washington Department of Game (WDG) began stocking Lake Whatcom stock kokanee salmon into Buffalo Lake in 1946 and today this population is self-sustaining (Arterburn 2003). Buffalo Lake is the only lake on the Colville Reservation that contains kokanee salmon, while providing fishing opportunities for rainbow trout,

brook trout, largemouth bass, and pumpkinseed sunfish. Buffalo Lake is one of the more popular fisheries on the Colville Reservation and angler usage in the 1970s was around 8,000 angler-days per year and average catch rate estimates were 2.5 fish per hour for an annual harvest of 20,000 trout between 7 and 13 inches in length, however the creel data could not be confirmed (Arterburn 2003). Rainbow trout and kokanee salmon have and continue to make up the majority of the game fish catch at Buffalo Lake. Although some limited natural recruitment of kokanee salmon occurs, the stream that enters this lakes southeast bay has insufficient fall flow to provide natural recruitment. Therefore, it is hypothesized that kokanee in Buffalo Lake utilize spring areas to spawn along the lake's shoreline.

46.4.3 Limiting Factors Kokanee Salmon

Kokanee are a lake species that utilize riverine habitat mostly for spawning, thus were included in the QHA approach to identify potential limiting factors to the life stage, spawning and incubation. Details of the QHA process are provided in Section 3.

Kokanee are currently present in nine of the 38 reaches within the Subbasin. The nine reaches were considered part of the historic distribution for comparison of past and present habitat conditions. The reaches include all of Lake Rufus Woods and the confluences of the Nespelem River and Coyote Creek with Lake Rufus Woods.

Based on QHA model, habitat attributes with the greatest deviation from reference conditions are shown in Table 46.4. Lower Coyote Creek received the top ranking for the largest change from historic conditions. This reach has an obstruction listed as the top alteration followed by a change in low flow conditions, habitat complexity, channel stability, fine sediments, and pollutants. The other top ranked reaches other than Lower Coyote Creek includes the entire reservoir, Lake Rufus Woods, and outlet of the Nespelem River. The attribute rankings of these reaches indicate that the flow regime and dissolved gas levels have experienced the greatest modification from reference conditions. In this area oxygen is not depleted, but total dissolved gas levels (TDG) are in excess of the 110 percent water quality standard during spill periods. The change in the hydrologic regime is attributed to operations of Chief Joseph and Grand Coulee dams.

Reaches ranked most similar to reference conditions, or highest for protection, are shown in Table 46.5. The top two reaches for protection included key kokanee spawning and rearing areas, the outlet of Coyote Creek and Nespelem River.

The tornado diagram (Table 46.6) and maps (Map LRW-1, Map LRW-2, located at the end of Section 46) presents the reach scores for both current habitat condition (ranging from zero to positive one, Map LRW-1) and protection (ranging from zero to negative one, Map LRW-2). 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.

Based upon the data collected during the QHA analysis it is important to understand that most model outputs are only as good as the data that is entered into them. Data that are lacking or inaccurate are likely to produce erroneous results. Within the Lake Rufus Woods Subbasin, lack of data makes interpreting QHA results highly subjective due to the distinct lack of confidence in the data used for this model. Confidence scores for protection ratings in the Lower Nespelem River was the only reach where sufficient confidence in the data existed to produce reliable results. Confidence results identified some data gaps existed for all other reaches; therefore anyone attempting to utilize the QHA assessment for making substantive decisions should do so with caution. In most cases current habitat conditions had better data and historic habitat ratings were largely considered speculative because this species was undocumented prior to completion of Chief Joseph Dam.

Spawning habitat is limited in the Subbasin to the confluences of the Nespelem River and Coyote Creek with Lake Rufus Woods. An estimated 90 percent of kokanee production for the entire Subbasin occurs in the Nespelem River reach (John Arterburn, Fish Biologist, CCT, personal communication, 2003). The QHA results show that these two reaches need protection, but also could benefit from some restoration. Small restoration projects may provide proportionally larger biological gains considering the ecological significance and contribution of the reaches. For example, the lower reach of Coyote Creek may benefit most by the removal of an obstruction whereas the lower Nespelem River may benefit from improvements to channel stability, protection of the riparian areas, and maintaining low flows along this reach.

Table 46.4. Ranking of reaches with the largest deviation from the reference habitat conditions for kokanee salmon in the Lake Rufus Woods 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
5	Lower Coyote Creek	1	0.2	8	2	2	2	8	2	8	7	8	2	1
8	Nespelem Bar	2	0.1	6	4	6	6	1	1	1	6	6	4	6
9	Buckley Bar	2	0.1	6	4	6	6	1	1	1	6	6	4	6
1	Chief Joe Dam	4	0.1	5	4	5	5	5	5	2	5	5	3	1
10	Upper Rufus Woods Reservoir	5	0.1	6	5	6	6	1	1	1	6	6	4	6
11	Coulee Dam Tailrace	6	0.1	5	5	5	5	1	1	1	5	5	4	5
13	Lower Nespelem River	7	0.1	6	1	5	6	3	6	6	1	4	6	6
2	Lower Rufus Woods Reservoir	8	0.1	4	3	4	4	4	4	1	4	4	2	4
4	Middle Rufus Woods Reservoir	8	0.1	4	3	4	4	4	4	1	4	4	2	4

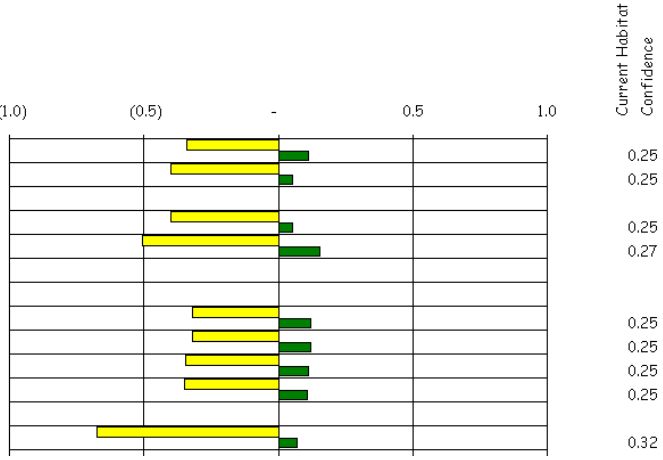
Table 46.5. Ranking of streams whose habitat is most similar to the reference condition for kokanee salmon in the Lake Rufus Woods Subbasin in comparison to other reaches. A reach rank equal to 1 reveals the reach with current conditions most similar to reference conditions in comparison to other reaches. 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
13	Lower Nespelem River	1	-0.67	11	8	9	5	4	1	1	5	10	1	7
5	Lower Coyote Creek	2	-0.51	10	3	7	3	1	7	1	6	9	3	10
2	Lower Rufus Woods Reservoir	3	-0.40	9	6	9	9	1	1	7	1	1	8	1
4	Middle Rufus Woods Reservoir	3	-0.40	9	6	9	9	1	1	7	1	1	8	1
11	Coulee Dam Tailrace	5	-0.35	9	1	9	9	5	5	5	1	1	8	1
10	Upper Rufus Woods Reservoir	6	-0.34	9	4	9	9	5	5	5	1	1	8	1
1	Chief Joe Dam	7	-0.34	8	5	8	8	1	1	6	1	1	7	8
8	Nespelem Bar	8	-0.32	9	4	9	9	4	4	4	1	1	8	1
9	Buckley Bar	8	-0.32	9	4	9	9	4	4	4	1	1	8	1

Table 46.6. Tornado diagram for kokanee salmon in the Lake Rufus Woods 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

Sequenc	Reach Name	Protection Confidence	Current Habitat Confidence
1	Chief Joe Dam	0.33	0.25
2	Lower Rufus Woods Reservior	0.33	0.25
3	Big Goose Lake	NP	
4	Middle Rufus Woods Reservior	0.33	0.25
5	Lower Coyote Creek	0.37	0.27
6	Middle Coyote Creek	NP	
7	Upper Coyote Creek	NP	
8	Nespelem Bar	0.33	0.25
9	Buckley Bar	0.33	0.25
10	Upper Rufus Woods Reservior	0.33	0.25
11	Coulee Dam Tailrace	0.33	0.25
12	Buffalo Lakes	NP	
13	Lower Nespelem River	0.47	0.32



46.4.4 Current Management

Current management of kokanee salmon in the Lake Rufus Woods Subbasin emphasizes protecting the lower Nespelem River spawning area, while enhancing and protecting other spawning locations throughout the Subbasin. Managers would like to develop an artificial production program that will supplement the lower Nespelem River, San Poil River, and Lake Roosevelt with genetically pure stocks that originate from unique naturalized stocks of kokanee salmon. Considerable data gaps exist for Lake Rufus Woods regarding entrainment, immigration from Lake Roosevelt and Banks Lake, juvenile habitat utilization, survival, possible impacts from fish passage at Chief Joe Dam, nonnative predation, competition, disease, and other influences that could impact kokanee residing in Lake Rufus Woods. Further studies examining these issues would be beneficial to the kokanee salmon populations within the Subbasin.

Current statewide and Colville Tribal regulations for non-Tribal members on kokanee for Lake Rufus Woods allow the harvest of two kokanee per day with no minimum size limits (WDFW 2003). All wild kokanee caught in Nespelem River Bay from July 15 to November 30 must be released immediately (WDFW 2003), (CCT 2004). Rivers on the Colville Reservation within the Lake Rufus Woods Subbasin are closed year-round to non-Tribal member fishing. Tribal members are allowed to fish in all areas of the Colville Reservation year-round with no bag or possession limits. Buffalo Lake provides angling opportunities for kokanee salmon for non-Tribal members from April 13 to October 31 and extended from January 1 to March 15 with the purchase of a special winter fishing season permit. The bag limit for Buffalo Lake kokanee is 15 for non-Tribal members.

46.5 Focal Species – Brook Trout

Brook trout were selected as a focal species for the Lake Rufus Woods Subbasin for their important recreational value, their subsistence value, and suitability to current habitat conditions. Brook trout are an introduced species and inhabit many of the higher elevation tributaries and lakes where other native game fishes are currently absent. The brook trout is indigenous to eastern North America and have been introduced throughout the other regions of the United States. In Washington state brook trout are most common in the northeast. Brook trout prefer cool, clear, headwater ponds and streams fed by springs (Wydoski and Whitney 2003). Brook trout are prevalent in streams on the Colville Reservation even with degraded habitat conditions, including warmwater temperatures exceeding 20 ºC and high levels of sedimentation (>60 percent) (CCT 2000). They provide one of the dominant fisheries in these settings within the Subbasin. Although brook trout are an important fish in the Lake Rufus Woods Subbasin, they are known to compete with native trout through direct competition and/or displacement (Wydoski and Whitney 2003).

46.5.1 Historic Status

Brook trout are not native and were introduced in the early 1900s with the establishment of the Owhi Lake population. Brook trout were observed by Tribal members as early as 1913 and were available in large numbers by 1930. Owhi Lake provided a readily available source of eggs, which were used in artificial propagation programs (Hunner et al. 2000). Historical stocking data indicate that brook trout were introduced to the Subbasin in the 1930s to augment depressed fisheries (Thiessen 1965; Halfmoon 1978). Early stocking efforts (1930-1989) included both lacustrine and fluvial habitats. Today, only lacustrine habitats are stocked and fisheries management efforts are solely conducted by the CCT. Brook Trout are preferred as a subsistence fish by many Colville Tribal members due to a taste and consistency that is closer to salmon than other trout (John Arterburn, Fish Biologist, CCT, personal communication, 2004).

46.5.2 Current Status

Brook trout are primarily managed within the lakes of the Subbasin where they are primarily stocked and are abundant enough to constitute a consumptive, nonnative sport fishery despite marginal water quality for other salmonids. Owhi, McGinnis, Buffalo, and Little Goose lakes have all been stocked with brook trout within the last two years. Stocking of brook trout is often on a put and take basis since most of the lakes are not conducive to natural reproduction. Natural reproduction does occur at Owhi Lake and fish from this lake are collected annually to support hatchery production used for enhancing recreational and subsistence fisheries.

Brook trout are able to survive a wider range of environmental conditions than other salmonids. Brook trout within the state of Washington are not known to exhibit various life history strategies, as other native salmonids do (Meehan 1991). Brook trout typically spawn in the fall between August and December when water temperatures drop below 10 ºC (50 ºF). Females vary greatly in their fecundity and eggs typically hatch within 144 days at water temperatures averaging 1.7 ºC (35 ºF) (Wydoski and Whitney 1979).

Although some local adaptations may have occurred in the last 100 years since brook trout were first stocked into Owhi Lake in the Lake Rufus Woods Subbasin, the genetic integrity of brook trout within the Subbasin is of minor importance since all populations are introduced. Fisheries investigations on Lake Rufus Woods indicate brook trout have likely not established viable populations (John Arterburn, Fish Biologist, CCT, personal communication, 2004).

46.5.3 Limiting Factors Brook Trout

Brook trout are an introduced species and are currently present in 20 of the 38 delineated reaches within the Subbasin. All 20 reaches were included for the historical distribution of brook trout in order to develop a baseline for comparing past and present habitat conditions. Current habitat conditions are severely altered from historic, and these conditions are likely to persist. Eastern brook trout are well suited to the current environmental conditions of most stream habitats in the Lake Rufus Woods Subbasin. Therefore, restoration and protection of habitats for other native species may result in more production of brook trout, especially in the Nespelem River and Coyote Creek watersheds.

For the highest ranked reaches listed in Table 46.7, the QHA output suggests the main habitat alterations have impacted the low flow regime, fine sediment loading, and habitat diversity. Approximately half of the top ten reaches with the greatest degree of deviation are located on the Little Nespelem River, while the other half are within the Nespelem River watershed. Fine sediment is listed as the top issue in the Little Nespelem, however historic levels of fine sediment loading remains uncertain (Arterburn, Fish Biologist, CCT, personal communication, 2003). The areas of degradation within the Nespelem River watershed (include the western tributaries and portions of the main channel) rank low flow and habitat complexity as the attributes with the greatest deviation from the reference condition.

The majority of the reaches receiving the highest rankings for protection is also within the Nespelem River watershed, but located primarily in the northern region and includes parts of the main channel (Table 46.8).

Table 46.7. Ranking of reaches with the largest deviation from the reference habitat conditions for brook trout in the Lake Rufus Woods 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
15	Little Nespelem Lower Meadow	1	0.3	8	2	2	1	8	2	10	10	5	6	7
18	Little Nespelem Upper Meadow	2	0.3	2	4	2	1	9	5	10	5	8	5	10
27	Whitelaw Creek	3	0.2	8	6	2	4	7	1	9	2	9	9	4
31	Pamenter Creek	4	0.2	5	6	1	4	8	1	9	1	9	9	6
17	Little Nespelem Canyon	5	0.2	8	6	8	3	7	1	8	1	4	5	8
28	Upper Mill Creek	6	0.2	8	6	4	1	7	1	8	4	8	8	3
29	Upper Nespelem River (Braids)	7	0.1	7	6	3	1	7	3	7	2	5	7	7
33	Middle Northstar Creek	8	0.1	4	5	5	2	8	1	9	2	9	9	7
14	Little Nespelem Falls	9	0.1	3	9	2	6	6	1	9	3	6	9	3
23	Nespelem River Lower Meadow	10	0.1	3	7	1	6	7	4	7	2	4	7	7
36	Middle Stepstone Creek	11	0.1	7	4	1	2	8	2	8	4	8	8	4
34	Upper Northstar Creek	12	0.1	7	4	1	4	7	1	9	1	9	9	4

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
24	Lower Mill Creek	13	0.1	6	5	1	2	7	2	7	2	7	7	7
25	Armstrong Creek	14	0.1	5	7	3	7	7	1	7	1	5	7	4
22	Nespelem River Developed Reach	15	0.1	1	6	6	11	8	2	8	2	5	2	8
32	Lower Northstar Creek	16	0.1	1	4	5	1	6	1	6	6	6	6	6
35	Lower Stepstone Creek	17	0.1	3	4	2	1	6	5	6	6	6	6	6
38	Nespelem River Headwaters	18	0.1	4	5	1	1	6	6	6	1	6	6	6
26	Middle Mill Creek	19	0.1	6	5	3	1	7	1	7	7	7	7	3
21	Nespelem Falls	20	0.1	2	5	1	11	5	5	5	2	4	5	5

Table 46.8. Ranking of streams whose habitat is most similar to the reference condition for brook trout in the Rufus Woods 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
38	Nespelem River Headwaters	1	-0.65	7	10	3	3	11	3	1	7	6	1	7
35	Lower Stepstone Creek	2	-0.65	8	10	3	5	11	7	1	3	6	1	8
32	Lower Northstar Creek	3	-0.65	9	10	3	4	11	7	1	4	6	1	7
26	Middle Mill Creek	4	-0.63	8	9	6	3	11	7	1	3	5	1	10
33	Middle Northstar Creek	5	-0.62	6	9	3	4	11	9	1	6	5	1	8
29	Upper Nespelem River (Braids)	6	-0.59	6	10	3	11	9	3	1	5	6	1	6
36	Middle Stepstone Creek	7	-0.59	7	9	4	3	10	8	1	6	5	1	11
34	Upper Northstar Creek	8	-0.58	6	7	4	3	9	9	1	9	5	1	7
17	Little Nespelem Canyon	9	-0.58	4	9	1	5	10	6	1	6	11	3	6
25	Armstrong Creek	10	-0.50	6	8	4	3	9	10	1	10	4	1	7
31	Pamenter Creek	11	-0.46	3	7	3	3	10	8	1	8	3	1	11
24	Lower Mill Creek	12	-0.41	9	5	5	3	9	7	1	7	9	1	4
27	Whitelaw Creek	13	-0.39	9	5	3	3	10	8	1	6	11	1	6

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
28	Upper Mill Creek	**14**	-0.39	9	6	3	3	9	7	1	3	9	1	8
22	Nespelem River Developed Reach	**15**	-0.37	5	11	2	9	5	3	1	3	5	10	5
21	Nespelem Falls	**16**	-0.36	6	10	4	9	6	1	1	3	4	6	10
23	Nespelem River Lower Meadow	**17**	-0.35	4	11	9	10	6	2	1	5	2	6	6
14	Little Nespelem Falls	**18**	-0.33	5	11	3	8	8	5	1	2	3	5	10
15	Little Nespelem Lower Meadow	**19**	-0.32	3	10	4	10	6	4	1	1	9	6	6
18	Little Nespelem Upper Meadow	**20**	-0.28	9	11	2	10	7	2	1	2	2	7	2

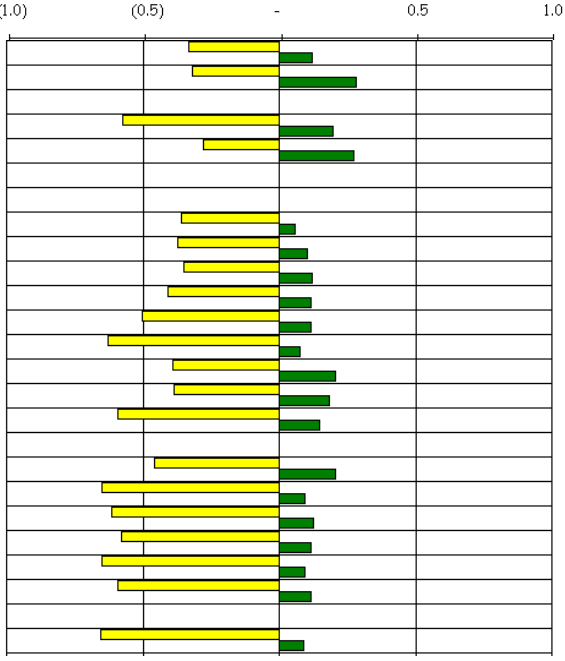
The tornado diagram (Table 46.9) and maps (Map LRW-3, Map LRW-4, located at the end of Section 46) presents the reach scores for both current habitat condition (ranging from zero to positive one, Map-3) and protection (ranging from zero to negative one, Map-4). Scores closest to negative one depict reaches 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.

Based upon the data collected during the QHA analysis, it is important to understand that most model outputs are only as good as the data that is entered into them. Data that is lacking or inaccurate is likely to produce erroneous results. Within the Lake Rufus Woods Subbasin a lack of data make interpreting QHA results highly subjective, due to the lack of confidence in the data used for this model. Confidence scores for protection ratings in the Little Nespelem lower meadow and Nespelem River lower meadow reaches were the only two reaches where sufficient confidence in the data existed to produce reliable results. Confidence results identified a complete lack of data about the habitat in the Nespelem Falls, Armstrong Creek, Whitelaw Creek, and Pamenter Creek reaches. Some data gaps existed for all other reaches; therefore anyone attempting to utilize the QHA assessment for making substantive decisions should do so with caution. In most cases current habitat conditions had better data and historic habitat ratings were largely considered speculative because this species was introduced.

Table 46.9. Tornado diagram for brook trout in the Lake Rufus Woods 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 Confidence
14	Little Nespelem Falls	0.43	0.30
15	Little Nespelem Lower Meadow	0.47	0.32
16	Joe Moses Creek	NP	
17	Little Nespelem Canyon	0.33	0.25
18	Little Nespelem Upper Meadow	0.42	0.29
19	Owhi Lake	NP	
20	Owhi Creek	NP	
21	Nespelem Falls	0.25	0.21
22	Nespelem River Developed Reach	0.43	0.30
23	Nespelem River Lower Meadow	0.47	0.32
24	Lower Mill Creek	0.38	0.28
25	Armstrong Creek	0.20	0.18
26	Middle Mill Creek	0.38	0.28
27	Whitelaw Creek	0.25	0.21
28	Upper Mill Creek	0.38	0.28
29	Upper Nespelem River (Braids)	0.33	0.25
30	Smith Creek	NP	
31	Pamenter Creek	0.08	0.13
32	Lower Northstar Creek	0.37	0.27
33	Middle Northstar Creek	0.37	0.27
34	Upper Northstar Creek	0.40	0.28
35	Lower Stepstone Creek	0.37	0.27
36	Middle Stepstone Creek	0.37	0.27
37	Upper Stepstone Creek	NP	
38	Nespelem River Headwaters	0.37	0.27



Although the QHA points to opportunities to improve stream habitat for brook trout, lakes are the top priority for brook trout management in the Lake Rufus Woods Subbasin (John Arterburn, Fish Biologist, CCT, personal communication, 2003). Due to the existence of natural barriers, the Nespelem River watershed can be separated into three distinct zones. Zone one is the mouth upstream to the Nespelem Falls. This section should be managed for the preservation of spawning habitat for adfluvial and perhaps someday, anadromous fish. Zone two is from the Nespelem Falls section upstream to any of the natural headwater barriers. Zone two is primarily brook trout habitat. Zone two is more conducive to hatchery supplementation and harvest activities than restoration activities, due to the preponderance of eastern brook trout. Zone three is the headwater areas above the natural barriers. Areas in zone three are more conducive for habitat/watershed and native fish restoration efforts until such a time when the core native fish populations in this zone are re-established.

46.5.4 Current Management

Regulations for the take of brook trout within the basin are managed by the CCT for areas on the Colville Reservation and WDFW in areas outside of the reservation borders; Lake Rufus woods is co-managed. A daily bag limit of 2 trout is in effect for Lake Rufus Woods with a current possession limit of two times the daily bag (CCT 2003) (WDFW 2003). For non-Tribal members to fish the lakes on the Colville Reservation requires the purchase of a tribal fishing license. Eastern brook trout bag limits for open waters are 5 fish to be retained daily but only one may exceed 20 inches in length, and possession is two times daily bag limit. Owhi Lake is open to Tribal members only. Tribal members are allowed unrestricted harvest opportunities throughout the Lake Rufus Woods Subbasin, with the exception of white sturgeon (CCT 2004) (WDFW 2003).

46.6 Focal Species – Rainbow Trout

Rainbow trout were selected as a focal species due to their recreational importance as a sport fish, their subsistence value to Upper Columbia United Tribes, and their ecological significance within the watershed

Rainbow trout were historically distributed from northern Mexico to southeastern Alaska and inland in rivers that are free of natural obstructions from the Pacific Ocean (Behnke 1992). Rainbow trout exhibit both anadromous and non-anadromous life history strategies, with the anadromous form being referred to as steelhead. Three life history strategies are displayed by non-anadromous rainbow trout. Fluvial fish rear as adults in larger rivers and migrate to tributary streams to spawn, adfluvial fish rear as adults in lakes or reservoirs and migrate to tributaries to spawn, and resident fish spend their entire life cycle in tributary streams. The present distribution of rainbow trout and steelhead has been affected by both indiscriminate stocking practices and habitat alterations (Wydoski and Whitney 2003).

Rainbow trout are a cold-water salmonid that prefer water with temperatures below 70^{o} F and high amounts of dissolved oxygen (Wydoski and Whitney 2003). Rainbow trout typically mature between age 1 and age 5, depending on their growth rates (Wydoski and Whitney 2003). Rainbow trout spawn in the spring usually between February and June, depending on the temperature and location. Substrate composition, cover, water quality, and water quantity are important habitat elements for spawning rainbow trout (Bjornn and Reiser 1991). Juvenile rainbow trout typically prey on drifting organisms while residing in lotic systems and prey on a variety of planktonic, terrestrial, and bethic organisms when in lentic habitats. Adult rainbow trout are ominivorous and often feed on the most abundant prey resource at any given time. As rainbow trout grow in size, a proportion of their diet may be comprised of fish.

Rainbow trout have been transplanted to many temperate-zone waters in both the northern and southern hemispheres and have self-sustaining populations in many areas (Bjornn and Reiser 1991). Two subspecies of rainbow trout exist in the State of Washington, the coastal rainbow trout (*O. mykiss mykiss*) and the redband trout (*O.*

mykiss gairdneri). Redband rainbow trout are native to the IMP and currently at risk in many areas due to introgression from transplanted coastal rainbow trout stocks. The extirpated steelhead runs within the IMP were of the redband subspecies (Behnke 1992), therefore conservation of current redband populations may have benefits for recovering steelhead runs within the IMP in the future with the possibility of fish passage at Chief Joseph and Grand Coulee dams.

Coastal rainbow trout stocks have been widely propagated and planted indiscriminately throughout the North American continent. Today hatchery production of coastal stocks of rainbow trout continues. However, a few facilities are beginning to experiment with triploiding technology that makes these fish sterile, thus reducing genetic impacts on local native stocks. Triploid rainbow trout have increased growth rates once they reach maturity and often obtain larger sizes. Although there is a movement for native redband conservation in Washington state and Tribal waters, local redband brood stocks will take many years to develop and are unlikely to replace coastal stocks in the near future. The Colville Tribal hatchery is currently moving from utilizing coastal rainbow trout stocks to triploid rainbow trout, and hopes to move further into stocking native redbands. There is an attempt in the Subbasin to transform from reliance on coastal stocks to triploid rainbow trout to locally adapted redband trout, but this will take many years for the transition to be complete. A destination fishery is developing for triploid rainbow trout at Lake Rufus Woods due to the efforts of the CCT in conjunction with the Columbia River Fish Farm. The Tribes purchase triploid rainbow trout that can weigh between 3 and 8 pounds from the aquaculture operations for release into Lake Rufus Woods. The results have attracted the attention of many anglers due to stories of rainbow trout over 20 pounds. Lake Rufus Woods has produced the last two state record rainbow trout at 23 and 26 pounds.

46.6.1 Historic Status

Redband rainbow trout have been identified as the native rainbow trout stock that historically resided in the Lake Rufus Woods Subbasin. Although redband trout are still present in some locations within the Subbasin, the anadromous form known as steelhead has been completely eliminated.

Chapman (1996) stated that large runs of Chinook and sockeye, and lesser runs of coho, steelhead, and chum historically returned to the Columbia River. Based on the peak commercial catch of fish in the lower Columbia River and other factors, such as habitat capacity, he estimated that approximately 500,000 spring Chinook and 450,000 steelhead were the best estimate of pre-development run sizes. Spring Chinook and steelhead were relatively abundant in upper Columbia River tributary streams prior to the extensive resource exploitation in the 1860s. By the 1880s, the expanding salmon canning industry and the rapid growth of the commercial fisheries in the lower Columbia River had heavily depleted the mid- and upper Columbia River spring and summer Chinook runs (McDonald 1895), and eventually steelhead (Mullan et al. 1992). The full extent of depletion in upper Columbia River salmonid runs is difficult to quantify because of limited historical records, but the runs had

been decimated by the 1930s (Craig and Suomela 1941). Many factors including construction of impassable mill and power dams, un-screened irrigation intakes, poor logging and mining practices, overgrazing and private development of the subbasins, in combination with intensive fishing, all contributed to the decline in abundance of Upper Columbia River basin salmonids (Fish and Hanavan 1948; Bryant and Parkhurst 1950; Chapman et al. 1982).

Mullan et al. (1992) noted that the Spokane River upstream from the current Grand Coulee Dam site was a major producer of steelhead but noted:

> The inescapable conclusion is that headwater lacustrine environments produced negligible numbers of steelhead. This conclusion, combined with the inaccessibility or infertility of nearly all tributary systems above the San Poil River, helps explain why steelhead were confined to a relatively few tributary habitats.

Since the 1930s, and particularly since the 1960s, construction of mainstem Columbia River dams has also affected fish abundance. While the dams on the mainstem may not have caused the original demise of the fish runs, they are a factor in reducing the resilience of the fish runs to handle natural perturbations. Steelhead counts began at Rock Island Dam in 1933, and annual counts averaged 2,800 between 1933 and 1939. These numbers do not reflect large fisheries in the lower river at that time that were estimated at harvesting greater than 60 percent of all available fish (Mullan et al. 1992).

In summary, both harvest rate and numerical harvest of spring Chinook and steelhead appeared to have peaked in the last 15 years of the 1800s. Numbers of spring Chinook and steelhead in the upriver run in the late 1930s and 1940s were depressed by decades of over-fishing and habitat degradation. Runs increased in the 1950s, partly in response to somewhat reduced harvest rates and favorable ocean productivity.

46.6.2 Current Status

The popular rainbow trout fishery in the reservoir consists mainly of fish originating from the Trout Lodge and other hatcheries. The Trout Lodge stock is a triploid stock of mixed steelhead and rainbow trout origin that is used for food fish production at net pens located along Lake Rufus Woods. Large fish from these aquaculture operations are purchased by the CCT and released in Lake Rufus Woods to supplement subsistence and recreational opportunities (Council 2000). Trout Lodge stock also is known to escape from the Columbia River Fish Farms net pens in Lake Rufus Woods and enter the fishery. The Spokane stock rainbow trout from the Spokane Tribal Hatchery are likely fish released from the Lake Roosevelt net pens that have entrained out of Lake Roosevelt. In addition, the CCT stocks up to 100,000 sub-catchable Goldendale rainbow trout annually in Lake Rufus Woods from the Colville Tribal Hatchery. Rainbow trout are also released annually into Mill Creek and the Nespelem River from the Colville Tribal Hatchery to supplement subsistence

fishing on Colville Reservation streams. In addition, Buffalo Lake receives annual stocking of rainbow trout from the Colville Tribal Hatchery.

46.6.3 Limiting Factors Rainbow Trout

According the QHA model, rainbow trout are currently present in 24 of the 38 reaches in the Subbasin. Only 14 reaches were identified as having rainbow trout historically present, and thus only 14 reaches were evaluated for the degree of change relative to the reference condition (Table 46.10). However, all 24 reaches were evaluated for a protection ranking (Table 46.11). In general, the main modifications to the habitat conditions resulted in a decrease in habitat diversity and riparian conditions, and the presence of more obstructions (see Table 49.2).

The reaches ranking highest for degradation or deviation from reference conditions included the Lake Rufus Woods and Little Nespelem River (Table 46.10). The top six ranked reaches were all in the reservoir and indicated habitat diversity as the most notable change from reference conditions. Riparian condition, low flow, oxygen, and an obstruction (refers to Chief Joseph and Grand Coulee dams) also received large marks in these reaches regarding the degree of change relative to historic conditions.

The top reaches ranked for protection include mostly the Nespelem River and some of its tributaries (Table 46.11). The reservoir reaches ranked 6-8, 10-12, and 14 (Table 46.11) showed temperature regimes have remained most similar to historic conditions compared to other habitat attributes.

Table 46.10. Ranking of reaches with the largest deviation from the reference habitat conditions for rainbow trout in the Lake Rufus Woods 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
1	Chief Joe Dam	1	0.3	5	7	1	4	8	8	3	8	8	5	1
8	Nespelem Bar	2	0.3	1	7	1	5	7	1	1	9	9	5	9
9	Buckley Bar	3	0.3	1	6	1	8	6	1	1	9	9	5	9
11	Coulee Dam Tailrace	4	0.3	4	8	1	4	4	2	2	8	8	4	8
4	Middle Rufus Woods Reservoir	5	0.2	4	6	1	2	7	7	2	7	7	4	7
10	Upper Rufus Woods Reservoir	6	0.2	4	7	1	8	4	2	2	8	8	4	8
6	Middle Coyote Creek	7	0.2	2	5	5	4	9	2	10	5	11	8	1
2	Lower Rufus Woods Reservoir	8	0.2	4	6	1	3	7	7	2	7	7	4	7
15	Little Nespelem Lower Meadow	9	0.2	9	2	3	1	8	3	10	10	3	3	3
18	Little Nespelem Upper Meadow	10	0.1	2	2	4	1	6	6	10	9	6	4	10
13	Lower Nespelem River	11	0.1	1	2	4	7	6	7	7	2	4	7	7
17	Little Nespelem Canyon	12	0.1	8	5	8	1	5	2	8	5	2	2	8
21	Nespelem Falls	13	0.1	2	5	1	11	5	5	5	2	4	5	5
7	Upper Coyote Creek	14	0.1	4	4	1	2	4	3	9	8	7	9	9
14	Little Nespelem Falls	15	0.0	6	6	6	6	3	1	6	4	5	6	1
5	Lower Coyote Creek	16	0.0	4	4	4	4	4	2	4	3	4	4	1

Table 46.11. Ranking of streams whose habitat is most similar to the reference condition for rainbow trout in the Lake Rufus Woods 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
26	Middle Mill Creek	1	-0.72	6	3	8	9	9	9	1	4	1	7	4
13	Lower Nespelem River	2	-0.70	11	8	4	8	10	1	1	5	7	6	1
29	Upper Nespelem River (Braids)	3	-0.69	3	8	3	11	10	3	1	8	3	7	1
23	Nespelem River Lower Meadow	4	-0.64	6	3	10	11	8	3	1	7	3	8	1
25	Armstrong Creek	5	-0.58	6	3	7	7	7	10	1	10	3	5	2
2	Lower Rufus Woods Reservoir	6	-0.57	10	5	10	9	6	1	6	1	1	8	1
10	Upper Rufus Woods Reservoir	7	-0.56	11	4	8	5	8	5	5	1	1	8	1
4	Middle Rufus Woods Reservoir	8	-0.56	9	5	9	9	6	1	6	1	1	8	1
6	Middle Coyote Creek	9	-0.55	4	3	5	10	9	11	1	5	2	5	5
11	Coulee Dam Tailrace	10	-0.55	11	1	7	7	7	5	5	1	1	7	1
9	Buckley Bar	11	-0.53	11	4	4	8	9	4	4	1	1	9	1
8	Nespelem Bar	12	-0.52	11	4	4	8	8	4	4	1	1	8	1
30	Smith Creek	13	-0.49	5	2	6	7	8	8	1	8	2	4	11
1	Chief Joe Dam	14	-0.48	9	4	9	8	5	1	5	1	1	7	9
24	Lower Mill Creek	15	-0.35	8	7	9	4	5	10	1	11	5	1	1
17	Little Nespelem Canyon	16	-0.34	5	7	5	4	7	9	1	10	10	3	1
7	Upper Coyote Creek	17	-0.33	6	6	9	4	8	11	1	10	5	1	1
27	Whitelaw Creek	18	-0.30	6	6	9	3	8	10	1	11	3	1	3

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
28	Upper Mill Creek	**19**	-0.29	5	5	8	3	5	10	1	11	3	1	8
22	Nespelem River Developed Reach	**20**	-0.12	7	7	7	7	1	3	4	5	6	7	1
18	Little Nespelem Upper Meadow	**21**	-0.10	7	7	7	7	2	3	3	5	5	7	1
15	Little Nespelem Lower Meadow	**22**	-0.09	7	7	7	7	1	3	3	3	6	7	1
14	Little Nespelem Falls	**23**	-0.09	7	7	7	7	1	2	2	5	6	7	2
5	Lower Coyote Creek	**24**	-0.07	6	6	6	6	1	5	2	4	3	6	6

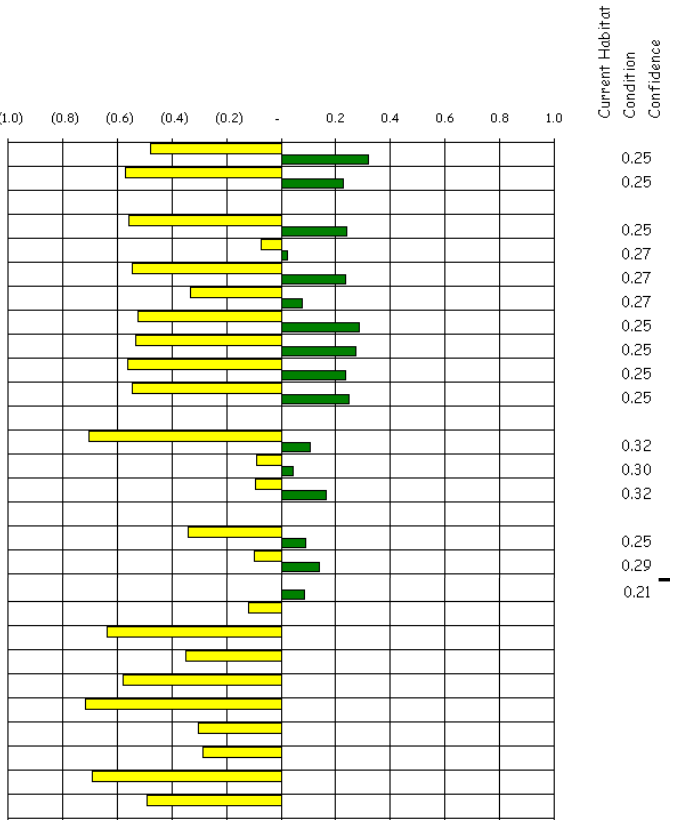
The tornado diagram (Table 46.12) and maps (Map LRW-5, Map LWR-6, located at the end of Section 46) presents the reach scores for both protection (ranging from zero to negative one, Map LRW-5) and current habitat condition (ranging from zero to positive one, Map LWR-6). Scores closest to negative one 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.

Based upon the data collected during the QHA analysis it is important to understand that most model outputs are only as good as the data that are entered into them. Data that are lacking or inaccurate are likely to produce erroneous results. Within the Lake Rufus Woods Subbasin a lack of data makes interpreting QHA results highly subjective due to the distinct lack of confidence in the data used for this model. Confidence scores for protection ratings in the Lower Nespelem River and Little Nespelem lower meadow reaches were the only two reaches where sufficient confidence in the data existed to produce reliable results. Confidence results identified a complete lack of data about the habitat in the Nespelem Falls reach. Some data gaps existed for all other reaches; therefore anyone attempting to utilize the QHA assessment for making substantive decisions should do so with caution. In most cases current habitat conditions had better data and historic habitat ratings were largely considered speculative. This was most prominent in the information for reaches above Nespelem Falls, due to a lack of historical information.

Table 46.12. Tornado diagram for rainbow trout in the Lake Rufus Woods 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	Chief Joe Dam	0.33	0.25
2	Lower Rufus Woods Reservior	0.33	0.25
3	Big Goose Lake	NP	
4	Middle Rufus Woods Reservior	0.33	0.25
5	Lower Coyote Creek	0.37	0.27
6	Middle Coyote Creek	0.37	0.27
7	Upper Coyote Creek	0.37	0.27
8	Nespelem Bar	0.33	0.25
9	Buckley Bar	0.33	0.25
10	Upper Rufus Woods Reservior	0.33	0.25
11	Coulee Dam Tailrace	0.33	0.25
12	Buffalo Lakes	NP	
13	Lower Nespelem River	0.47	0.32
14	Little Nespelem Falls	0.43	0.30
15	Little Nespelem Lower Meadow	0.47	0.32
16	Joe Moses Creek	NP	
17	Little Nespelem Canyon	0.33	0.25
18	Little Nespelem Upper Meadow	0.42	0.29
21	Nespelem Falls	0.25	0.21
22	Nespelem River Developed Reach	NP	
23	Nespelem River Lower Meadow	NP	
24	Lower Mill Creek	NP	
25	Armstrong Creek	NP	
26	Middle Mill Creek	NP	
27	Whitelaw Creek	NP	
28	Upper Mill Creek	NP	
29	Upper Nespelem River (Braids)	NP	
30	Smith Creek	NP	



No historic evidence of rainbow trout being present upstream of Nespelem Falls exists. However, there are populations maintained through stocking activities and an important recreational fishery currently exists in Lake Rufus Woods that would benefit from increased management activities. Lake Rufus Woods and other lake environments provide an opportunity for extensive subsistence and recreational harvest. The Colville Tribal hatchery has been the primary source of fish for these activities over the last decade. Aquaculture production of rainbow trout in Lake Rufus Woods has helped to establish a trophy fishery for rainbow trout at Lake Rufus Woods. The development of this fishery has been largely through the purchase of fish from these operations by the CCT and also from increased nutrient availability resulting from on-going aquaculture businesses.

Stream habitats and headwater habitats more specifically are largely restricted by biological constraints, such as low nutrient levels, although physical habitat is adequate. Habitats best suited for redband trout recovery are found in Northstar, Stepstone, and Mill creeks along with the mainstem Nespelem River above Smith Creek. If efforts to

establish native fish are to be made then habitats below Smith creek are unlikely to support robust redband populations due to high summer water temperatures, substrates made up almost exclusively of fine sediments, little habitat diversity, and extremely low stream gradient.

Due to the existence of natural barriers, the Nespelem River watershed can be separated into three distinct zones. Zone one is the mouth of the Nespelem River upstream to Nespelem Falls. Zone one should be managed for the preservation of spawning habitat for adfluvial and perhaps someday, anadromous fish. Zone two is from the Nespelem Falls section upstream to any of the natural headwater barriers. Zone two is the primarily brook trout habitat. Zone two is more conducive to hatchery supplementation and harvest activities for rainbow trout than restoration activities, due to the preponderance of eastern brook trout. Zone three is the headwater area above the natural barriers. Zone three is the most conducive area for habitat/watershed and native redband trout restoration efforts at least until such a time that core native fish populations in this zone are re-established.

46.6.4 Current Management

Lake Rufus Woods is co-managed by WDFW and the CCT, and the daily bag is 2 fish with a possession limit of two times the daily bag. Lakes on the Colville Reservation are managed solely by the CCT, and for non-Tribal members to fish the lakes on the Colville Reservation requires the purchase of a tribal fishing license. Rainbow trout bag limits for Buffalo Lake is 5 fish daily but only one may exceed 20 inches in length and possession is two times the daily limit. Buffalo Lake provides angling opportunities for rainbow trout for non-Tribal members from April 13 to October 31. This season can be extended from January 1 to March 15 with the purchase of a special winter fishing season permit. Most Rainbow trout fisheries in the Rufus Woods Subbasin are the result of artificial production due to nonnative species interactions, habitat degradation, and other environmental constraints. Rainbow trout populations will continue to need hatchery supplementation in order to meet current and future management objectives and provide for subsistence and recreational fisheries in the Lake Rufus Woods Subbasin. The Lake Rufus Woods triploid fishery will require efforts to manage people and access as the popularity of this fishery continues to increase.

46.7 Focal Species – White Sturgeon

White sturgeon were once abundant in the Lake Rufus Woods Subbasin and provided subsistence and recreational opportunities. The white sturgeon was selected as a focal species for the Subbasin because of their cultural importance to the Upper Columbia United Tribes, and their potential ecological significance within the reservoir habitat. Information regarding this stock is limited, and potential impacts that passage at Chief Joseph Dam would have on white sturgeon are unknown. Since dams on both the upstream and downstream ends of the reservoir confine this population, it is highly unlikely that a self-sustaining population can persist. Limited scientific knowledge about this population makes specific actions difficult to address.

White sturgeon are found in marine waters and freshwater rivers along the Pacific Coast from California to Alaska (Wydoski and Whitney 2003). In the State of Washington,

white sturgeon are found in the Columbia and Snake rivers, Grays Harbor, Willapa Bay, Puget Sound, and Lake Washington (Wydoski and Whitney 2003).

White sturgeon are the largest fish found in the freshwaters of North America, with specimens being reported to reach length of 20 ft and weights of 1, 800 pounds (Wydoski and Whitney 2003). Reproduction occurs at between 9 and 16 years of age and only a small percentage of adults may spawn in any given year. White sturgeon migrate great distances in unimpounded rivers and display both anadromous and resident life history forms.

White sturgeon in the Columbia River declined in numbers due numerous factors, including obstruction of migration by dams, altered stream flows, altered temperature regimes, reduced spawning habitats, and over-harvest (Wydoski and Whitney 2003).

46.7.1 Historic Status

Prior to hydroelectric development, white sturgeon within the Subbasin were likely anadromous and may have migrated considerable distances between subbasins within the Columbia River. In general, white sturgeon are not known to display variable life history strategies other than occasional, facultative anadromy. White sturgeon spawn in the spring and can be highly fecund, however survival from egg to adult is relatively low (Anders 2002). White sturgeon have not been stocked historically within the Lake Rufus Woods Subbasin.

46.7.2 Current Status

Relative abundance compared to other aquatic species is unknown but presumed to be low. Numbers of adult white sturgeon within the Lake Rufus Woods Subbasin are presumed to be minimal (Anders and Powell 1999). Recruitment is also presumed low or non-existent.

Theoretically, white sturgeon entrained through Grand Coulee Dam may represent gene flow to the population within the impounded Lake Rufus Woods. However, a recent genetic survey indicated white sturgeon from Lake Rufus Woods had only a single observed maternal lineage as compared to the significantly more variable Upper Columbia River (Anders and Powell 1999). With only seven fish sampled within the lake, genetic diversity remains largely unknown (Anders and Powell 1999). Any anadromous component to the life history of white sturgeon within the Lake Rufus Woods Subbasin was lost with the construction of Chief Joseph and Grand Coulee dams without fish passage.

Although data on white sturgeon in Lake Rufus Woods is sparse, more data has been collected for the Upper Columbia Subbasin. It is presumed that white sturgeon, like other fishes in Lake Roosevelt are entrained through Grand Coulee Dam, thus spending part of their life histories within the Lake Rufus Woods Subbasin. Since white sturgeon are a long-lived species, a fish entrained in Lake Rufus Woods could live a substantial portion of its life in the lake. Below is a summary on white sturgeon population above Grand Coulee Dam, just upstream of Lake Rufus Woods.

The current white sturgeon population estimate is 1,400 adults in the trans-boundary region of the Upper Columbia River basin (Upper Columbia White Sturgeon Recovery Plan 2002). Specific numbers for the Upper Columbia Subbasin are not known. Nonetheless, the population status is considerably less than the endangered status criteria of 2,500 adults determined by the World Conservation Union. Although most of the upper-mainstem populations appear unstable, their genetic similarity to the stable lower Columbia River population has excluded them from consideration for listing under the federal Endangered Species Act, unlike the Kootenai River population.

White sturgeon are found in Lake Roosevelt and the Columbia River upstream of the reservoir. Any anadromous component to the life history of white sturgeon within the Subbasin has been presumably lost. Genetic diversity of the samples collected is similar to the diversity observed elsewhere within the Columbia and Kootenai river basins (Anders and Powell 1999).

Recent data indicate that older fish dominate the population structure of white sturgeon in Lake Roosevelt. These data indicate that juvenile recruitment may be limiting this population. If this trend continues, the white sturgeon population in Lake Roosevelt may be in jeopardy. If recruitment does not improve, the Upper Columbia River basin population is projected to decline 50 percent within 10 years and 75 percent within 20 years (Upper Columbia White Sturgeon Recovery Plan 2002).

In 1998, a stock-indexing project (Devore et al. 2000) found that only 1.5 percent of the captured white sturgeon were juveniles (<110 cm Fork Length), suggesting poor recruitment. Furthermore, of the 204 fish captured, only three were captured in experimental gill nets (deployed for the purpose of catching juvenile sturgeon) and length at age assignments revealed an age structure of 12- to 96-year-old fish (Devore et al. 2000). The conclusion that there are severe recruitment limitations (Devore et al. 2000) supports conclusions of research conducted in the Canadian Reach of the Columbia River (R.L. & L. Environmental Services Ltd. 1996). Devore et al. (2000) found that the relative weight (Wr) of 91 percent of the white sturgeon collected from Lake Roosevelt was lower than other populations. (To date, this is the lowest recorded Wr value recorded for any Columbia River Basin white sturgeon population).

Distribution of white sturgeon within the Upper Columbia Subbasin is dependent upon water condition and suitable habitat (Devore et al. 2000). Trends in abundance will likely show declines since there appear to be little or no juvenile recruitment within the stock (Anders, 2002; Devore et al. 2000). Carrying capacity within the Lake Rufus Woods Subbasin is not known and needs to be further assessed. Current stocks are considered depressed but limiting factors are not completely known. Areas of successful spawning and recruitment are habitats to be identified, protected, and/or enhanced.

46.7.3 Current Management

White sturgeon are closed to harvest for all anglers in all portions of the Columbia River upstream of Chief Joseph Dam (WDFW 2003) (CCT 2004). At this time a sufficient

carrying capacity and productivity of white sturgeon to support a sport fishery in Lake Rufus Woods is unknown and research is still needed to address these uncertainties. White sturgeon have not been introduced or stocked and no captive breeding programs currently exist in the Lake Rufus Woods Subbasin.

46.8 Species of Interest – Pacific Lamprey

Although currently extirpated from the Lake Rufus Woods Subbasin, Pacific lamprey were an important ecological and cultural species and provided a subsistence fishery within the Subbasin before the construction of Chief Joseph Dam. Pacific lamprey would most likely once again be an ecologically important fish to the Subbasin if fish passage is restored in the future. Although Pacific lamprey were not chosen by the technical team as a focal species in the Lake Rufus Woods Subbasin, they are included within the strategies and objectives formulated by the work team members, therefore they are of interest to the future direction of the Lake Rufus Woods Subbasin.

Pacific lamprey are found in streams from southern California to the Gulf of Alaska (Wydoski and Whitney 2003). In Washington state, Pacific lamprey are found in most large coastal and Puget Sound rivers and occurs long distances inland in the Columbia, Snake, and Yakima River systems (Wydoski and Whitney 2003).

Pacific lamprey are anadromous and rear as adults in the Pacific Ocean. Adults are parasitic, feeding on the body fluids of various species of fish. Adults reach lengths of 30 inches and a weight of about 1 pound (Wydoski and Whitney 2003). Unlike Pacific salmon, Pacific lamprey may be able to spawn more than once (Wydoski and Whitney 2003). The importance of Pacific lamprey predation in the Pacific Ocean has not been clearly evaluated (Wydoski and Whitney 2003), although biologists suspect there might be significant effects on some fish populations.

46.8.1 Historic Status

Pacific lamprey were historically present in the Lake Rufus Woods Subbasin prior to the construction of Chief Joseph Dam. The construction of the dams without fish passage facilities prevented migration upstream of Pacific lamprey and other anadromous species as well as extirpated them from the Subbasin.

46.8.2 Current Status

Currently, Pacific lamprey are not known to be present within the Subbasin.

46.8.3 Current Management

There is no current management for the species, since Pacific lamprey were extirpated from the Lake Rufus Woods Subbasin.

46.9 Species of Interest – Burbot

Burbot were selected as a species of interest for their ecological significance, their native species status, and their potential recreational importance as a sport fish. Although burbot are not as sought after by recreational anglers as the salmonids and walleye in the region, they are excellent table fare. More research needs to be conducted to truly understand the

status of burbot in this Subbasin. Burbot were chosen not be analyzed by the QHA model in this assessment. The QHA model was developed for salmonid fishes and would not effectively identify limiting factors for populations of burbot in the Lake Rufus Woods Subbasin. Although data on the general population characteristics and distribution is not well understood, burbot are perceived as an important species in the Subbasin and warrant research to further understand how they interact with their environment in the Subbasin.

46.9.1 Historic Status

Distribution of burbot is circumpolar in the northern hemisphere. There is not a lot known about burbot in the Upper Columbia River, but they are found in Lake Roosevelt, Lake Rufus Woods and the Columbia River downstream from Chief Joseph Dam. Early systematic studies placed burbot into three distinct subspecies with only one of these subspecies found in North America, *Lota lota lacustris* (Hubbs and Schultz 1941). Current evidence suggests the sub-specific designation is unwarranted (Scott and Crossman 1973). Burbot are benthic feeders that reside in deep waters in lakes or rivers and are not considered migratory. Sexual maturity is reached between age 2 and age 4. Burbot spawn during the winter from mid-December to early April. Spawning habitat conditions include mostly shallow waters (0.3-1.5 m) and clean substrate (sand, gravel and stones) (Morrow 1980).

46.9.2 Current Status

Little is known regarding burbot biology within the Lake Rufus Woods Subbasin. Population status, abundance, and trends are unknown. Abundance appears to be fairly stable with comparison to other harvest and species composition data (WDFW catch data for Lake Roosevelt). Carrying capacity and current habitat condition for burbot remains relatively unknown within the Subbasin.

46.9.3 Current Management

Currently burbot have a daily catch limit of five per day. This was increased from previous regulations of two per day in an attempt to increase angler interest and harvest for burbot (WDFW 2003). No hatchery production or current captive breeding programs operate within the Lake Rufus Woods Subbasin. Current management direction is to maintain the harvest regulations that are in place.

46.10 Species of Interest – Walleye

Walleye were not included as a focal species for the subbasin planning process; however because of their potential ecological significance and popularity as a recreational fishery, entities within the Lake Rufus Woods Subbasin have included walleye as a "species of interest."

46.10.1 Historic Status

Walleye are an introduced species that were first observed in Lake Roosevelt, upriver from Lake Rufus Woods during the early 1950s. Walleye may have occupied fluvial habitat and interacted with indigenous fish species downstream of Lake Roosevelt prior to impoundment by Chief Joseph Dam in 1961. The construction of Chief Joseph Dam

and subsequent impoundment (Lake Rufus Woods) eliminated anadromous fish populations above Chief Joseph Dam and significantly reduced the viability of resident salmonid populations through habitat alterations and passage barriers, while at the same time increased habitat conducive to introduced species, including walleye. Although the altered habitat is likely more conducive to walleye populations than that provided during pre-impoundment, substantial water level fluctuations, short water retention times, and minimal plankton production result in a relatively unproductive aquatic ecosystem (Zook et al. 1982). Walleye recruitment is thought to be largely entrainment from Lake Roosevelt rather within reservoir production, although a thorough investigation of walleye life-history trajectory has not been conducted. Walleye have been and continue to be a focal target species for recreational angling in Lake Rufus Woods. Specific creel census data is lacking for Lake Rufus Woods. Because of its proximity to Lake Roosevelt and common species composition, it is likely that proportional fishery value (percent of total recreational catch) of the walleye fishery in Lake Rufus Woods during the 1980s and 1990s mimicked that observed in Lake Roosevelt, where a large proportion of the recreational catches were comprised of walleye. More recently, rainbow trout associated with the triploid net-penning operation within Lake Rufus Woods has gained in popularity. However, walleye continue to provide a substantial recreational opportunity.

46.10.2 Current Status

Walleye currently occupy habitat within Lake Rufus Woods and support an important recreational fishery. Recruitment is thought to be primarily entrainment from Lake Roosevelt.

46.10.3 Current Management

Walleye are managed to provide a recreational sport fishery. The current population supports an important recreational fishery, although systematic creel census information is lacking, the fishery is well-known throughout Washington state. The walleye fishery in Lake Rufus Woods is managed consistent with WDFW Statewide Rules for walleye.

46.11 Environmental Conditions

46.11.1 Environmental Conditions within the Subbasin

46.11.1.1 Lake Rufus Woods

Lake Rufus Woods is a reservoir created by the construction of Chief Joseph Dam. Since it was historically riverine habitat; it was evaluated by the QHA. In general, fisheries in Lake Rufus Woods are limited by available spawning habitats and reduced flow for most native resident fish. Although habitats still exist for Chinook salmon, they and all other anadromous fishes are limited by a lack of passage at Chief Joseph Dam. Nonnative fish stocks have benefited from inundation and complicate native fish management within Lake Rufus Woods, because of competition, predation, and introgression. Total dissolved gases can have a major influence on fish populations during some years, but effects are stochastic.

Environmental conditions within the Subbasin consists of the impounded portion of the Columbia River between Chief Joseph and Grand Coulee dams (reservoir habitat), several tributaries including the Nespelem River (riverine habitat), and several small

lakes such as Owhi Lake (lake habitats). The majority of the aquatic habitat conditions found in Lake Rufus Woods are largely controlled by the operation of Grand Coulee and Chief Joseph dams. Chief Joseph Dam has very little storage capacity and functions as a re-regulating reservoir passing the water released from Grand Coulee Dam either by spilling or power generation. This situation creates highly variable water levels. Grand Coulee Dam operations (power production and spill) contribute to dissolved gas saturation that has been recorded to 138 percent in Lake Rufus Woods (USACE, 2000) and is listed on the 1998 final EPA 303(d) list for the State of Washington.

46.11.1.2 Nespelem River and Other Tributaries

The hydrology of the Nespelem River watershed is generally a product of snowmelt from forested mountains in the headwaters (Harkness et al. 1974). Between 86 and 91 percent of the annual surface water discharge at the mouth of the Nespelem River is from melting snow (Harkness et al. 1974). The historic conditions, with unaltered riparian areas and forested uplands, allowed vegetative ground protection that caused snow to melt off slowly throughout the summer months (Hunner and Jones 1996). This resulted in perennial stream flow and coldwater conditions necessary for native salmonid persistence. Further, sedimentation and embedded substrate were minimal due to channel morphology and hydraulics.

These natural conditions have been altered by activities including logging, road building, grazing, urbanization, water withdrawals, and agriculture. A decrease in canopy closure has reduced the amount of shade allowing more rapid snowmelt, resulting in unusually high spring flows and unusually low late summer flows. Hunner and Jones (1996) also documented a change in the hydrologic regime and reported 44 percent of the currently intermittent tributaries to the Nespelem River were historically perennial. Further, the lack of canopy closure, particularly in the riparian area, has resulted in warmwater conditions that often create metabolic demands that native salmonids cannot maintain with the given food supply. The lack of ground protecting vegetation allows for increased erosion that deposits fine sediments in streams, functionally reducing or eliminating native salmonid spawning habitat by increasing embedded substrate (LeCaire and Peone 1991). Additionally, increased embeddedness reduces invertebrate production, which is the primary food source for native tertiary consumers (fish).

46.11.1.3 Lakes

The lakes throughout this Subbasin are mostly found on the Colville Indian Reservation. Five lakes in the Subbasin have conditions suitable for maintaining subsistence and recreational fisheries and range from eutrophic to meso-oligotrophic (Hunner and Jones 1996). Big Goose, Buffalo, McGinnis, Owhi, and Rebecca lakes are closed basin lakes with little or no connectivity to the fluvial system. Lakes are maintained largely by stocking from the Colville Tribal Hatchery and through some natural production of nonnative warmwater species (Hunner and Jones 1996). Considerable additional information regarding these lakes is contained in the CCT Lakes Compendium (Arterburn 2003).

46.11.2 Out-of-Subbasin Effects and Assumptions

The Lake Rufus Woods Subbasin has been heavily affected by both impoundments on the Columbia River upstream and downstream. Grand Coulee Dam located on the upstream edge of Lake Rufus Woods has changed the hydrograph within the lake and halted the upstream migration of migratory fishes. Chief Joseph Dam, located on the downstream edge of Lake Rufus Woods, has also disconnected migratory fishes from downstream portions of the Columbia River. Large amounts of riparian and tributary habitat were lost with the inundation of Lake Rufus Woods. Nine dams on the mainstem Columbia River are present downstream of Chief Joseph Dam. All downstream dams have potentially detrimental effects on the Lake Rufus Woods Subbasin, when the potential for reintroducing migratory salmon, steelhead, and Pacific lamprey are considered. All other subbasins in the IMP possibly influence the Lake Rufus Woods Subbasin, since it is tied to each by waterways and is positioned on the downstream end of the province.

46.12 Limiting Factors and Conditions

46.12.1 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 reference conditions. These results, coupled with knowledge of local biologists and biological status of the focal species, can assist in identifying key limiting factors. This section provides QHA results on a subbasin level for Lake Rufus Woods Subbasin. Results specific to each focal species are discussed in each focal species section.

In the Lake Rufus Woods Subbasin both stream reaches and watersheds were delineated to analyze habitat conditions for brook trout, rainbow trout, and kokanee using the QHA model (Map LWR-7 located at the end of Section 46). Table 46.13 shows the reaches in Lake Rufus Woods Subbasin historically having habitat attributes less with less than optimal in the reference condition. Riparian condition (defined in Section 3) was the most common habitat attribute considered less than optimal in the reference condition.

Table 46.13. Reaches ranked as containing less than optimal habitat conditions in the reference condition.

Sequence	Reach Name	Habitat Attribute < Optimal
1	Chief Joseph Dam	Riparian Condition
2	Lower Rufus Woods Reservoir	Riparian Condition
4	Middle Rufus Woods Reservoir	Riparian Condition
5	Lower Coyote Creek	Riparian Condition, Low Flow, Low and High Temperature, Obstructions
6	Middle Coyote Creek	Habitat Diversity, Low Flow, Low and High Temperature
7	Upper Coyote Creek	High and Low Flow, High Temperature
8	Nespelem Bar	Riparian Condition, Channel Stability
9	Buckley Bar	Riparian Condition, Channel Stability
10	Upper Rufus Woods Reservoir	Riparian Condition
11	Coulee Dam Tailrace	Riparian Condition

Sequence	Reach Name	Habitat Attribute < Optimal
13	Lower Nespelem River	Riparian Condition, Channel Stability, Fine Sediment, High Temperature
14	Little Nespelem Falls	Riparian Condition, High Temperature
15	Little Nespelem Lower Meadow	Fine Sediment, High Temperature
16	Joe Moses Creek	Riparian Condition, Channel Stability, Habitat Diversity, Fine Sediment, Low Flow, Low and High Temperature, Obstructions
17	Little Nespelem Canyon	High Temperature
18	Little Nespelem Upper Meadow	Fine Sediment, Low Flow, Low and High Temperature
20	Owhi Creek	Riparian Condition, Channel Stability, Habitat Diversity, Fine Sediments, Low and High Flow, Low and High Temperature, Pollutants, Obstructions
21	Nespelem Falls	Riparian Condition, Fine Sediment, High Temperature, Obstructions
22	Nespelem River Developed Reach	Fine Sediment, High Temperature
23	Nespelem River Lower Meadow	Fine Sediment
24	Lower Mill Creek	Riparian Condition, Fine Sediment, Low Flow, Low Temperature
25	Armstrong Creek	Riparian Condition, Channel Stability, Habitat Diversity, Fine Sediments, Low Flow, Low and High Temperature
26	Middle Mill Creek	Riparian Condition, Habitat Diversity, Low Flow, Low Temperature
27	Whitelaw Creek	Fine Sediment, Low Flow, Low Temperature
28	Upper Mill Creek	Riparian Condition, Habitat Diversity, Low Flow, Low Temperature
29	Upper Nespelem River (Braids)	Riparian Condition, Channel Stability, Fine Sediment
30	Smith Creek	Fine Sediment, Low and High Flows, Low and High Temperature, Obstructions
31	Pamenter Creek	Fine Sediment, Low and High Flows, Low and High Temperature, Obstructions
32	Lower Northstar Creek	Low Flow, Low Temperature
33	Middle Northstar Creek	Low Flow, Low Temperature
34	Upper Northstar Creek	Low Flow, Low Temperature
35	Lower Stepstone Creek	Low Flow, Low Temperature
36	Middle Stepstone Creek	Low Flow, Low Temperature, Obstructions
37	Upper Stepstone Creek	Low Flow, Low Temperature
38	Nespelem River Headwaters	Low Flow, Low Temperature

The habitat attributes with the greatest deviation from reference conditions vary by species and are presented in Table 46.14. This table indicates the types of habitat attributes problematic for the focal species in the Subbasin as a whole. Some reaches had more than one habitat parameter that was 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 attribute currently ranked less than the reference. Table 46.14 only lists those habitat parameters that had the greatest deviation from reference, not all the parameters that could be less than optimal.

Table 46.14. Habitat conditions with the greatest deviation from reference conditions for each focal species in Lake Rufus Woods Subbasin. Number in parentheses indicates number of reaches analyzed with respect to each focal species and the number of

reaches or watersheds with the particular habitat attribute exhibiting the largest deviation within that area.

Brook Trout (20)	Kokanee (9)	Rainbow (14)
Low Flow (10)	Oxygen (6)	Habitat Diversity (9)
Fine Sediment (7)	High and Low Flows (4)	Obstructions (3)
Habitat Diversity (7)	Obstructions (2)	Riparian Condition (3)
Low Temperature (5)	Channel Stability (1)	Low Flow (2)
Riparian Condition (2)	Low Temperature (1)	Fine Sediment (2)

The Nespelem River along with its northern and western tributaries represent the least degraded habitats in the Lake Rufus Woods Subbasin. The Lower Nespelem River above Nespelem Falls and the Little Nespelem River watershed represent highly degraded areas heavily impacted by development around the town of Nespelem, Washington. Outside of the town of Nespelem cattle grazing and agriculture practices are most likely causes for degraded habitats. Denuded riparian areas, water withdrawals, destabilized banks, and hot summer air temperatures all contribute to fine sediment, flow, and high summer water temperature issues. In the upper part of the watershed, sediment from high road densities and altered flow regimes from logging activities are the main contributors to fish habitat losses, although some intact areas still exist.

46.12.1.1 Lake Rufus Woods

High total dissolved atmospheric gasses in Lake Rufus Woods have caused it to be placed on the Washington 303(d) list. This high gas concentration is potentially a limiting factor to all fish populations in the reservoir. Research conducted by the U.S. Geological Survey (USGS), using gear types designed to sample species and habitats most likely to be affected by gas bubble disease (GBD), indicated that only one fish out of more than 5,000 examined exhibited signs of GBD in 1999, presented in Table 46.15 (Council 2000). However, 1999 was a relatively low water year and gas saturation levels were substantially lower than the previous three years. Therefore, it is unlikely that results based on data collected during 1999 revealed the impacts of gas supersaturation on the fish assemblage. For example, data collected by Chief Joseph Fish Farms and Columbia River Fish Farms suggests that fish in net pens exhibit higher mortalities when total dissolved gas (TDG) levels elevate to levels above 110 percent (USACE draft, in press). It is also worth noting that these increased TDG levels usually correspond with increasing water temperatures (15-24 $^{\circ}$C) making gas less soluble (USACE draft, in press). TDG levels are also affected by discharge at Grand Coulee Dam. Discharge through turbines and over the drum gates produce lower TDG levels than when water is discharged through the spill tubes.

Table 46.15. Prevalence of Gas Bubble Disease (GBD) in Five Common Fish Species Collected by electrofishing and beach seining in Lake Rufus Woods between April-July, 1999. Sucker spp. includes bridgelip, largescale, longnose, and unidentified suckers.

Species	Number Examined	Number With GBD

Rainbow trout	1028	0
Walleye	456	0
Northern pikeminnow	390	0
Redside shiner	688	0
Sucker spp.	2755	1

46.12.1.2 Nespelem River and Tributaries

One of the most important fish populations in the Subbasin, from a native fish recovery standpoint, is the adfluvial kokanee population that spawns in the lower Nespelem River. The habitat conditions existing in the 1.5-mile section of the Nespelem River below the barrier falls appear to be limiting the kokanee spawning production (Council 2000). The major limiting factors include silt deposition that increases embeddedness, elevated summer water temperatures that exceed 24 °C and non-point source ammonia levels that have resulted in lethal parasitic infection by Columnaris (*Columnaris flexibacter*) (LeCaire 1999; Hunner and Jones 1996). High water temperatures documented during mid- to late summer may also affect juvenile survival (Figure 46.1). The bulk of the kokanee spawning activity takes place in one general area and the balance occurs in pockets behind boulders (Council 2000).

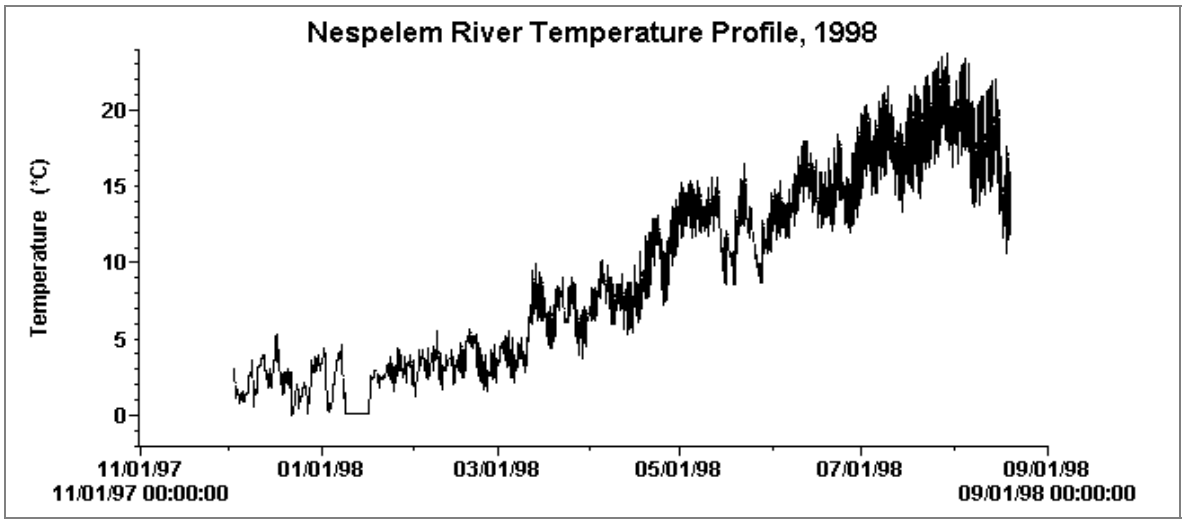


Figure 46.1. Nespelem River Water Temperature Profile

The unknown behavior of the juvenile age classes of native kokanee may be a limiting factor to the total population. If a large percentage of juvenile kokanee entrain through Chief Joseph Dam, then they will not be able to contribute to the next generation in the Nespelem River. Further, the lack of knowledge regarding juvenile behavior may be allowing for managers and dam operators to implement measures that are actually creating negative impacts to the population. Finally, predation from introduced species such as walleye may also be impacting the wild kokanee population. Eastern brook trout spawn mostly in the perennial headwater reaches of the Nespelem River watershed

located upstream of Smith Creek, but little is known about the specific contribution of each tributary. Brown trout have developed a self-sustaining population but it is unknown where spawning occurs within the Nespelem River watershed. However, an adfluvial population has existed for many years at low abundance that returns to the lower 1.5 miles of the Nespelem River to spawn. These fish rear in Lake Rufus Woods.

46.12.1.3 Lakes

The lakes in the Subbasin that will support fish populations are managed to enhance subsistence and recreational fisheries. Lake management strategies are based on harvest objectives established using the best available information and knowledge. Annually lakes are monitored and stocking rates are adjusted using adaptive management to maximize recreational and subsistence harvest opportunities. Limiting factors have been assessed (Arterburn 2003). Habitat improvements that can be implemented could result in considerable increases to natural recruitment and result in more efficient use of resources.

Buffalo Lake is a large coldwater lake located in Okanogan County at T30N, R31E, Sections 26, 27, 34, and 35 in the Nespelem River drainage within the Lake Rufus Woods Subbasin. Several intermittent and one unnamed perennial streams that feed the lake are located along the northern and eastern shorelines along with several submerged springs. Elders in the area have mentioned that rainbow trout historically spawned in the "no name" perennial creek at the lake's eastern shore. However, heavy grazing and upland timber harvest has devastated this drainage that has down-cut over 30 feet in some places. Buffalo is the only lake on the Colville Reservation that contains kokanee salmon while providing fishing opportunities for rainbow trout, largemouth bass, and pumpkinseed sunfish. Anglers introduced largemouth bass in the 1970s from nearby Rebecca Lake; this population is naturally reproducing in Buffalo Lake. All fish species are naturally reproducing in Buffalo Lake with the exception of rainbow trout that are stocked annually. All game fish species exhibit good condition, abundance, and growth characteristics, with the exception of the eastern brook trout, which has declined precipitously in recent years. Therefore, managers have discontinued hatchery plants since 2002. The data suggest that the decline of eastern brook trout has also resulted in an increase in largemouth bass abundance in recent years. Rainbow trout and kokanee salmon have and continue to make up the majority of the game fish catch at Buffalo Lake. Although some limited natural recruitment of kokanee salmon occurs, the stream that enters this lake's southeast bay has insufficient flow to provide natural recruitment. No spawning activity takes place at this location because suitable substrate and depth are lacking due to poor upland land use practices (Arterburn 2003). It appears that kokanee salmon utilize abundant springs for shoreline spawning along the northeastern shore.

Owhi Lake is a medium-sized coldwater lake located in Okanogan County at T32, 31N, R31E, Section 27,34,3 in the Nespelem River drainage of the Lake Rufus Woods Subbasin. This lake was originally developed as an irrigation reservoir but today is managed as a recreational and substance fishery for Colville Tribal members. Owhi Lake is the brood source for all brook trout eggs used by the Colville Tribal Hatchery. It historically produced up to 10 million eggs commercially sold by the CCT before the 1947 cooperative agreement with the Washington Department of Game was signed. The

intermittent inflow along the northeastern portion is through Owhi Creek. Several springs and a perennial unnamed tributary that flows from Little Owhi Lake enter the north end of Owhi Lake and provide excellent shoreline spawning habitat for brook trout. The outlet is through the Little Nespelem River. Supplemental stocking has occurred since the 1930s, but most of the fish are thought to be produced through natural reproduction. This will be verified over the next several years. Starting in 2002 all fish stocked will be differentially marked. Stocking records are unknown until 1951 but WDG did stock Owhi Lake prior to this date and anecdotal information suggests that this lake was originally stocked with brook trout in the late 1890s. Owhi Lake is the most popular Tribal member-only lake on the reservation and has a reputation for producing large brook trout. This fishery is most productive in the winter, early spring, and late fall because summer water temperatures force fish to be suspended off-shore (Arterburn 2003).

McGinnis Lake is a medium-sized coldwater lake located in Okanogan County at T29N, R31E, Sections 2,3,10A, 10B within the Upper Columbia Subbasin. The inflow is along the northeastern corner of the lake via an intermittent unnamed tributary. There is no outlet to the lake. Terrain surrounding the lake is rolling hills covered in sage and bunch grasses with basalt outcroppings and a few stands of aspen and yellow pine. Prior to 1953, the trout fishing at this lake was good, but by the mid-1950s fish production had been reduced and the WDG determined the lake was in need of rehabilitation. The rehabilitation efforts started in 1953 and were repeated in 1958 using 5 percent rotenone applied at 1-ppm by weight, but these efforts were ineffective for reducing the population of pumpkinseed sunfish. The CCT used toxaphene in 1965 and no pumpkinseed sunfish have been observed since. Today, McGinnis Lake is the only place on the Colville Reservation that non-Tribal members can fish exclusively for brook trout. Consequently, it is often a destination for local anglers targeting this species. Since population abundance, growth, and condition have been stable, the CCT plan no changes to current management strategies.

Big Goose Lake has marginal habitat specification for a warmwater lake. The main habitat constraint is dissolved oxygen. A recently installed windmill that circulates water should be able provide the slight increase in dissolved oxygen needed to prevent most fish kills. The lake is extremely shallow, so water is critical to the success of any fishery at this lake. No water withdrawals should occur from this lake, as ample water is available from other sources in this area. Fish stocked in 1949 and 1950 came from Pearrygin Lake located near the town of Winthrop. The 1974 stocking was from fish collected at Fish Lake in Pine Creek, 1981 stockings were from Bourgeau Lake on the Colville Reservation. In 2002, this lake was stocked with fish salvaged from Rebecca Lake when the lake level was lowered. After bass were stocked in 1974 and in 2002, game wardens reported that anglers were fishing and catching bass later that same year. However, a complete winter kill occurred in 1979. The lake was restocked in 1981 and plans to install an aeration system began. A partial winter kill in 1984 prompted the Colville Business Council to close Big Goose Lake in 1985 so that the population could be restocked and have time to be re-established. No records of stocking during this time are available. This lake supported medium-to-heavy fishing effort after an aerator system

was installed in 1987. Many large fish were taken and fish appeared to have been reproducing naturally. However, the aeration system was not maintained and during low water years the lake died out. A new aeration system was installed in 2002, with hopes of recreating a quality largemouth bass fishery. Goose Lake has always been managed as a largemouth bass fishery and is one of only three lakes actively managed for largemouth bass on the entire Colville Reservation. Windmills were installed in 2002 and fish were restocked. Pumpkinseed sunfish were also stocked in 2002 to enhance the prey base. Natural recruitment and good survival from fish stocked in 2002 were observed in spring 2003 (Arterburn 2003).

Rebecca Lake is a small cool-water lake located in Okanogan County at T30N, R31E, Section-32 within the Lake Rufus Woods Subbasin. This lake was created when a small board dam was placed at the outlet of a permanent wetland raising the water level 4 feet. Prior to the dam installation, this lake was better suited to waterfowl habitat. Rebecca Lake has been a successful warmwater fishery for several years displaying a population structure of a traditional panfish option fishery. Small largemouth bass at high densities produce moderate numbers of large pumpkinseed sunfish. No population data has been collected but angler comments support this conclusion. In 2002, fish from this lake were electroshocked and transported to Big Goose Lake to start a new warmwater fishery. Legal issues may require the removal of the dam at Rebecca Lake and it is unclear if this lake will ever be refilled.

46.12.2 Description of Historic Factors Leading to Decline of Focal Species

The native fish assemblage within the boundaries of the Lake Rufus Woods Subbasin was supported by pristine habitat conditions and consisted of both resident and anadromous fish species. Anadromous fish transported marine nutrients into the Subbasin and were keystone species to the ecosystem (Willson and Halupka 1995; Mills et al. 1993; Cederholm et al. 1989; Kline et al. 1990). Construction of Chief Joseph Dam in 1958 blocked the upstream migration of adult salmon. Anadromous fish were extirpated from Lake Rufus Woods. The transformation of habitat conditions in the reservoir allowed for introduced nonnative species to establish self-sustaining populations within Lake Rufus Woods. This resulted in a shift in the fish community to nonnative species (Scholz et al. 1985). Therefore, discussions regarding native fish and/or native ecosystem recovery efforts must consider anadromous fish, as they are a significant part of the native ecosystem.

SECTION 47 – Table of Contents

47 Lake Rufus Woods Subbasin Inventory of Existing Programs – Aquatic

Large portions of Section 47 were contained within the Lake Rufus Woods Subbasin Summary Report (2001) and are summarized here.

47.1 Current Management Directions

Within the Lake Rufus Woods Subbasin, fish and wildlife resources are co-managed by the Washington Department of Fish and Wildlife (WDFW) and the Colville Confederated Tribes (CCT) outside of the boundaries of the Colville Indian Reservation and exclusively by the CCT within the boundaries of the reservation. The current management direction is to maintain viable populations of native and desired nonnative species of fish and wildlife, and their supporting habitats, while providing sufficient numbers to meet the cultural, subsistence and recreational needs. 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.

47.1.1 Local Government

47.1.1.1 Douglas County

Douglas County on the east side of the reservoir regulates and enforces the Growth Management Act and is responsible for planning, land use and building permits. The vision for the CCT is to manage the natural resources under its jurisdiction on the Colville Indian Reservation to enhance and maintain the ecological health of the environment and the social well being of the Tribal Members and other human populations (CCT 2000)

47.1.1.2 Okanogan County

The CCT have management and regulatory authority of lands within the boundaries of the Colville Indian Reservation in Okanogan County.

47.2 Existing and Imminent Protections

Currently, bull trout are the only federally listed fish species within the Lake Rufus Woods Subbasin. However, it is presumed that the distribution of bull trout is not widespread within the Subbasin. Habitat within the Lake Rufus Woods Subbasin has not been determined to be within the critical habitat area as outlined by the USDA (2001). A petition to list westslope cutthroat trout as a threatened species in 2003 has been set aside by the USFWS (Federal Register 2003). Other aquatic candidates for potential listing may include redband trout due to hybridization with introduced stocks of rainbow trout and white sturgeon because of a lack of juvenile recruitment and suitable spawning habitat within Lake Rufus Woods.

47.3 Inventory of Recent Restoration and Conservation Projects

Few activities are ongoing in the Subbasin (both BPA and non-BPA funded) that address current research, monitoring and evaluation needs in the Lake Rufus Woods Subbasin. At

this time the activities are focused on small areas. Many are in the initial stages of assessment and enhancements. Most of what does occur is done as part of a larger project and not necessarily focused at the Lake Rufus Woods Subbasin.

47.3.1 BPA Funded Activities

Chief Joseph Kokanee Enhancement Project (#9501100)

Project Description:

This is mainly a fish stock status project with emphasis placed upon the protection and ultimate enhancement of the natural production kokanee found in the blocked area. Current focus is on testing the efficacy of strobe light technology as a deterrent to fish entrainment at Grand Coulee Dam. At the direction of the Independent Scientific Review Panel (ISRP), the project engaged a subcontractor to test strobe lights at Grand Coulee. The project is using multi and split beam acoustic transducers combined with exclusive software developed to determine the effectiveness of the light array to elicit an avoidance response to the lights. Additionally the project is monitoring fine scale fish behavior using surgically implanted sonic tags monitored by underwater hydrophone arrays in the power plant cul-de-sac and below the dam. Other objectives include determining the baseline genetic code of natural production kokanee found within the blocked area and Canada. As part of this objective the project is monitoring the annual status of the natural production kokanee stocks at various locations on and off of the Colville Indian Reservation.

Associated Monitoring:

The project is monitoring entrainment on an ongoing basis each spring and early summer period. It is also tracking and compiling a genetic family tree of "wild" kokanee stocks found in the blocked area. Annual adult kokanee spawner recruitment is tracked as a matter of routine each fall.

Accomplishments:

- Conducted a 42-month entrainment study at Grand Coulee Dam using single beam acoustic monitors installed near the turbine intake area of 14 of the 24 turbine intakes at Grand Coulee Dam.
- Determined that entrainment was substantial and represented the greatest threat to the BPA funded hatchery program related to Lake Roosevelt and Banks Lake.
- Determined that entrainment ranged from 211,000 to 600,000 annually. A total of 1,655,000 fish targets counted in the 42-month study.
- Identified the third power plant as entraining the greatest number of fish annually. Eighty five percent of the total entrainment occurred at the third power plant.
- Determined that power peaking and flood control operations were the cause of much of the high entrainment rates.
- Determined that a correlation exists between high water years, timing of lake refill, dam discharge, dam operations, timing of net pen and hatchery releases, and high entrainment.
- Determined that at a minimum six kokanee stocks have the potential of occupying Lake Roosevelt waters.
- Discovered a stock of kokanee in Chain Lake that predates the construction of Grand

Coulee Dam that is genetically unique probably due to genetic isolation.

- Determined that wild tributary spawning kokanee do support the intensive Lake Roosevelt kokanee fishery.
- In conjunction with the entrainment a weekly gill net survey was conducted that determined that while many fish species were present near the dam, kokanee and rainbow trout made up the majority of the gill net catch. Walleye were the third most commonly encountered specie.
- Determined that some current velocities present in the center of the third power plant cul-de-sac may overwhelm the ability of fish to modify their direction of travel and be sucked through the dam intakes.
- Discovered that operations of the Pumping/Generation station may also be a substantial contributor to entrainment at Grand Coulee Dam.
- Determined that the pumping station intakes are unscreened as are the turbine intakes.

Colville Tribal Fish Hatchery (#8503800)

Currently the hatchery provides surplus fish when available to supplement the rainbow trout fishery within Lake Rufus Woods and stocks fish into lakes and streams on the Colville Reservation. Lakes on the Colville Reservation are monitored and evaluated for activities associated with hatchery stocking efforts, broodstock maintenance/development, fishery contribution, and relative species abundance**.**

47.3.2 Non-BPA Funded Activities

Confederated Tribes of the Colville Reservation

- A fish passage feasibility studies were and continue to be funded by the Colville Tribes for Chief Joseph Dam.
- Ecological Interaction Research Study (Tropic Cascade) and limnological studies were conducted on Buffalo Lake. .
- Creel census work was and continues to be conducted on many Subbasin lakes and streams largely as part of the Colville Tribal Hatchery monitoring and evaluation efforts.
- Both the CCT Parks and Recreation Department and the WDFW enforce fish and wildlife regulations.
- Tribal Environmental Trust department monitors water quality and flow regimes in Subbasin lakes and streams.
- Permitting and regulatory activities are conducted by the CCT (including but not limited to shoreline, Hydraulic, planning/land use, burning, water withdrawal, timber harvest, and other permits that are issued by a variety of departments.

Washington Department of Natural Resources

The Washington Department of Natural Resources monitors land use and forest practice activities on fee lands within the Subbasin.

U.S. Bureau of Reclamation

The Bureau of Reclamation monitors water flow regimes and water quality. Dissolved gas and lake levels are monitored for Lake Roosevelt and Grand Coulee Dam.

U.S. Geological Survey
The Kalispel Tribe Stock Status Above Chief Joseph and Grand Coulee Dams (#9700400) project is developing better communication and data use throughout the province while conducting inventories on all pertinent fish species. The USGE-BRD has conducted Gas Bubble disease studies in Lake Rufus Woods.

Douglas County
Various building and shoreline codes are monitored and permitted by this county government.

47.4 Strategies Currently Being Implemented Through Existing Projects

Few projects through the Northwest Power and Conservation Council's (Council) Fish and Wildlife Program have been initiated in the Lake Rufus Woods Subbasin. These projects were undertaken to partially mitigate for the loss of anadromous fish due to the creation of the federal hydropower system utilizing resident fish substitution. The following projects have enhanced the resident fishery (both native and nonnative) in the Lake Rufus Woods Subbasin:

- Stock assessments: Chief Joseph Kokanee Enhancement Project #9501100
    - Addresses kokanee salmon monitoring in the blocked area and entrainment reduction research at Grand Coulee Dam.
    - Primarily represents R, M & E activities for blocked area.

- Artificial production enhancement activities: Colville Tribal Fish Hatchery #8503800
    - Provides hatchery production for lakes and streams on the Colville Reservation.
    - Monitors and evaluates hatchery activities.
    - Resident Fish substitution and R, M & E activities on lakes.

47.4.1 Limiting Factors and Strategies Currently Being Implemented

As described in Section 2.4.2, a database was developed that lists the recent projects that have been implemented in the Subbasin. Each project was coded for the limiting factors that were addressed and the strategies that were employed.

In the Lake Rufus Woods Subbasin, seven recent restoration and conservation projects were identified. Of the projects identified, three were focused on resident fish, three primarily benefited wildlife, and one benefited both fish and wildlife. Projects in the Lake Rufus Woods Subbasin have been diverse. All the categories of limiting factors received some attention in recent years (Figure 47.1).

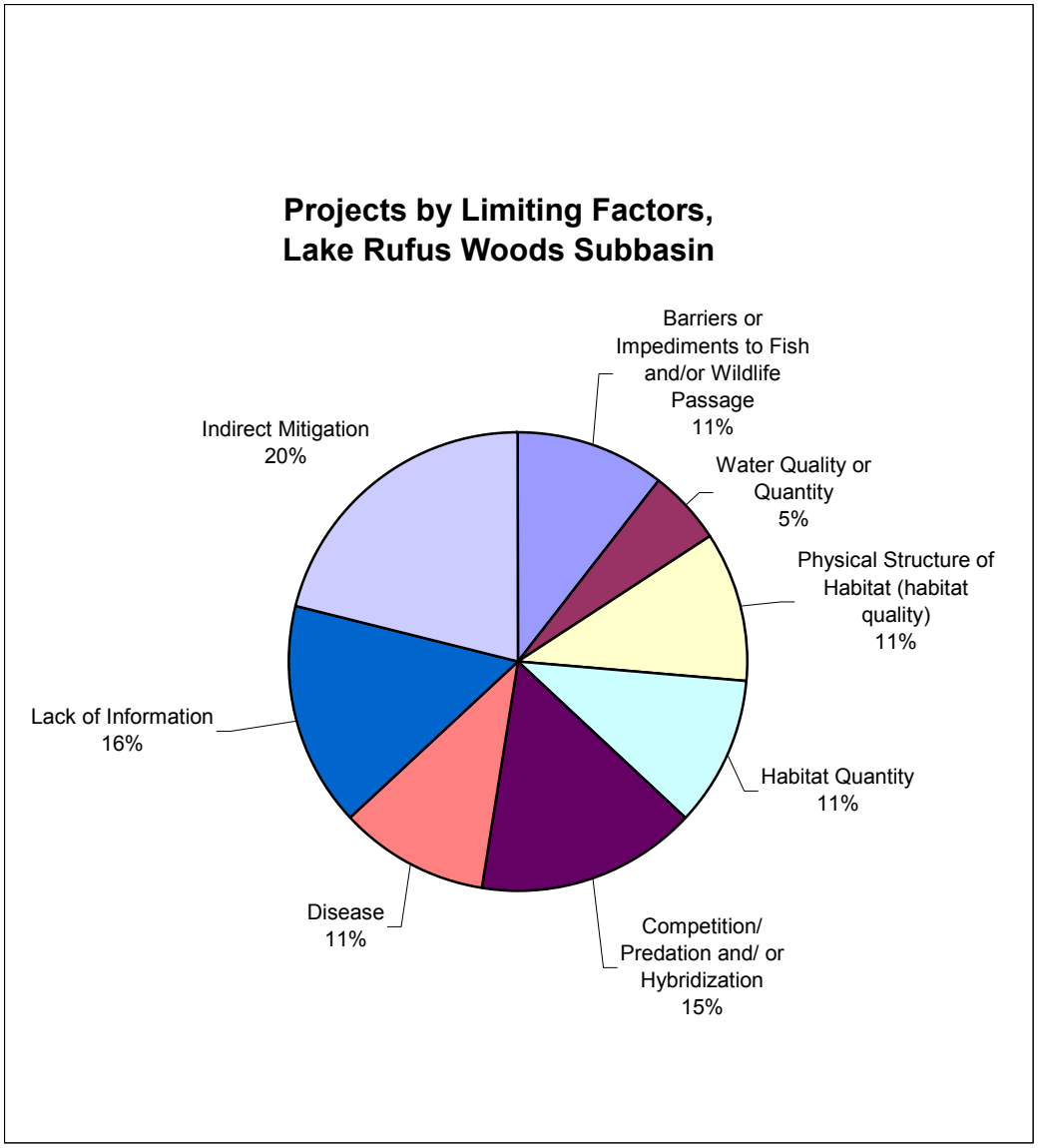


Figure 47.1. Proportion of projects in the Lake Rufus Woods Subbasin that relate to specific limiting factors

The strategies that have been employed in the Lake Rufus Woods Subbasin have also been diverse (Figure 47.2). The only strategy that has not been extensively employed by the projects in the database is enforcement/protection.

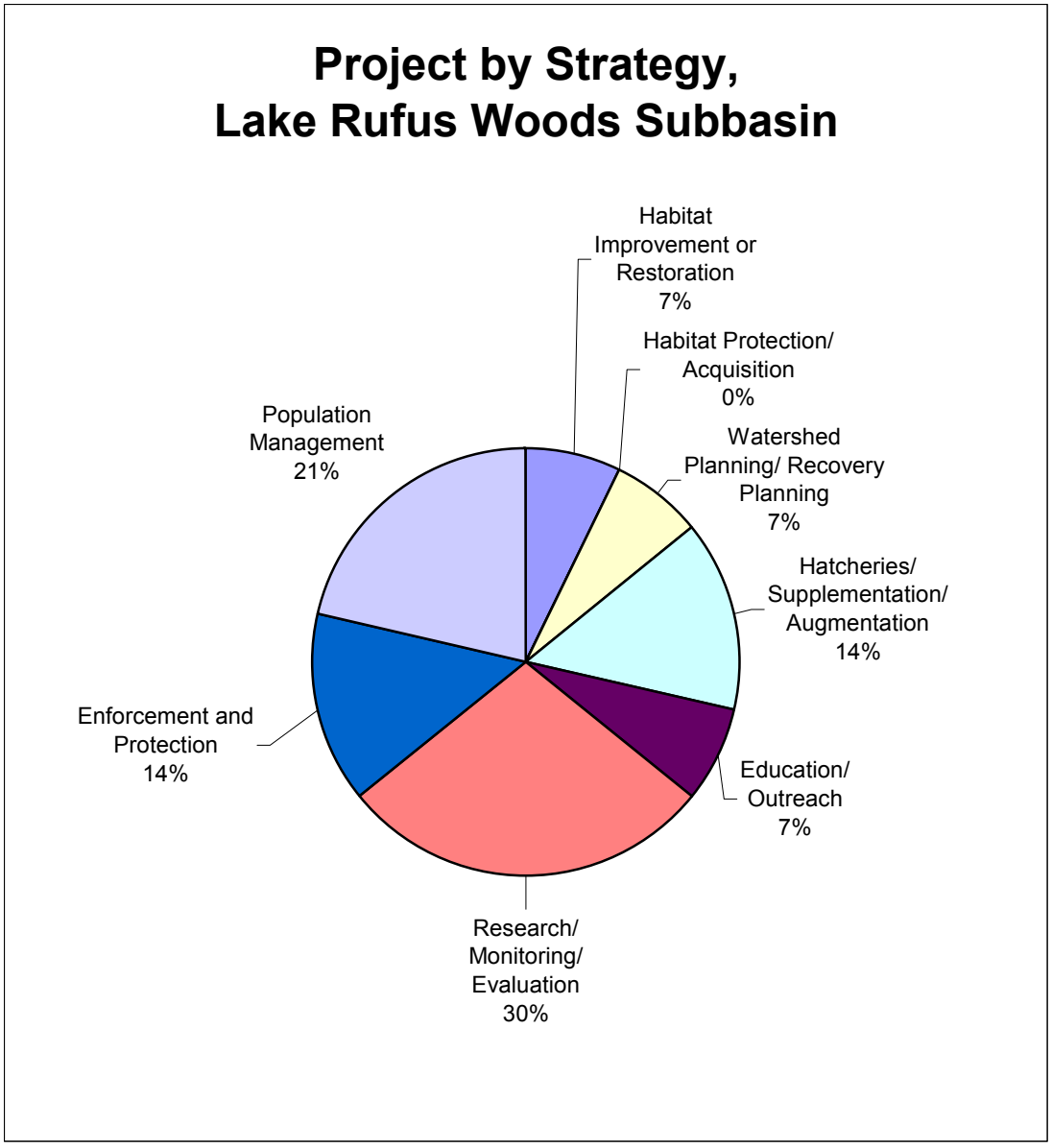


Figure 47.2. Proportion of projects in the Lake Rufus Woods Subbasin that relate to specific strategies

47.4.2 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 identified only 7 total projects in this Subbasin for both fish and wildlife combined. The most obvious gap between the actions taken and the actions needed in the Lake Rufus Woods Subbasin is the lack of action.

SECTION 48 – Table of Contents

48 Lake Rufus Woods Subbasin Assessment – Terrestrial

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

The Lake Rufus Woods Subbasin is dominated by shrub-steppe habitats, which occur across the western and southern portions of the subbasin. Forested habitats of ponderosa pine and interior mixed conifer forest occur in the higher elevations of the northeastern portion of the subbasin. Agriculture and related land uses comprise over 16 percent of the Subbasin, primarily south of Lake Rufus Woods. The largest urban centers include Nespelem, Elmer City, and Coulee Dam.

The current distribution of wildlife-habitat types in the Subbasin (based on IBIS 2003) is shown in Section 45, Figure 45.2. Table 48.1 below presents the acreages by habitat type and by subbasin focal habitats. Five focal habitats were selected for the IMP: wetlands, riparian, steppe and shrub-steppe, upland forest, and cliff/rock outcrops. The same habitats were selected as focal habitats for the Lake Rufus Woods Subbasin (Ad Hoc Terrestrial Resources Tech Team, May 5, 2003). Focal habitats comprise about 84 percent of the basin, including steppe and shrub-steppe (58 percent), upland forests (22 percent), and wetlands and riparian habitats (5 percent, including open water habitats). Developed habitats, including agricultural and urban lands, currently comprise approximately 16 percent of the Subbasin and are located primarily south of Lake Rufus Woods. Cliff/rock outcrop habitats are not mapped in the IBIS system.

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 and wildlife within the Lake Rufus Woods Subbasin is available for selected ownerships and/or jurisdictions; these sources include the WDFW, WDOE, Colville Confederated Tribes, USACE, and USFS. Data from these sources has been used where available to provide more specific information on habitat and wildlife species 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 for a discussion of historical vs. current habitat types in the IMP and factors influencing the distribution and quality of those habitats.

Table 48.1. Current wildlife-habitat types in the Lake Rufus Woods Subbasin

Wildlife-Habitat Type	Lake Rufus oods Current Acres	Percent of Total
Wetlands (Focal Habitat)		
Lakes, Rivers, Ponds, and Reservoirs	12,128	2.8%
Herbaceous Wetlands	1,280	0.3%
Montane Coniferous Wetlands	4,305	1.0%
Riparian and Riparian Wetlands (Focal Habitat)		0.0%
Eastside (Interior) Riparian Wetlands	2,834	0.7%
Steppe and Shrub-Steppe (Focal Habitat)		0.0%
Eastside (Interior) Grasslands	19,694	4.6%
Shrub-Steppe	229,340	53.0%
Upland Forest (Focal Habitat)		0.0%
Montane Mixed Conifer Forest	969	0.2%
Eastside (Interior) Mixed Conifer Forest	58,072	13.4%
Lodgepole Pine Forest and Woodlands	828	0.2%
Ponderosa Pine Forest and Woodland	32,976	7.6%
Upland Aspen Forest	1,222	0.3%
Alpine and Subalpine		0.0%
Subalpine Parklands	15	0.0%
Alpine Grasslands and Shrublands	220	0.1%
Developed		0.0%
Agriculture, Pasture, and Mixed Environs	67,930	15.7%
Urban and Mixed Environs	662	0.2%
Total	**432,475**	**100.0%**

(*Source*: adapted from IBIS 2003)

48.1.1 Open Water, Wetlands, and Riparian Areas

The IBIS wildlife-habitat map (Figure 45.2) is based in part on National Wetlands Inventory (NWI) mapping, but does not utilize all of the wetland categories or show the full extent of very small mapped areas. The following discussion of open water habitats is based on Figure 45.2 and the corresponding Table 48.1. Figure 48.1 provides a more detailed mapping of wetlands, excluding open water habitats, based on WDOE mapping (WDOE 1999) using aggregated NWI wetland types. Table 48.2 summarizes the acreages of wetlands in the Subbasin by wetland category.

48.1.1.1 Open Water

Open water habitats of natural and human origin comprise approximately three percent of total area of the Lake Rufus Woods Subbasin (IBIS 2003). Lake Rufus Woods, the reservoir behind Chief Joseph Dam, is the largest waterbody in the Subbasin with a surface area of over 8,000 acres. Other large lakes in the Subbasin include Owhi, Little Owhi, Johnson, Buffalo, and McGinnis lakes. Numerous small lakes are scattered throughout the Subbasin. The Nespelem River is the primary tributary river system in the Subbasin.

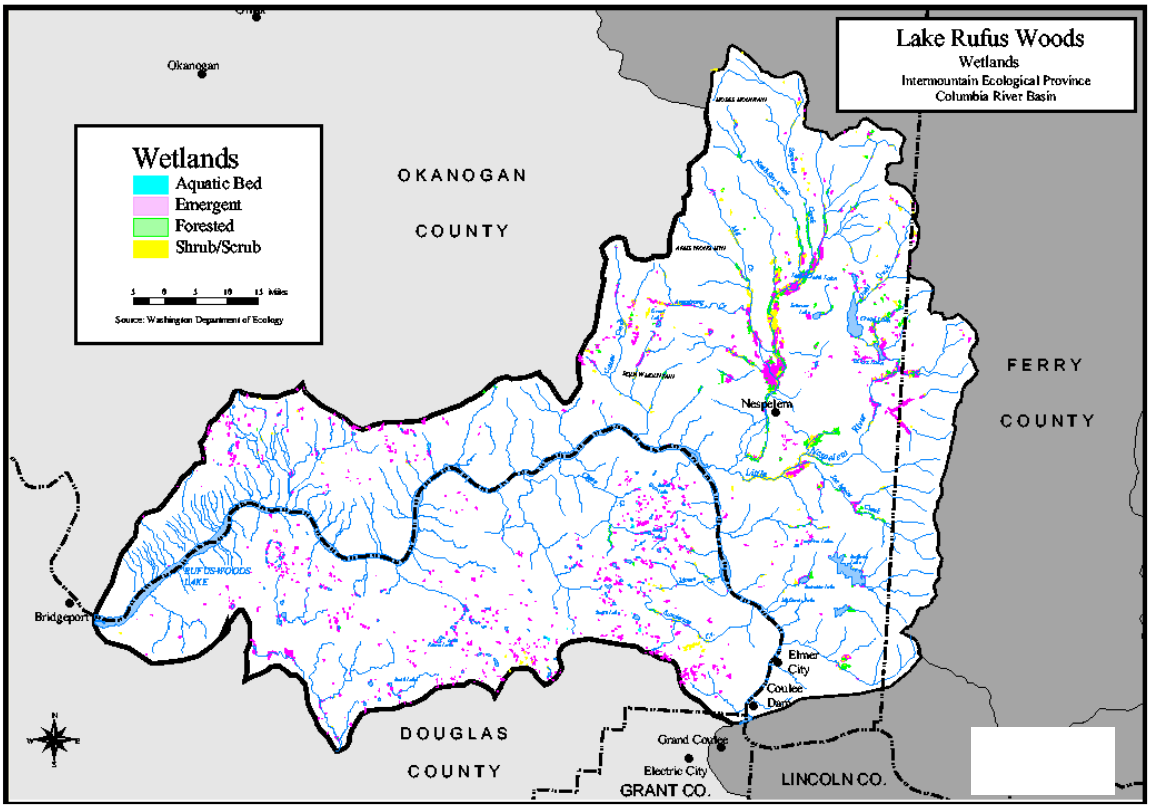


Figure 48.2

Figure 48.1 Wetland areas within the Lake Rufus Woods Subbasin

The Chief Joseph Project caused the impoundment of approximately 51 miles of the Columbia River (Kuehn and Berger 1992). The project is operated as a run-of-river facility, providing little storage capacity within the reservoir confines. Other factors that have influenced the Subbasin's waterbodies include various water resources projects, agriculture, grazing, timber harvest, and residential development.

48.1.1.2 Wetlands and Riparian Areas

Wetlands (excluding open water habitats) comprise approximately one percent of land cover in the Lake Rufus Woods Subbasin (Table 48.2). Wetlands are dominated by emergent herbaceous habitats (54 percent of total wetland habitat); these wetlands are scattered throughout the Subbasin, with the largest complexes associated with the Nespelem and Little Nespelem river riparian areas. Scrub-shrub wetlands comprise about 25 percent and forested wetlands about 18 percent of total wetland habitat; these wetlands are also located in greatest concentration along the Nespelem and Little Nespelem rivers.

Table 48.2. Acres of Wetlands in the Lake Rufus Woods Subbasin by Wetland Type

Wetland Type	Acres
Emergent	3,526
Scrub/shrub	1,550
Forested	1,126
Aquatic bed	54
Total all wetland types	**6,256**

(*Source*: WDOE 1999)

Riparian vegetation along Lake Rufus Woods currently is limited due to the fluctuation of the reservoir. Construction of the Chief Joseph Project resulted in loss of 658 acres of riparian habitats dominated by woody, broad-leaved species (Kuehn and Berger 1992) located along the Columbia River and tributary streams.

In the northeastern portion of the Subbasin, forested habitats of the upper Nespelem and Little Nespelem drainages support woody riparian vegetation. Timber management in these drainages has been intensive, and many of the riparian areas have been modified as a result. In the remainder of the Lower Subbasin, non-forested habitats prevail. Riparian zones within these areas have been greatly modified through grazing and agricultural practices. Effects have included removal of streamside vegetation, compaction of soil, and increased cover of nonnative plant species (CCT 2000).

48.1.2 Steppe and Shrub-Steppe

Shrub-steppe habitat is the dominant land cover in the Lake Rufus Woods Subbasin, occupying 53 percent of the total area; an additional 5 percent of the Subbasin is classified as interior grasslands. The extent of shrub-steppe has declined from historic conditions due to the large-scale conversion of shrub-steppe to agricultural and developed lands. Approximately 16 percent of the Subbasin is currently in agricultural uses; the majority of this land was converted from shrub-steppe. A secondary effect of agriculture and grazing is the introduction of nonnative noxious weeds through seed sources and via roads and equipment. Remaining shrub-steppe habitats in the Subbasin are greatly modified from historic conditions by reduction of native plant species and increases the cover of noxious weeds.

Construction of the Chief Joseph Project resulted in loss of 1,681 acres of shrub-steppe habitat for placement of project facilities and creation of the reservoir (Kuehn and Berger 1992). Additional habitat was lost due to the 10-foot pool raise that occurred in 1981 (USACE 1980).

48.1.3 Upland Forests

Upland forests in the Lake Rufus Woods Subbasin are dominated by interior mixed conifer stands (13 percent of land cover) at higher elevations and ponderosa pine (8 percent) at lower elevations. Timber harvest is a primary land use on the Colville Indian Reservation across the northern portion of the Subbasin.

Forested stands in the Subbasin have been modified through timber management and associated human land uses. Late and old-successional stage stands have has been reduced from the historic condition, and have been largely replaced by younger seral

stands with dominance of less fire-resistant species such as Douglas fir. Timber management has caused increased road densities throughout the subbasin. Fire control, grazing, and residential development have also influenced the distribution and structure of upland forests in the Subbasin.

Construction of the Chief Joseph Project and reservoir inundation caused the direct loss of an estimated 346 acres of ponderosa pine savannah and 106 acres of mixed forest (Kuehn and Berger 1992). Additional forest habitat was affected by the 10-foot pool raise that occurred in 1981.

48.1.4 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 anthropogenic 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 that have important influences on habitat quality and wildlife use has been compiled for this assessment, including road density and salmonid nutrients lost to the IMP.

48.1.4.1 Road Density

Road density, by density class, for each sixth order watershed in the Lake Rufus Woods Subbasin is shown in Section 45, Figure 45.3. The northeastern portion of the Subbasin is ranked as high road density (1.7 to 4.7 miles of road per square mile), due in large part to timber management activities in the Nespelem River watershed. The majority of the Subbasin is ranked as moderate density (0.7 to 1.7 miles of road per square mile). Several watersheds in Douglas County in the south-central portion of the Subbasin are ranked as low density (0.1 to 0.7 miles of road per square mile).

High road densities are indicative of human land uses and activities. Road density values in excess of 1.5 miles per square mile are considered suboptimal for mule deer and white-tailed deer summer range; values greater than 0.5 miles per square mile are suboptimal for the same species on their winter ranges (WDFW 1991). Most of the Lake Rufus Woods Subbasin currently supports road density levels considered suboptimal for these game species. However, the Subbasin has the lowest road densities, on average, in the IMP. Road access to the Lake Rufus Woods reservoir is very limited, restricted mainly to the upper and lower ends.

48.1.4.2 Loss of Salmonid Nutrient Base

Construction and operation of the Chief Joseph Dam on the Columbia River prevented salmon and other anadromous fishes from returning to the Lake Rufus Woods Subbasin. The loss of anadromous fish affected not only subsistence and recreational use of the 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.

Scholz, et al. (1985) compiled information on salmon and steelhead run size and harvest above Grand Coulee Dam, which is located about 51 miles above Chief Joseph 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.

48.1.5 Land Ownership and Gap Status

Land ownership in the Lake Rufus Woods Subbasin is summarized in Table 48.3, based on data from the Gap Analysis Program (GAP). A map of ownership categories across the IMP is presented in Section 4, Figure 4.3. The Lake Rufus Woods Subbasin is dominated by Tribal lands of the Colville Indian Reservation, which occupy the northern and eastern portions of the Subbasin (64 percent of total). (Note: private lands located within the reservation boundaries are not displayed in Figure 4.3 and Table 48.3.) Private ownership comprises about 28 percent of the total; these lands are located south of the reservoir. State lands south of Lake Rufus Woods make up about seven percent of the Subbasin. Federal lands comprise about one percent of the total ownership, and are associated primarily with Grand Coulee Dam.

Relative protection levels of native habitats in the Lake Rufus Woods Subbasin are shown in Table 48.4. No lands within the Subbasin are categorized as Status 1, High Protection. Habitats protected under Status 2, Medium Protection, comprise less than one percent of the total and are confined to a limited number of parcels near the Chief Joseph and Grand Coulee dam sites. About nine percent of the Subbasin lands are in Low Protection; these lands correspond in part to the state-owned properties in the southern portion of the Subbasin. The majority of lands (90 percent) within the Subbasin have no formal protections for terrestrial resources.

Due to the scale of the IBIS and GAP mapping, small parcels may be incorrectly categorized in this analysis. For example, the 3,417-acre Moses Mountain Natural Area located on the Colville Indian Reservation (CCT 2000; CCT 2004b) is located within the Lake Rufus Woods Subbasin. This highly protected area is not shown in the GAP analysis. No commercial timber harvest is allowed within the natural area.

Table 48.3. Land ownership in the Lake Rufus Woods Subbasin by wildlife-habitat types

Wildlife-Habitat Type (acres)	Federal Lands	Native American Lands	State Lands	Local Gov't. Lands	Non-Gov't. Org.Lands	Private Lands	Water	Total
Wetlands								
Lakes, Rivers, Ponds, and Reservoirs	246	6,310	231	0	0	5,338	0	12,125
Herbaceous Wetlands	0	614	208	0	0	556	0	1,378
Montane Coniferous Wetlands	0	4,305	0	0	0	0	0	4,305
Riparian and Riparian Wetlands								0
Interior Riparian Wetlands	48	2,311	81	0	0	395	0	2,834
Steppe and Shrub-Steppe								
Interior Grasslands	0	19,675	0	0	0	0	0	19,675
Shrub-steppe	4,318	134,262	18,045	0	0	72,624	0	229,248
Upland Forest								
Montane Mixed Conifer Forest	0	962	0	0	0	0	0	962
Interior Mixed Conifer Forest	0	57,946	1	0	0	13	0	57,959
Lodgepole Pine Forest & Woodlands	0	825	0	0	0	0	0	825
Ponderosa Pine Forest & Woodlands	28	32,322	94	0	0	515	0	32,959
Upland Aspen Forest	0	1,215	0	0	0	0	0	1,215
Alpine and Subalpine								
Subalpine Parkland	0	15	0	0	0	0	0	15
Alpine Grasslands and Shrublands	0	219	0	0	0	0	0	219
Developed								
Agriculture, Pasture, and Mixed Environs	484	15,982	9,222	0	0	42,189	0	67,876
Urban and Mixed Environs	415	247	0	0	0	0	0	662
Total Acres	**5,538**	**277,211**	**27,881**	**0**	**0**	**121,629**	**0**	**432,259**

(*Source*: adapted from IBIS 2003)

Table 48.4. GAP status of lands in the Lake Rufus Woods Subbasin by wildlife-habitat type

Wildlife-Habitat Type (acres)	1 - High Protection	2 - Medium Protection	3 - Low Protection	4 - No Protection	Water	Total
Wetlands						
Lakes, Rivers, Ponds, and Reservoirs	0	83	491	11,550	0	12,125
Herbaceous Wetlands	0	0	258	1,121	0	1,378
Montane Coniferous Wetlands	0	0	0	4,305	0	4,305
Riparian and Riparian Wetlands						
Interior Riparian Wetlands	0	23	138	2,673	0	2,834
Steppe and Shrub-Steppe						
Interior Grasslands	0	0	0	19,675	0	19,675
Shrub-steppe	0	1,271	19,015	208,963	0	229,248
Upland Forest						
Montane Mixed Conifer Forest	0	0	0	962	0	962
Interior Mixed Conifer Forest	0	0	1	57,959	0	57,959
Lodgepole Pine Forest & Woodlands	0	0	0	825	0	825
Ponderosa Pine Forest & Woodlands	0	0	99	32,860	0	32,959
Upland Aspen Forest	0	0	0	1,215	0	1,215
Alpine and Subalpine						
Subalpine Parkland	0	0	0	15	0	15
Alpine Grasslands and Shrublands	0	0	0	219	0	219

Wildlife-Habitat Type (acres)	1 - High Protection	2 - Medium Protection	3 - Low Protection	4 - No Protection	Water	Total
Developed						
Agriculture, Pasture, and Mixed Environs	0	252	20,379	47,246	0	67,876
Urban and Mixed Environs	0	410	0	252	0	662
Total Acres	**0**	**2,039**	**40,380**	**389,840**	**0**	**432,259**

(*Source*: adapted from 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.

48.2 Wildlife of the Lake Rufus Woods Subbasin

48.2.1 Wildlife Occurring in the Lake Rufus Woods Subbasin

Wildlife-habitat types in the Lake Rufus Woods Subbasin are dominated by shrub-steppe habitats in the south and ponderosa pine and interior mixed conifer forests in the northeast. There are approximately 356 species of terrestrial vertebrate wildlife that occur within the Subbasin, many of which are important for ecological, cultural, and/or economic reasons. Table 48.5 presents the terrestrial vertebrate wildlife species occurring within the Subbasin. Due to the large number of wildlife species, the following discussion focuses on wildlife species that are important indicators of habitat quality, those that represent other wildlife species, and those with special management status. Refer to the Lake Rufus Woods Subbasin Summary (LeCaire 2000) for more detailed information on general wildlife of the Subbasin.

Table 48.5. Number of wildlife species (and percent of province total) in the Lake Rufus Woods Subbasin

	Occurring Species (Percent of Province Total)	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	12 (71%)	0	0	0	0	0
Birds	231 (84%)	9	1	2	3	53
Mammals	96 (95%)	3	0	1	2	24
Reptiles	17 (94%)	0	0	0	0	2
Total	356 (86%)	12	1	3	5	79

(*Source*: IBIS 2003)

48.2.2 HEP and Priority Species of the Lake Rufus Woods Subbasin

Subbasin planners selected a group of wildlife species to represent the focal habitats and wildlife of the Lake Rufus Woods Subbasin. Species used in the Chief Joseph Project Habitat Evaluation Procedures (HEP) study (Kuehn and Berger 1992) were selected because they were used to assess the construction and inundation losses 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 federally-listed and state classified threatened and endangered species, is presented in Table 48.6.

Table 48.6. Federal and state endangered/threatened, HEP, and priority wildlife species of the Lake Rufus Woods Subbasin and degree of association1 with focal habitats during breeding

Common & Scientific Names	Federal/ State Listing Status [2]	HEP/ Priority Status [3]	Focal Habitats				
			Cliff/ Rock Outcrop	Wetland	Riparian	Steppe/ Shrub-Steppe	Upland Forest
Bald eagle *Haliaeetus leucocephalus*	T / t	P(1,3,4)	-	-	General	-	General
Bobcat *Lynx rufus*	-	HEP	General	-	General	General	General
Canada goose *Branta canadensis*	-	HEP	General	Close	-	General	-
Golden eagle *Aquila chrysaetos*	-	P(1,3)	Close	-	General	General	General
Lewis woodpecker *Melanerpes lewis*	-	HEP	-	-	General	General	General
Mink *Mustela vison*	-	HEP	-	Close	Close	-	-
Mule deer *Odocoileus hemionus hemionus*	-	HEP	-	General	General	General	General
Ring-necked pheasant *Phasianus colchicus*	-	HEP	-	-	Close	Close	-
Sage grouse *Centrocercus urophasianus*	- / t	HEP	-	-	-	Close	-
Sharp-tailed grouse *Tympanuchus phasianellus Columbianus*	- / t	HEP	-	-	-	Close	General
Spotted sandpiper *Actitis macularia*	-	HEP	-	General	Close	-	-
Yellow warbler *Dendroica petechia*	-	HEP	-	-	Close	-	-

(*Source*: 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.

3 **HEP** = Species evaluated via Habitat Evaluation Procedures loss assessment for Chief Joseph Dam (Kuehn and Berger 1992)
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., close).

The province-wide status and trends of federal and state threatened and endangered species are discussed in Section 4, Terrestrial Resources in the Intermountain Province. Subbasin-level information on occurrence of these species is provided in this section. The occurrence of HEP and priority species in the Subbasin is also 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 in the Subbasin is not available.

48.2.2.1 Federal and State Threatened and Endangered Species

American white pelican. Approximately 80 non-breeding pelicans have been observed at the mouth of the Okanogan River from spring through fall during the past ten years (R. Fischer, USACE, personal communication, December 3, 2003). Although this location is outside of the Subbasin (to the west), occasional use of Lake Rufus Woods by the pelicans has been observed.

Bald eagle. A total of seven nesting territories have been documented on Lake Rufus Woods, beginning with a single nest in 1990 (R. Fischer, USACE, personal communication, December 3, 2003). During 2003, five territories had active nests. WDFW (2003b) report two winter roosts along the Columbia River, found in 1979 and 1984, and a nesting territory near Buffalo Lake.

Sage grouse. The only known sage grouse lek in the IMP is located south of the Columbia River in the southwestern portion of the Lake Rufus Woods Subbasin (WDFW 2003b). The lek was reported in 1996. The sage grouse lost 1,179 Habitat Units as a result of construction of the Chief Joseph hydropower project.

Sharp-tailed grouse. Records from the WDFW (2003b) show that 33 of 48 sharp-tailed grouse leks in the province occur within this Subbasin. The Chief Joseph hydropower project caused a loss of 2,290 Habitat Units for sharp-tailed grouse.

48.2.2.2 Chief Joseph HEP Species

Bobcat. The WDFW does not report trapping statistics for this species, nor do they systematically monitor its population. It is presumed that the bobcat occurs throughout the subbasin. The Chief Joseph hydropower project reported a loss of 401 Habitat Units for bobcat.

Canada goose. Canada goose is known to breed in the Lake Rufus Woods Subbasin. Data from the WDFW (2004a; Appendix G) estimates that the Lake Rufus Woods Subbasin provides less than one percent of the state's total goose hunting harvest and recreation. That statistic combines all goose species for the state. The Canada goose lost 213 Habitat Units from construction of the Chief Joseph Project.

Lewis' woodpecker. The Washington GAP Analysis Project (Smith et al. 1997) reports no evidence of Lewis' woodpecker breeding within this Subbasin, and the WDFW (2003b) does not have any records of occurrence. The Chief Joseph Project resulted in a loss of 286 Habitat Units for Lewis' woodpecker.

Mink. The WDFW reports almost no trapping harvest of mink within the counties of the Subbasin (Appendix G). The Chief Joseph Project caused the loss of 920 mink Habitat Units.

Mule deer. Mule deer population management objective of the WDFW is an increase in populations within the limitations of available mule deer habitat (WDFW 2003c). The recreation management objective is to maintain or increase hunting opportunity and improve hunting quality. The current general, post-hunting-season buck survival of 15 per 100 does. After a population decline due to the 1996-97 severe winter, numbers have fully recovered. During winter, the deer population benefits significantly from available agricultural crops, especially alfalfa and wheat. Deer have also benefited significantly from plantings accomplished through the Conservation Reserve Program (CRP). An estimate of deer hunting harvest and recreation in the Subbasin is presented in Table 48.7; note that the data include both mule deer and white-tailed deer. The Subbasin contributes a relatively small proportion of Washington State's total deer harvest and deer hunting recreation.

Table 48.7. Mule deer (and white-tailed deer) hunting harvest and recreation within the Lake Rufus Woods Subbasin[1]

	Harvest		Hunter-Days	
Year	Quantity	% of State Total	Quantity	% of State Total
1999	66	0.2	1,033	0.1
2000	52	0.1	708	0.1
2001	81	0.2	712	0.1
2002	88	0.3	864	0.1
Average	72	0.2	829	0.1

(*Source*: Appendix G)

[1] Includes a portion of Washington Game Management Unit 248.

Construction of the Chief Joseph Project resulted in a loss of 1,992 Habitat Units for mule deer.

Ring-necked pheasant. The WDFW objectives for pheasant in this Subbasin are to maintain a viable population for hunting recreation and harvest, and to increase population size above that of the past five years. Pheasant populations have declined dramatically over the last 30 years and are now at very low levels. Habitat loss or fragmentation from human development and agricultural practices is speculated as the primary reason. For instance, agricultural crops have changed from species that benefit the pheasant to undesirable ones, and recent culturing techniques have caused more pheasant loss than before. Research is needed to identify the exact causes. Pheasant hunting harvest and recreation in the Subbasin make up less than one percent of the state total for those measures (Appendix G). The Chief Joseph Project caused the loss of 239 pheasant Habitat Units in the Subbasin.

Sage grouse. Refer to preceding section describing federal and state threatened and endangered Species.

Sharp-tailed grouse. Refer to preceding section describing federal and state threatened and endangered Species.

Spotted sandpiper. Smith et al. (1997) confirmed that breeding occurs in the Subbasin, but in winter this shorebird migrates to warmer latitudes. The Chief Joseph Project reported a loss of 1,255 Habitat Units for the spotted sandpiper.

Yellow warbler. The Washington GAP Analysis Project (Smith et al. 1997) reports probable, but not confirmed, evidence of breeding in the Subbasin. However, that finding might be from insufficient sampling since general references such as Sibley (2003) indicate that breeding does occur in the Subbasin. The Chief Joseph Project resulted in the loss of 1,255 Habitat Units for the yellow warbler.

48.2.2.3 Other Priority Species

Golden eagle. There are approximately 13 golden eagle nesting territories in the Subbasin: 12 along the Columbia River, and one in the Coyote Creek drainage (WDFW 2003b).

48.3 Summary of Terrestrial Resource Limiting Factors

48.3.1 Direct Effects of Federal Hydrosystem Projects

Development of the Chief Joseph Project resulted in direct loss of wildlife and wildlife habitats along a 51-mile reach of the Columbia River. Habitat losses associated with inundation of project reservoirs were assessed in the Wildlife Habitat Impact Assessment for the Chief Joseph Dam Project (Kuehn and Berger 1992) through a Habitat Evaluation Procedures (HEP) study. 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 (HUs), which are units of value based on both quality and quantity of habitat. The study provides the number of habitat units to be provided in compensation for the construction losses and identifies potential mitigation areas. The study also provides a list of prioritized mitigation objectives for the two wildlife management jurisdictions, the Colville Confederated Tribes and the WDFW.

Table 48.8 summarizes the loss of habitats as determined by Kuehn and Berger (1992). The loss of habitat value for individual wildlife species, as determined through the HEP study and expressed in HUs, is summarized in Table 48.9. The current status of completed mitigation for the Chief Joseph Project is also presented; approximately 84 percent of the mitigation remains to be implemented.

In 1981, the full pool level of the Lake Rufus Woods reservoir was raised 10 feet to 956 feet msl. Assessment of the effects of the pool raise on terrestrial resources was conducted through a modified HEP analysis (USACE 1980). A mitigation plan for the pool raise impacts was developed cooperatively with the Tribes, WDFW, and USFWS. Sixteen mitigation sites were established on a total of over 1,500 acres. A variety of enhancements were implemented, including irrigation, shrub and tree plantings, livestock exclusion fences, raptor poles, and goose nesting structures. Monitoring of these sites has occurred on a five-year interval since initial implementation in 1983. The impacts of the 10-foot pool raise and mitigation for that loss are evaluated separately of the original construction and inundation impacts, and are not displayed in the following tables.

Table 48.8. Acres of habitat types affected by Chief Joseph project construction and inundation

Chief Joseph Project	Habitat Type	Acres of Habitat Inundated/converted
	Riverine	2,910
	Shrub-steppe	1,681
	Sand/gravel/cobble	1,184
	Riparian/Macrophyllus draws	658
	Agriculture	343
	Rockland	380
	Ponderosa pine savannah	346
	Island/sandbar	238
	Rock	256
	Mixed forest	106
	Palustrine (ponds/slackwater)	90
Total		**8,192**

(*Source*: Kuehn and Berger 1992)

Table 48.9. Status of mitigation for construction and inundation wildlife-habitat losses, Chief Joseph project

Chief Joseph Project	Species	Habitat Units lost	Habitat Units acquired	Percent complete
	Bobcat	401	132	32.9%
	Canada goose	213	10	4.7%
	Lewis' woodpecker	286	141	49.3%
	Mink	920	137	14.9%
	Mule deer	1,992	409	20.5%
	Ring-necked pheasant	239	-	0.0%
	Sage grouse	1,179	554	47.0%
	Sharp-tailed grouse	2,290	14	0.6%
	Spotted sandpiper	1,255	10	0.8%
	Yellow warbler	58	26	44.8%
Total all loss species		**8,833**	**1,433**	**16.2%**

(*Source*: BPA 2002)

48.3.2 Operational Effects of Federal Hydrosystem Projects

Ongoing operation of the Chief Joseph Project affects terrestrial resources of the Lake Rufus Woods Subbasin through:

1) erosion of shoreline habitats along Lake Rufus Woods;
2) ongoing absence of riparian vegetation, particularly woody species along reservoir shorelines;
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; and

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.

Ongoing effects of operation of the Chief Joseph 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 Lake Rufus Woods Subbasin Work Team.

48.3.3 Secondary Effects of Federal Hydrosystem Projects and Other Limiting Factors

The federal hydropower system contributed to development in the Lake Rufus Woods Subbasin by providing an inexpensive source of both power and irrigation water. The Subbasin supports high levels of agriculture and grazing, and active timber management in the northeastern portion. Residential land uses occur throughout the southern half of the subbasin. Factors that currently limit terrestrial resources in the Subbasin are dominated by loss of habitat through conversion and modification, disturbance of wildlife species by humans and human activities, and interactions with nonnative plant and animal species.

48.4 Interpretation and Synthesis

The Lake Rufus Woods Subbasin has been highly modified from historic conditions due primarily to agriculture, grazing, residential development, and, in the northeastern portion of the Subbasin, timber management. Approximately 16 percent of native habitats, primarily shrub-steppe, have been converted to agriculture and developed land uses. The majority of the remaining habitats have been modified through land use practices. Construction of the Chief Joseph Dam directly affected the Columbia River along a 51-mile reach. The dam blocks all anadromous fish access to the Lake Rufus Woods Subbasin and upstream Columbia, Spokane, and Pend Oreille river subbasins. Road densities are moderate throughout much of the Subbasin. Protected lands are very low in acreage. Secondary effects of the power projects on development of the Subbasin are wide-reaching, including agriculture, grazing, timber harvest, and residential development.

Terrestrial resources mitigation related to initial construction and inundation of the Chief Joseph Project is approximately 16 percent complete. Completion of the mitigation is the highest terrestrial resources priority for the Subbasin Work Team, followed by assessment and mitigation of operational impacts of the hydrosystem projects.

SECTION 49 – Table of Contents

49 Lake Rufus Woods Subbasin Inventory of Existing Programs – Terrestrial

49.1 Current Management Directions

Within the Lake Rufus Woods Subbasin, fish and wildlife resources are co-managed by the State of Washington and the Colville Tribes outside of the boundaries of the Colville Indian Reservation and by the Colville Tribes within the boundaries of the reservation. Other state and federal agencies, including, but not limited to, the U.S. Fish and Wildlife Service (USFWS), U.S. Forest Service (USFS), U.S. Army Corps of Engineers (USACE), Environmental Protection Agency (EPA), the Natural Resources Conservation Service (NRCS), and the 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 Natural Resources Department of the Colville Tribes has management and regulatory authority that includes, but is not limited to, the following areas: fish and wildlife management, enforcement, land use activities, water rights and adjudication, development permitting, hydraulics permitting and shoreline protection (for example, Confederated Tribes of Colville Reservation (CTCR) Shoreline Management Act). CTCR/Bureau of Indian Affairs uses the Colville Reservation Forest Plan, Integrated Resource Management Plan, Code of Federal Regulations, and others to manage land, fish, and wildlife on the Colville Reservation. It is the mission of the Fish and Wildlife Division, "To provide subsistence, cultural opportunities and economic benefits for the Tribal Membership through sustainable ecosystem management. We accept our responsibility to manage, protect, and enhance tribal natural resources and to provide multiple products and services for the tribal membership on the reservation and on accustomed and traditional lands." The current management direction is to maintain viable populations (numbers and distribution of reproductive individuals) of native and desired nonnative species of fish and wildlife, and their supporting habitats, while providing sufficient numbers to meet cultural, subsistence and recreational needs.

49.1.1 Local Government

49.1.1.1 Douglas County

Douglas County borders Lake Rufus Woods along the southern shoreline. The County regulates and enforces the Growth Management Act and is responsible for planning, land use and building permits.

49.1.1.2 Okanogan County

The Colville Confederated Tribes has management and regulatory authority of lands within the boundaries of the Colville Indian Reservation in Okanogan County.

49.2 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 Lake Rufus Woods Subbasin. Refer to the Lake Rufus Woods Subbasin Terrestrial Resources Assessment, Section 48, for detailed description of the occurrence and status of federal and state threatened and endangered species in the subbasin.

49.2.1 Endangered Species Act

Bald Eagle

Bald eagles are currently listed as threatened under the federal Endangered Species Act. 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 U.S. Fish and Wildlife Service.

Bald eagles are classified as threatened in Washington State.

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).

American White Pelican

The American white pelican is listed as an endangered species in Washington. American white pelican, a Washington State endangered species, has been observed on occasion on Lake Rufus Woods. No breeding or regular use areas are thought to occur in the Subbasin.

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. 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).

Sage Grouse
The sage grouse is classified as a threatened species in Washington. The only known sage grouse lek in the IMP is located south of the Columbia River in the southwestern portion of the Lake Rufus Woods Subbasin (WDFW 2003b).

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 Columbian sharp-tailed grouse is classified as a threatened species in Washington. Records from the WDFW (2003) show that 33 of 48 sharp-tailed grouse leks in the Province occur within this Subbasin.

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).

49.3 Inventory of Recent Restoration and Conservation Projects

Below is a summary of some of the BPA and non-BPA funded projects identified within the Lake Rufus Woods Subbasin. Projects that are relevant to both terrestrial and aquatic resources may be presented in the aquatic inventory section for this Subbasin (see Section 47). 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. Appendix H includes more comprehensive listings of the BPA and non-BPA funded project conducted in this subbasin and the entire IMP.

49.3.1 BPA Funded Projects

Project #1992-048-00 Colville Tribes Hellsgate Wildlife Mitigation

Project Description:

The focus of the Hellsgate Project is the protection, restoration, and enhancement of critical winter habitat for big game and shrub-steppe/sharp-tailed grouse habitat on lands purchased/managed for mitigation on the Colville Indian Reservation. At present, the Hellsgate Project protects and manages 25,501 acres for the biological requirements of wildlife (CCT 2004). Currently there are 12 management units that make up the Hellsgate Project, most are located on or near the Columbia River (Lake Rufus Woods and Lake Roosevelt) and surrounded by Tribal land. These management units contain a wide diversity of vegetative types and habitats for a variety of wildlife.

Associated Monitoring:

- Monitor threatened and endangered species and habitats of concern.
- Conduct HEP to evaluate habitats and collect HU data for mitigation accounting.
- Conduct annual neo-tropical birds surveys for species diversity using project lands.
- Conduct population and trend data to monitor habitat use and seasonal distribution.
- Coordinate with other agencies and Tribes on Columbia River mitigation issues and methodologies.

Accomplishments:

- Acquired 25,501 acres of habitat for mitigation.
- Protected 14,920 Habitat Units on acquired lands.
- Installed fencing on several units.
- Conducted noxious weed control on acquired lands.

Notes:

No enhancements to project lands to offset hydropower losses have taken place. Some small-scale enhancements have been conducted using USDA funds to plant native vegetation on selected sites.

Project #21034 Colville Tribes Habitat Restoration and Adaptive Management of Columbian Sharp-tailed Grouse on the Intermountain Province

Project Description:

Develop and implement an adaptive management plan that will include restoration of native plant communities on lands within the IMP to support viable meta-populations of Columbia sharp-tailed grouse.

Associated Monitoring:

Monitor sharp-tailed grouse and their habitats using scientific principals and techniques to ensure that project objectives are being met and to provide a basis for use of adaptive management when appropriate. To evaluate species and habitat responses to management activities for the benefit of sharp-tailed grouse and other wildlife using similar habitats. Develop a Habitat Suitability Index for the area and create a sharp-tailed grouse management plan for the Colville Reservation.

Accomplishments:

- Literature review of all information concerning sharp-tailed grouse on the IMP.
- Conducted grouse surveys on known and historic leks.
- Surveyed for new leks.
- Trapped and collected data on marked 48 birds fitted with radio collars.
- Followed and mapped habitats used by marked grouse throughout the year.
- Conducted genetic variance tests on trapped birds.
- Determined sharp-tailed grouse seasonal ranges and associated GIS maps.
- Formed and coordinated with a regional grouse team for support and input.
- Reported progress through quarterly reports and unpublished papers.
- Conducted a public outreach program to inform individuals of status and future of sharp-tailed grouse on the Colville Indian Reservation and IMP.

Notes:

This is currently the last year of funding for the sharp-tailed grouse project. The regional grouse team agrees that this is an extremely important project that addresses concerns of various agencies throughout the region dealing with a State Threatened and Endangered Species. It is the recommendation of the regional grouse team that future funding for this project be a priority within the IMP and that the work continue to conserve and protect this species and associated habitats.

49.3.2 Non-BPA Funded Projects

Foster Creek Habitat Conservation Plan (FCHCP)

Project Description:

The Foster Creek Conservation District in cooperation with local, state, and federal agencies, local stakeholders, and advocacy groups is in the process of developing a habitat conservation plan for presentation to the USFWS for Section 10 incidental take permits on 17 terrestrial animal species. The plan may also include an addition element for spring Chinook and steelhead Section 10 permits from NOAA Fisheries. The FCHCP is intended to offer legal certainty and coverage for incidental take to the agricultural producers of Douglas County. The county is approximately 87 percent privately owned, with nearly 570,000 acres in privately owned/operated agriculture. When adopted, the FCHCP will provide strategies to minimize impacts to terrestrial species and mitigate for lost habitat in Douglas County. The project is funded by the USFWS Section 6 and sponsored by the Foster Creek Conservation District. This project will run for 50 years of acceptance by the USFWS.

Associated Monitoring:

The FCHCP includes provisions to monitor the plan implementation on large and small scales. On the large scale, remote sensing and GIS information will be utilized to assess the progress of the plan on an ecosystem-wide scale. This will be accomplished by comparative analysis and appropriate ground truthing. On the smaller scale, all participants will be required to develop a farm plan though the NRCS farm planning

process. This allows for site-specific data to be gathered and monitored on an annual basis, or more often as necessary.

Accomplishments:
To date, technical assessment and stakeholder committees have been formed and are meeting regularly. Best Management Practices (BMPs) have been developed to minimize impacts to the covered species. Sample farm plans have been created and monitoring strategies developed to ensure internal and external validation is achieved. Federal Register notice has been given to begin the process of developing an environmental impact statement. A preliminary draft FCHCP has been presented to all collaborators for review and comment.

HB 2514 Watershed Planning

Project Description:
To create and adopt a watershed plan for WRIA 44 and 50. The process involves conducting a technical assessment of all watersheds in the two WRIAs and develop strategies to manage the watershed in the future. A final management plan will be adopted that describes community-developed strategies for the Foster Creek and Moses Coulee watersheds. This project is funded by the WDOE and is sponsored by the Foster Creek Conservation District; it will run through 2009.

Associated Monitoring:
Currently, real time stream and well monitoring is occurring in support of the watershed planning process. Quarterly snorkel surveys of all surface water streams in Douglas County are performed. Macro invertebrate and water quality analysis is also performed quarterly to establish baseline data to evaluate future management strategies after implementation.

Accomplishments:
A preliminary basin assessment was completed in January of 2003. Following this, groundwater models of both WRIA have been developed to aid in the understanding of hydrology in the area. A final management plan is scheduled to be adopted by the end of September 2004.

Conservation Reserve Program (CRP)

Project Description:
To provide a resource for agricultural producers to remove their land from production in return for an annual payment. The lands removed from active agriculture are required to be restored to a prescribed level of native habitat and managed to control invasive species.

Associated Monitoring:
The Farm Service Agency conducts annual aerial photography for compliance and overall project evaluation. Local agency representatives also conduct on-farm inspection on a rotating basis to ensure compliance.

Accomplishments:
187,000 acres of agricultural land in Douglas County are enrolled in the program, approximately 13,000 acres in the Lake Rufus Woods Subbasin. These lands are providing increased habitat quality verses their traditional agricultural uses. Significant improvements to species populations have been linked to the improved habitat quality on lands enrolled in the program.

Conservation Reserve Program Projects with WDFW
Within the Douglas County section of the Lake Rufus Woods subbasin, several projects have occurred protecting and restoring habitat. CRP has had the biggest influence in this area. Specific restoration projects within the last five years are as follows:

A. Strahl Canyon Habitat Project- WDFW/Foster Farm. This was a riparian restoration project, started in 1999 and completed in 2003. Approximately 4000 trees/shrubs were planted to restore critical sharp-tailed grouse wintering habitat. This was completed and managed by the UWRP of the WDFW. Part of this project was funded by NRCS WHIP program. The project took place on private land and was funded by state and federal funds. The riparian habitat in Strahl Canyon is very critical riparian habitat for local sharp-tailed grouse. Legal Description: T29N R29E SW ¼ Section 33.

B. Rice Farms Habitat Project-WDFW/Richard Rice. This was a habitat project to provide permanent protective cover for local wildlife. It was completed in 2003. Approximately 2,000 trees/shrubs were planted. This project was completed by the UWRP of the WDFW. This project took place on private land and was funded by state/federal funds. Permanent protective cover is very critical to wildlife in the winter months. Legal Description: T29N R30E SE ¼ Sec. 19.

C. Upper China Creek Habitat Project- WDFW/Leroy Sanderson
This was a riparian restoration project to provide critical winter cover for sharp-tailed grouse. It was completed in 1999. Approximately 1,250 trees/shrubs were planted. This project was completed by the UWRP of the WDFW. This project took place on private land and was funded by state/federal funds. China Creek is very critical riparian habitat for local sharp-tailed grouse. Legal Description: T30N R29E SE ¼ Sec. 25

Noxious Weed Control
Project Description:
Biological Noxious Weed Control using beneficial insects. With the cooperation of many landowners in Douglas County, the Foster Creek Conservation District was able to establish release sites for the stem-boring weevil *(Mecinus janthinus),* an effective biological control for the suppression of Dalmation toadflax. In 2002, 4,500 *Mecinus janthinus* were released. In 2003, 6,900 *Mecinus janthinus* were released. Additional species were introduced in 2003. These included releasing 1,000 *Gymnetron tertrum* to suppress mullein, 1,250 *Larinus minutus* for diffuse knapweed, and *2,000 Rhinocyllus conicus to control Canada thistle.* Approximately, 4,000 *Mecinus janthinus,* 1,000 *Gymnetron tertrum,* 200 *Larinus minutus* and 700 *Rhinocyllus conicus* were released on private lands within the Lake Rufus Woods Subbasin. This project is funded by the

Washington State Conservation Commission and is sponsored by the Foster Creek Conservation District; it is ongoing.

Associated Monitoring:
Photo monitoring

Accomplishments:
The Conservation District established release sites for beneficial insects with and relationships with approximately 50 private landowners in Douglas County, 10 within the Rufus Wood Subbasin. The use of a biological control is a long-term method for weed management. The general time frame for biological weed control agents is to see a weed reduction in three to five years. Their impacts will not be noticeable until they reach high population densities.

Environmental Quality Incentive Program – EQIP
Project Description:
Conversion of rill irrigation to sprinkler systems, install field filter strips, livestock exclusion from the Columbia River, spring development including wells, pipelines and troughs. The project is funded by the Commodity Credit Corporation and is sponsored by the USDA and NRCS. The project will run through 2008.

Associated Monitoring:
Annual status reviews by NRCS field staff.

Accomplishments:
First component to be installed in spring of 2004.

49.4 Strategies Currently Being Implemented Through Existing Projects

49.4.1 Limiting Factors and Strategies

Refer to Figure 47.1 of the Aquatic Inventory section for a graphic displaying the percent of all fish and wildlife mitigation projects in the Subbasin that respond to specific limiting factors. Wildlife mitigation projects in the basin respond primarily to the limiting factors of habitat quantity and quality. In addition, the sharp-tailed grouse project addressed lack of information on the species.

Figure 47.2 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 RM&E and watershed planning/recovery planning.

49.4.2 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 Chief Joseph Project.

The construction loss assessment was completed in 1992 (Kuehn and Berger 1992). Currently, the mitigation for the construction wildlife losses in terms of Habitat Units (HUs) is about 16 percent complete (refer to Section 48).

Two state threatened species are among the HEP indicator species for which mitigation is owed: sage grouse (HU acquisition about 47 percent complete) and Columbian sharp-tailed grouse (HU acquisition less than one percent complete). Populations of these species are considered at very high risk in the state. The current sharp-tailed grouse project is in its last year of funding. The regional grouse team notes that this is an extremely important project that addresses concerns of various agencies throughout the region and recommends that future funding for this project be a priority within the IMP.

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

Pygmy rabbit, a federally threatened species, no longer occurs within the Subbasin due to habitat loss and modification. The species is managed under the state recovery plan at the Sagebrush Flat Wildlife Area in Douglas County, adjacent to the Subbasin. Long-term funding of reintroduction and habitat enhancement efforts will be necessary to ensure recovery of the species.

SECTION 50 – Table of Contents

50 Lake Rufus Woods Management Plan

The Lake Rufus Woods Subbasin Management Plan was developed by the Lake Rufus Woods 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 Lake Rufus Woods 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.

50.1 Summary of Lake Rufus Woods 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 Lake Rufus Woods Subbasin, the aquatic and terrestrial assessments and inventories are described in detail in sections 46 to 49 of this document. A brief overview of the key limiting factors that are addressed in this management plan is included below.

50.1.1 Lake Rufus Woods Aquatic Assessment and Limiting Factors

Focal species selected for the Lake Rufus Woods Subbasin were Chinook and kokanee salmon, brook and rainbow trout, and white sturgeon. Anadromous Chinook are no longer present in the Subbasin because of the lack of fish passage at Chief Joseph Dam.

Overall, the most important limiting factors for fisheries in the Lake Rufus Woods Subbasin resulted from the construction of Chief Joseph and Grand Coulee dams and the subsequent loss of anadromous fishes and the conversion of rivers into reservoirs. The loss of the anadromous life history in the blocked area had a wide range of impacts on the fish, wildlife, and people of the area. These impacts are described in more detail in sections 2.2 and 1.4.1, but include loss of aquatic productivity, loss of fishing opportunity, increased fishing and hunting pressure on other species, and increased

stocking of nonnative species. These limiting factors are addressed in the Lake Rufus Woods Subbasin Management Plan through objectives 2D1, 2D2, 2D3, 2A2, 2C2, and 2C1.

We used QHA modeling to help us 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 50.1-1, 50.1-2, 50.1-3. In parentheses is the number of reaches or watersheds within the Lake Rufus Woods 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 Lake Rufus Woods Subbasin are described in more detail in section 50.3.

Table 50.1-1. Stream habitat conditions that currently most deviate from the reference for brook trout, Lake Rufus Woods Subbasin. The number in parenthesis is the number of reaches or watersheds within the Lake Rufus Woods 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 50.3.

Brook Trout	
Habitat Condition	**Objective**
Low Flow (10)	1B1, 1B6
Fine Sediment (7)	1B1, 1B4
Habitat Diversity (7)	1B1, 1B5
Low Temperature (5)	1B1, 1B7
Riparian Condition (2)	1B1, 1B3

Table 50.1-2. Stream habitat conditions that currently most deviate from the reference for kokanee, Lake Rufus Woods Subbasin. The number in parenthesis is the number of reaches or watersheds within the Lake Rufus Woods 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 50.3.

Kokanee	
Habitat Condition	**Objective**
Oxygen (6)	1B1, 1B8
High and Low Flows (4)	1B1, 1B6
Obstructions (2)	1B1, 1B2
Channel Stability (1)	1B1, 1B5
Low Temperature (1)	1B1, 1B7

Table 50.1-3. Stream habitat conditions that currently most deviate from the reference for rainbow trout, Lake Rufus Woods Subbasin. The number in parenthesis is the number of reaches or watersheds within the Lake Rufus Woods 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 50.3.

Rainbow	
Habitat Condition	**Objective**
Habitat Diversity (9)	1B1, 1B5
Obstructions (3)	1B1, 1B2
Riparian Condition (3)	1B1, 1B3
Low Flow (2)	1B1, 1B6
Fine Sediment (2)	1B1, 1B4

Lake Rufus Woods is a reregulating reservoir for peaking operations out of the Grand Coulee Project. Because Grand Coulee Dam may release extremely large amounts of water and spill from very high heads, water quality in Rufus Woods can suffer. High total dissolved atmospheric gasses within Lake Rufus Woods have resulted in this water being placed on the Washington 303(d) list. This high gas concentration is potentially a limiting factor to all fish populations in the reservoir. Objectives 1A1 and 1B8 in the management plan address the issue of TDG in the Lake Rufus Woods Subbasin.

Habitat degradation, flow alterations, inundation, water level fluctuations, and nonnative species interactions are all responsible for the diminished populations of the native fishes in the Subbasin. The introduction of nonnative species, although creating an important recreational and subsistence fishery, has the potential to negatively impact the remaining native fishes of the Subbasin. Nonnative fish issues are addressed through objectives 2A3, 2A1, 2A4, and 2C1 in the management plan.

The lack of information about fish populations is a particular problem in the Lake Rufus Woods Subbasin. Objectives 1A1 and 1C1 are research and evaluation objectives that are also discussed in the Research, Monitoring and Evaluation Plan.

50.1.2 Lake Rufus Woods Terrestrial Assessment and Limiting Factors

Wildlife in the Lake Rufus Woods Subbasin are limited by habitat quantity and quality. Construction of the Chief Joseph Project affected 51 miles of the Columbia River and inundated over 8,000 acres of land. In addition, the project resulted in secondary effects to terrestrial resources, 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 Subbasin are dominated by loss of habitat and modification of habitat quality as a result of human land uses. The Lake Rufus Woods Subbasin has been highly modified from historic conditions due primarily to agriculture, grazing, residential development, and, in the northeastern portion of the Subbasin, timber management. Approximately 16 percent of native habitats, primarily shrub-steppe, have been converted to agriculture and developed land uses. The majority of the remaining habitats have been modified through land use practices.

Management plan objectives that address the losses from the construction of and inundation from Chief Joseph 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.

50.2 Subbasin Vision and Guiding Principles

The vision for the Lake Rufus Woods Subbasin is:

> *We envision the Lake Rufus Woods Subbasin being comprised of and supporting viable diverse anadromous fish, resident fish, and wildlife populations, and their habitats that contribute to the social, cultural, ecological, and economic wellbeing of the region.*

In addition to the vision, the Lake Rufus Woods Subbasin Work Team drafted the following guiding principles:

1. Subbasin planning should 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. Integrated subbasin plans should consider ecological AND political boundaries.
3. Human interests can be balanced with fish and wildlife needs.
4. All people are stewards for future generations.
5. The Lake Rufus Woods Subbasin Plan should be based on best current scientific, ecological, and biological principles.
6. Subbasin plans will address landowner, cultural, subsistence, and recreational harvest issues.
7. Public outreach is essential for successful plan development and implementation.
8. Possibility of anadromous fish should be considered in the development of the Lake Rufus Woods Subbasin Plan (passage, artificial production, wildlife/fisheries interactions, etc.).
9. Use common sense in decision making.
10. Ensure that projects aimed at restoring fish or wildlife do not result in negative impacts to other fish, wildlife, habitats, or cultural resources.

50.3 Aquatic Objectives and Strategies

Columbia River Basin-level aquatic resource objectives were developed by the Northwest Power and Conservation Council in their 2000 Fish and Wildlife Program. The planners in the IMP have developed province level aquatic resource objectives that are tiered to the Columbia River Basin level goals. 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 subbasin objectives and strategies are prioritized. Strategies are listed in priority

order. The ranking of the objectives are given in parenthesis after the objective. 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: Develop and implement plans to reduce hydropower impacts to native and focal species. (Priority 7)

Strategy a*: Collect basic inventory, abundance, and interaction information on fish.

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

Strategy c*: Continue USGS dissolved gas study during a year with anticipated high gas saturation.

Strategy d*: Develop plan to work with local fish farms to monitor trends in fish health and environmental conditions.

Strategy e: Ensure fish stocking activities are coordinated between Indian Tribes, USFWS, WDFW, NMFS, and private aquaculture operations.

Strategy e*: Explore and implement, where feasible, changes in flow regime/lake elevation that enhance salmonid recruitment within Lake Rufus Woods.

Subbasin Objective 1A2: Develop and implement plans to enhance sturgeon and burbot populations, based on the evaluation of limiting factors. (Priority 17)

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

Strategy b*: Collect basic inventory, abundance, and interaction information on fish.

Strategy c*: Conduct burbot population assessment, determine limiting factors, and develop plan to address limiting factors.

Strategy d*: Conduct sturgeon population assessment, determine limiting factors, and develop plan to address limiting factors.

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 in-stream and riparian habitat to maintain functional ecosystems for resident fish, including addressing the chemical, biological, and physical factors influencing aquatic productivity.

Subbasin Objective 1B1: Begin implementation of habitat strategies for addressing identified limiting factors for all focal species and native fishes by 2005. (Priority 2)

Strategy a: Conserve and protect floodplain connectivity and function wherever possible.

Strategy b: Conduct riparian habitat restoration, reduce fine sediment inputs, and increase channel complexity to address known limiting factors for all focal species.

Strategy c: Limit livestock from riparian areas and replant native riparian plants where appropriate.

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

Strategy e: Remove artificial migration barriers as to allow fish passage were prudent to increase habitat quantity for migratory fish species.

Strategy f: Develop criteria for prioritizing streams for habitat improvements.

Strategy g*: Develop minimum in-stream flows for fish-bearing streams within the Lake Rufus Woods Subbasin that meet the biological requirements of salmonid fishes.

Strategy h: Ensure water rights are defined and enforced.

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

Strategy k: Install in-stream structures that improve habitat complexity (Vortex rock weirs, drop log structures, root wads, habitat boulders, etc.).

Strategy l*: Explore and implement, where feasible, changes in flow regime/lake elevation that enhance salmonid recruitment within Lake Rufus Woods.

Subbasin Objective 1B2*: Inventory all barriers in the Rufus Woods Subbasin, including Chief Joseph Dam, by 2005 and begin implementing necessary passage improvements associated with man-made barriers by 2006. (Priority 4)

Strategy a: Remove or modify artificial migration barriers to allow fish passage where prudent to increase habitat quantity for migratory fish species.

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

Strategy c*: Develop minimum in-stream flows for fish-bearing streams within the Lake Rufus Woods Subbasin that meet the biological requirements of salmonid fishes.

Strategy d*: Explore and implement, where feasible, changes in flow regime/lake elevation that enhance salmonid passage within Lake Rufus Woods.

Subbasin Objective 1B3*: Inventory riparian habitat condition and implement actions to promote riparian area function for all streams within the Subbasin. (Priority 6)

Strategy a: Develop priority criteria and implement actions to address critical limiting factors to riparian function.

Strategy b*: Develop and implement monitoring and evaluation efforts to assess efficacy of actions to restore riparian.

Strategy c: Conserve and protect floodplain connectivity and function wherever possible.

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

Strategy e: Conduct riparian habitat restoration, reduce fine sediment inputs, and increase channel complexity to address known limiting factors for all focal species.

Strategy f: Limit livestock from riparian areas and replant native riparian plants where appropriate.

Strategy g*: Implement habitat inventory to determine current condition/limiting factors/riparian function of salmonid spawning areas.

Strategy h: Use vegetation enhancements, annual seeding and water retention in backwater areas to increase near-shore fish production, increase shoreline stability, and reduce erosion.

Strategy i: Decommission roads wherever possible and develop road abandonment plans for Tribal lands to reduce road densities below 3 miles of road per square mile.

Subbasin Objective 1B4: Improve or maintain streambed embeddedness between 20 percent and 30 percent in all streams with known salmonid populations. (Priority 13)

Strategy a: Conserve and protect floodplain connectivity and function wherever possible.

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

Strategy c: Conduct riparian habitat restoration, reduce fine sediment inputs, and increase channel complexity to address known limiting factors for all focal species.

Strategy d: Limit livestock from riparian areas and replant native riparian plants where appropriate.

Strategy e: Decommission roads wherever possible and develop road abandonment plans for Tribal lands to reduce road densities below 3 miles of road per square mile.

Subbasin Objective 1B5: Reduce width-to-depth ratios to <10 for all streams within the Subbasin. (Priority 10)

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

Strategy b: Conduct riparian habitat restoration, reduce fine sediment inputs, and increase channel complexity to address known limiting factors for all focal species.

Strategy c: Develop minimum in-stream flows for fish-bearing streams within the Lake Rufus Woods Subbasin that meet the biological requirements of salmonid fishes.

Strategy d: Limit livestock from riparian areas and replant native riparian plants where appropriate.

Strategy e: Install in-stream structures that improve habitat complexity (Vortex rock weirs, drop log structures, root wads, habitat boulders, etc.).

Strategy f: Use vegetation enhancements, annual seeding and water retention in backwater areas to increase near-shore fish production, increase shoreline stability, and reduce erosion.

Subbasin Objective 1B6: Protect and maintain flows at or near historic in all intermittent, ephemeral, and perennial streams. (Priority 14)

Strategy a: Conserve and protect floodplain connectivity and function wherever possible.

Strategy b: Establish water bank, set “target flows”, encourage voluntary relinquishment of water rights, protect areas without existing water rights from new allocations, develop water recharge and storage.

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

Strategy d: Ensure all water rights are defined and enforced.

Strategy e*: Develop minimum in-stream flows for fish-bearing streams within the Lake Rufus Woods Subbasin that meet the biological requirements of salmonid fishes.

Subbasin Objective 1B7: Maintain and/or achieve stream temperatures below 18^{o} C for all streams that support salmonid fish populations. (Priority 8)

Strategy a: Conserve and protect floodplain connectivity and function wherever possible.

Strategy b: Conduct riparian habitat restoration, reduce fine sediment inputs, and increase channel complexity to address known limiting factors for all focal species.

Strategy c: Develop minimum in-stream flows for fish-bearing streams within the Lake Rufus Woods Subbasin that meet the biological requirements of salmonid fishes.

Strategy d: Limit livestock from riparian areas and replant native riparian plants where appropriate.

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

Strategy f: Ensure all water rights are defined and enforced.

Strategy g: Use vegetation enhancements, annual seeding and water retention in backwater areas to increase near-shore fish production, increase shoreline stability, and reduce erosion.

Subbasin Objective 1B8: Maintain total dissolved gases (TDG) below 110 percent saturation for mainstem Columbia River. (Priority 11)

Strategy a: Make Bureau of Reclamation responsible for finding solutions to any negative TDG issues resulting from discharge at outlet tubes on Grand Coulee.

Strategy b: Flip-lip installation at Chief Joseph and speed up implementation of Grand Coulee power swap with Chief Joseph.

Strategy c: Participate in technical and policy working groups (for example, TDG, TMDL) to develop changes in hydrosystem operations and/or physical attributes of dams to reduce TDG.

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 (e.g., 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 Lake Rufus Woods Subbasin, objectives that address Province level objectives 1C1-1C4 are addressed under 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*: The Lake Rufus Woods Subbasin is within the N.E. Washington Bull Trout Recovery Unit and is identified as a "Research Need Area" (USFWS 2002). Surveys are needed in the Subbasin to determine how/if the Subbasin can contribute to recovery. (Priority 19)
(Refer to http://pacific.fws.gov/bulltrout/recovery.htm)

Strategy a: Conduct bull trout distribution and habitat suitability surveys.

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 Lake Rufus Woods Subbasin, objectives that address the topics listed in Province Level Objective 1C6 are addressed under 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 level objectives 2A1 – 2A4:

Subbasin Objective 2A1: Determine genetic distribution of native focal species (white sturgeon, rainbow/redband trout, kokanee), identify limiting factors, and develop strategies for addressing limiting factors by 2005. (Priority 15)

Strategy a*: Assess distribution of native species, population abundance, and historical presence pre-BPA hydro projects on the Columbia River.

Strategy b*: Collect basic inventory, abundance, and interaction information on fish.

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

Subbasin Objective 2A2: Maintain average rainbow trout catch rates on Lake Rufus Woods at between 0.5 and 0.75 fish/hour annually, and maintain fish condition with Wr greater than or equal to 100. (Priority 12)

Strategy a: Augment with direct stocking with yearling age rainbow trout if natural recruitment is insufficient.

Strategy b: Enhance tributary habitat to increase rainbow production and potential emigration into Lake Rufus Woods.

Strategy c*: Provide a randomized roving creel census survey to assess if achieving objective.

Subbasin Objective 2A3: Preserve and enhance native fish where historically present. (Priority 9)

Strategy a: Artificially produce or purchase native trout and stock.

Strategy b: Avoid future introduction of exotic species/stocks into waters that have only indigenous species composition.

Strategy c: Utilize available species interaction research data for habitat conditions to develop site-specific management plans that provide fishery opportunities for indigenous and non-indigenous species in locations that they currently co-exist. Management should be consistent with maintenance/preservation/enhancement of indigenous species where habitat allows.

Subbasin Objective 2A4: Protect the genetic integrity of all focal and native fish species throughout the Subbasin. (Priority 18)

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

Strategy b: Wherever possible use locally adapted genetically appropriate salmonids to supplement natural populations or in harvest applications where emigration can occur.

Strategy c: Ensure fish stocking activities are coordinated between Indian Tribes, USFWS, WDFW, NMFS, and private aquaculture operations.

Strategy d: Maintain genetic quality of native fish.

Strategy e: Prevent introgression between hatchery and wild stocks.

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.

Planners in the Lake Rufus Woods Subbasin did not develop objectives and strategies for Province Level Objective 2B. Objectives related to habitats and ecosystem conditions and functions are listed under 1B.

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.

Subbasin Objective 2C1: Manage walleye consistent with native and focal species management. (Priority 20)

Strategy a: Assess walleye limiting factors on consumptive and non-consumptive fish.

Strategy b: Conduct walleye/other species interaction assessment.

Strategy c: Develop management plans consistent with native and focal species management (including walleye and other species).

Strategy d: Evaluate limiting factors on walleye (RME to Review and update WDFW study done in 1970s).

Subbasin Objective 2C2: Artificially produce enough salmonids to supplement a consistent harvest rate of 1 fish per hour, where habitats allow. (Priority 16)

Strategy a: Wherever possible use locally adapted genetically appropriate salmonids to supplement natural populations or in harvest applications where emigration can occur.

Strategy b: Ensure fish stocking activities are coordinated between Indian Tribes, USFWS, WDFW, NMFS, and private aquaculture operations.

Strategy c: Annually produce a minimum of 50,000 pounds of trout at the Colville Tribal Hatchery.

Strategy d: Utilize existing creel data/stocking efforts to determine validity of this objective.

Strategy e: Prioritize select waters that are determined to have the capacity to achieve one fish/hour catch rate with reasonable stocking support and provide necessary fish stocking to support the highest priority fishery.

Strategy f: Monitor fishery to assess the maintenance of the one fish/hour catch rate. If stocking successfully supports the fishery with reasonable stocking effort, apply the strategy to other waters identified in the prioritization.

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

Columbia River Basin Level Goal 2D:
Reintroduce anadromous fish into blocked areas where feasible[1].

Province Level Objective 2D1:
Develop an anadromous fish reintroduction feasibility analysis by 2006 for Chief Joseph and by 2015 for Grand Coulee[2].

Subbasin Objective 2D1*: Develop an anadromous fish reintroduction feasibility analysis by 2006. (Priority 1)

Strategy a: Conduct a feasibility study for anadromous fish reintroduction to subbasin.

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

Province Level Objective 2D2:

[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.

Develop an implementation plan within five years of feasibility determination for each facility.

Subbasin Objective 2D2: If anadromous fish reintroduction is deemed feasible, implement anadromous reintroductions within five years of feasibility determination. (Priority 3)

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

Strategy b: Expand Chinook salmon and steelhead range and habitat wherever possible.

Strategy c: Close critical spawning areas to fishing during spawning or until escapement quotas are reached.

Strategy d: Use artificial production to rebuild extirpated salmonid stocks and provide harvest opportunities.

Strategy e: Provide anadromous fish passage at Chief Joseph Dam.

Strategy f: Ensure all Tribal trust fishing, hunting, and water rights are defined and enforced.

Strategy g: Ensure fish stocking activities are coordinated between Indian Tribes, USFWS, WDFW, NMFS, and private aquaculture operations.

Strategy h*: Monitor efficacy of reintroduction.

Strategy i: Modify Lake Rufus Woods elevations or flow regimes to increase salmonid production.

Strategy j: Wherever possible use locally adapted salmonids to supplement natural populations or in harvest applications where emigration can occur.

Strategy k: Construct spawning channels or acclimation sites to increase salmonid production.

Subbasin Objective 2D3: Increase the amount of salmon available for harvest in areas directly downstream of Chief Joseph Dam utilizing artificial production. (Priority 5)

Strategy a: Build an anadromous fish hatchery below Chief Joseph Dam.

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

50.3.1 Prioritization of Aquatic Objectives and Strategies

A detailed discussion of the methods used to prioritize the objectives and strategies is found in Section 1.2. In Lake Rufus Woods 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 ranking criteria were finalized by the IMP OC, but each Work Team was offered the option of adding additional subbasin specific criteria to the ranking. In the Lake Rufus Woods Subbasin, the Work Team decided not to add any additional subbasin specific criteria.

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 aquatic objectives for the Lake Rufus Woods Subbasin is displayed in Table 50.3-1.

Table 50.3-1. Ranking of aquatic objectives in the Lake Rufus Woods 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
(1) Develop an anadromous fish reintroduction feasibility analysis by 2006[3]. **Subbasin Objective 2D1**	**Strategy a:** Conduct a feasibility study for anadromous fish reintroduction to subbasin. **Strategy b:** Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Lake Rufus Woods Subbasin.	Loss of anadromous life history
(2) Begin implementation of habitat strategies for addressing identified limiting factors for all focal species and native fishes by 2005. **Subbasin Objective 1B1**	**Strategy a:** Conserve and protect floodplain connectivity and function wherever possible. **Strategy b:** Conduct riparian habitat restoration, reduce fine sediment inputs, and increase channel complexity to address known limiting factors for all focal species. **Strategy c:** Limit livestock from riparian areas and replant native riparian plants where appropriate. **Strategy d:** Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Lake Rufus Woods Subbasin. **Strategy e:** Remove artificial migration barriers as to allow fish passage were prudent to increase habitat quantity for migratory fish species. **Strategy f:** Develop criteria for prioritizing streams for habitat improvements. **Strategy g*:** Develop minimum in-stream flows for fish-bearing streams within the Lake Rufus Woods Subbasin that meet the biological requirements of salmonid fishes. **Strategy h:** Ensure water rights are defined and enforced. **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:** Decommission roads wherever possible and develop road abandonment plans for federal, state and Tribal lands to reduce road densities below 3 miles of road per square mile. **Strategy k:** Install in-stream structures that improve habitat complexity (Vortex rock weirs, drop log structures, root wads, habitat boulders, etc.).	Habitat limiting factors such as: riparian vegetation, sediment, floodplain connectivity, in-stream flows, fish passage barriers, etc.

[3] Not all members of the Work Team agreed that this objective should be first priority. See text for more information on the minority report.

Objectives in Priority Order	Strategies in Priority Order	Limiting Factor(s) Addressed
	Strategy l*: Explore and implement, where feasible, changes in flow regime/lake elevation that enhance salmonid recruitment within Lake Rufus Woods.	
(3) If anadromous fish reintroduction is deemed feasible, implement anadromous reintroductions within five years of feasibility determination. **Subbasin Objective 2D2**	**Strategy a:** Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Lake Rufus Woods Subbasin. **Strategy b:** Expand Chinook salmon and steelhead range and habitat wherever possible. **Strategy c:** Close critical spawning areas to fishing during spawning or until escapement, quotas are reached. **Strategy d:** Use artificial production to rebuild extirpated salmonid stocks and provide harvest opportunities. **Strategy e:** Provide anadromous fish passage at Chief Joseph Dam. **Strategy f:** Ensure all Tribal trust fishing, hunting, and water rights are defined and enforced. **Strategy g:** Ensure fish stocking activities are coordinated between Indian Tribes, USFWS, WDFW, NMFS, and private aquaculture operations. **Strategy h*:** Monitor efficacy of reintroduction. **Strategy i:** Modify Lake Rufus Woods elevations or flow regimes to increase salmonid production. **Strategy j:** Wherever possible use locally adapted salmonids to supplement natural populations or in harvest applications where emigration can occur. **Strategy k:** Construct spawning channels or acclimation sites to increase salmonid production.	Loss of anadromous life history
(4) Inventory all barriers in the Rufus Woods Subbasin, including Chief Joseph Dam, by 2005 and begin implementing necessary passage improvements associated with man-made barriers by 2006. **Subbasin Objective 1B2***	**Strategy a:** Remove or modify artificial migration barriers as to allow fish passage where prudent to increase habitat quantity for migratory fish species. **Strategy b:** Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Lake Rufus Woods Subbasin. **Strategy c*:** Develop minimum in-stream flows for fish-bearing streams within the Lake Rufus Woods Subbasin that meet the biological requirements of salmonid fishes. **Strategy d*:** Explore and implement, where feasible, changes in flow regime/lake elevation that enhance salmonid passage within Lake Rufus Woods.	Fish passage barriers
(5) Increase the amount of salmon available for	**Strategy a:** Build an anadromous fish hatchery below Chief	Loss of anadromous life history, loss of

Objectives in Priority Order	Strategies in Priority Order	Limiting Factor(s) Addressed
harvest in areas directly downstream of Chief Joseph Dam utilizing artificial production. **Subbasin Objective 2D3**	Joseph Dam. **Strategy b:** Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Lake Rufus Woods Subbasin.	lotic habitat, habitat degradation
(6) Inventory riparian habitat condition and implement actions to promote riparian area function for all streams within the Subbasin. **Subbasin Objective 1B3***	**Strategy a:** Develop priority criteria and implement actions to address critical limiting factors to riparian function. **Strategy b*:** Develop and implement monitoring and evaluation efforts to assess efficacy of actions to restore riparian. **Strategy c:** Conserve and protect floodplain connectivity and function wherever possible. **Strategy d:** Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Lake Rufus Woods Subbasin. **Strategy e:** Conduct riparian habitat restoration, reduce fine sediment inputs, and increase channel complexity to address known limiting factors for all focal species. **Strategy f:** Limit livestock from riparian areas and replant native riparian plants where appropriate. **Strategy g*:** Implement habitat inventory to determine current condition/limiting factors/riparian function of salmonid spawning areas. **Strategy h:** Use vegetation enhancements, annual seeding and water retention in backwater areas to increase near-shore fish production, increase shoreline stability, and reduce erosion. **Strategy i:** Decommission roads wherever possible and develop road abandonment plans for Tribal lands to reduce road densities below 3 miles of road per square mile.	Riparian habitat degradation
(7) Develop and implement plans to reduce hydropower impacts to native and focal species. **Subbasin Objective 1A1**	**Strategy a*:** Collect basic inventory, abundance, and interaction information on fish. **Strategy b:** Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Lake Rufus Woods Subbasin. **Strategy c*:** Continue USGS dissolved gas study during a year with anticipated high gas saturation. **Strategy d*:** Develop plan to work with local fish farms to monitor trends in fish health and environmental conditions. **Strategy e:** Ensure fish stocking activities are coordinated between Indian Tribes, USFWS, WDFW, NMFS, and private	Lack of data, habitat degradation

Objectives in Priority Order	Strategies in Priority Order	Limiting Factor(s) Addressed
	aquaculture operations. **Strategy e*:** Explore and implement, where feasible, changes in flow regime/lake elevation that enhance salmonid recruitment within Lake Rufus Woods.	
(8) Maintain and/or achieve stream temperatures below 18^{o} C for all streams that support salmonid fish populations. **Subbasin Objective 1B7**	**Strategy a:** Conserve and protect floodplain connectivity and function wherever possible. **Strategy b:** Conduct riparian habitat restoration, reduce fine sediment inputs, and increase channel complexity to address known limiting factors for all focal species. **Strategy c:** Develop minimum in-stream flows for fish-bearing streams within the Lake Rufus Woods Subbasin that meet the biological requirements of salmonid fishes. **Strategy d:** Limit livestock from riparian areas and replant native riparian plants where appropriate. **Strategy e:** Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Lake Rufus Woods Subbasin. **Strategy f:** Ensure all water rights are defined and enforced. **Strategy g:** Use vegetation enhancements, annual seeding and water retention in backwater areas to increase near-shore fish production, increase shoreline stability, and reduce erosion.	Water temperature
(9) Preserve and enhance native fish where historically present. **Subbasin Objective 2A3**	**Strategy a:** Artificially produce or purchase native trout and stock. **Strategy b:** Avoid future introduction of exotic species/stocks into waters that have only indigenous species composition. **Strategy c:** Utilize available species interaction research data for habitat conditions to develop site-specific management plans that provide fishery opportunities for indigenous and non-indigenous species in locations that they currently co-exist. Management should be consistent with maintenance/preservation/enhancement of indigenous species where habitat allows.	Nonnative fish, habitat degradation
(10) Reduce width-to-depth ratios to <10 for all streams within the Subbasin. **Subbasin Objective 1B5**	**Strategy a:** Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Lake Rufus Woods Subbasin. **Strategy b:** Conduct riparian habitat restoration, reduce fine sediment inputs, and increase channel complexity to address known limiting factors for all focal species.	Stream channel instability

Objectives in Priority Order	Strategies in Priority Order	Limiting Factor(s) Addressed
	Strategy c: Develop minimum in-stream flows for fish-bearing streams within the Lake Rufus Woods Subbasin that meet the biological requirements of salmonid fishes. **Strategy d:** Limit livestock from riparian areas and replant native riparian plants where appropriate. **Strategy e:** Install in-stream structures that improve habitat complexity (Vortex rock weirs, drop log structures, root wads, habitat boulders, etc.). **Strategy f:** Use vegetation enhancements, annual seeding and water retention in backwater areas to increase near-shore fish production, increase shoreline stability, and reduce erosion.	
(11) Maintain total dissolved gases (TDG) below 110% saturation for mainstem Columbia River. **Subbasin Objective 1B8**	**Strategy a:** Make Bureau of Reclamation responsible for finding solutions to any negative TDG issues resulting from discharge at outlet tubes on Grand Coulee. **Strategy b:** Flip-lip installation at Chief Joseph and speed up implementation of Grand Coulee power swap with Chief Joseph. **Strategy c:** Participate in technical and policy working groups (e.g., TDG, TMDL) to develop changes in hydrosystem operations and/or physical attributes of dams to reduce TDG.	Water quality degradation
(12) Maintain average rainbow trout catch rates on Lake Rufus Woods at between 0.5 and 0.75 fish/hour annually, and maintain fish condition with Wr greater than or equal to 100. **Subbasin Objective 2A2**	**Strategy a:** Augment with direct stocking with yearling age rainbow trout if natural recruitment is insufficient. **Strategy b:** Enhance tributary habitat to increase rainbow production and potential emigration into Lake Rufus Woods. **Strategy c*:** Provide a randomized roving creel census survey to assess if achieving objective.	Loss of fishing opportunity due to loss of anadromous life history, loss of lotic habitat, habitat degradation
(13) Improve or maintain streambed embeddedness between 20% and 30% in all streams with known salmonid populations. **Subbasin Objective 1B4**	**Strategy a:** Conserve and protect floodplain connectivity and function wherever possible. **Strategy b:** Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Lake Rufus Woods Subbasin. **Strategy c:** Conduct riparian habitat restoration, reduce fine sediment inputs, and increase channel complexity to address known limiting factors for all focal species. **Strategy d:** Limit livestock from riparian areas and replant native riparian plants where appropriate. **Strategy e:** Decommission roads wherever possible and	Sedimentation, lack of spawning habitat

Objectives in Priority Order	Strategies in Priority Order	Limiting Factor(s) Addressed
	develop road abandonment plans for Tribal lands to reduce road densities below 3 miles of road per square mile.	
(14) Protect and maintain flows at or near historic in all intermittent, ephemeral, and perennial streams. **Subbasin Objective 1B6**	**Strategy a:** Conserve and protect floodplain connectivity and function wherever possible. **Strategy b:** Establish water bank, set "target flows", voluntary relinquishment of water rights, protect areas without existing water rights from new allocations, develop water recharge and storage. **Strategy c:** Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Lake Rufus Woods Subbasin. **Strategy d:** Ensure all water rights are defined and enforced. **Strategy e*:** Develop minimum in-stream flows for fish-bearing streams within the Lake Rufus Woods Subbasin that meet the biological requirements of salmonid fishes.	In-stream flows
(15) Determine genetic distribution of native focal species (white sturgeon, rainbow/redband trout, kokanee), identify limiting factors, and develop strategies for addressing limiting factors by 2005. **Subbasin Objective 2A1**	**Strategy a*:** Assess distribution of native species, population abundance, and historical presence pre-BPA hydro projects on Columbia River. **Strategy b*:** Collect basic inventory, abundance, and interaction information on fish. **Strategy c:** Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Lake Rufus Woods Subbasin.	Nonnative species impacts, habitat degradation
(16) Artificially produce enough salmonids to supplement a consistent harvest rate of 1 fish per hour, where habitats allow. **Subbasin Objective 2C2**	**Strategy a:** Wherever possible use locally adapted genetically appropriate salmonids to supplement natural populations or in harvest applications where emigration can occur **Strategy b:** Ensure fish stocking activities are coordinated between Indian Tribes, USFWS, WDFW, NMFS, and private aquaculture operations. **Strategy c:** Annually produce a minimum of 50,000 pounds of trout at the Colville Tribal Hatchery. **Strategy d:** Utilize existing creel data/stocking efforts to determine validity of this objective. **Strategy e:** Prioritize select waters that are determined to have the capacity to achieve one fish/hour catch rate with reasonable stocking support and provide necessary fish stocking to support the highest priority fishery.	Loss of fishing opportunity due to loss of anadromous life history, loss of lotic habitat, habitat degradation

Objectives in Priority Order	Strategies in Priority Order	Limiting Factor(s) Addressed
	Strategy f: Monitor fishery to assess the maintenance of the one fish/hour catch rate. If stocking successfully supports the fishery with reasonable stocking effort, apply the strategy to other waters identified in the prioritization. **Strategy g:** Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Lake Rufus Woods Subbasin.	
(17) Develop and implement plans to enhance sturgeon and burbot populations, based on the evaluation of limiting factors. **Subbasin Objective 1A2**	**Strategy a:** Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Lake Rufus Woods Subbasin. **Strategy b*:** Collect basic inventory, abundance, and interaction information on fish. **Strategy c*:** Conduct burbot population assessment, determine limiting factors, and develop plan to address limiting factors. **Strategy d*:** Conduct sturgeon population assessment, determine limiting factors, and develop plan to address limiting factors.	Loss of lotic habitat, modification of flow regimes, fish passage barriers
(18) Protect the genetic integrity of all focal and native fish species throughout the Subbasin. **Subbasin Objective 2A4**	**Strategy a:** Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Lake Rufus Woods Subbasin. **Strategy b:** Wherever possible use locally adapted genetically appropriate salmonids to supplement natural populations or in harvest applications where emigration can occur. **Strategy c:** Ensure fish stocking activities are coordinated between Indian Tribes, USFWS, WDFW, NMFS, and private aquaculture operations. **Strategy d:** Maintain genetic quality of native fish. **Strategy e:** Prevent introgression between hatchery and wild stocks.	Nonnative species impacts
(19) The Lake Rufus Woods Subbasin is within the N.E. Washington Bull Trout Recovery Unit and is identified as a “Research Need Area” (USFWS 2002). Surveys are needed in the Subbasin to determine how/if Subbasin can contribute to recovery. **Subbasin Objective 1C1***	**Strategy a:** Conduct bull trout distribution and habitat suitability surveys.	Lack of information
(20) Manage walleye consistent with native and focal species management. **Subbasin Objective 2C1**	**Strategy a:** Assess walleye limiting factors on consumptive and non-consumptive fish. **Strategy b:** Conduct walleye/other species interaction	Loss of fishing opportunity due to habitat degradation and loss of anadromous life history

Objectives in Priority Order	Strategies in Priority Order	Limiting Factor(s) Addressed
	assessment. **Strategy c:** Develop management plans consistent with native and focal species management (including walleye and other species). **Strategy d:** Evaluate limiting factors on walleye (RME to Review and update WDFW study done in 1970s).	

* = Objectives and strategies that are included in the RM&E plan.

50.3.2 Discussion of Aquatic Prioritization

The Work Team discussed the preliminary prioritization results for the aquatic objectives and strategies, and, based on a consensus decision with one minority opinion, agreed to the final prioritization of the aquatic objectives and strategies that are reflected in Table 50.3-1. The Lake Rufus Woods Subbasin Work Team selected Objective 2D1 "Develop an anadromous fish reintroduction feasibility analysis by 2006" as their top priority objective. The Work Team agreed that restoration of anadromous fish in the blocked area is an extremely important cultural issue and a major impact of the construction of the FCRPS. Loss of anadromous fish has had a profound effect on the fish, wildlife, and people of the upper Columbia River basin. Restoration of anadromous fish cannot happen upstream of Grand Coulee Dam until anadromous fish are passed upstream of Chief Joseph Dam. Therefore, the group felt it was appropriate to make this objective the top priority objective in this subbasin. This objective is compatible with the Council's assumption that, "restoration of anadromous fish into areas blocked by dams should be actively pursued where feasible." The third priority objective for the Subbasin is contingent upon the first priority objective. That is, if anadromous fish reintroduction is deemed feasible, then reintroduction would be implemented.

The minority opinion on the choice of the top priority objective reads: "Jim Egbert, and some other property owners, would rather see habitat restoration efforts having a higher prioritization than reintroduction of anadromous fish." In addition, 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.

The second priority objective is a broad, overarching objective to address habitat limiting factors. The Work Team was in consensus agreement about this, and all other, priorities. As described above, the Lake Rufus Woods Subbasin has experienced a wide array of habitat problems in Lake Rufus Woods, the Nespelem River, and tributary streams. This objective would cover a variety of habitat improvement projects that may be needed in the Lake Rufus Woods Subbasin. This priority is in alignment with the Council's 2000 Fish and Wildlife Program which is "a habitat-based program, rebuilding healthy, naturally producing fish and wildlife populations by protecting, mitigating, and restoring habitats and the biological systems within them, including anadromous fish migration corridors."

Many of the objectives that were ranked fourth through eighteenth priority are a mixture of habitat restoration objectives that target specific habitat problems. For example, Objective 1B2 (ranked fourth) addresses fish passage barriers and Objective 1B3 (ranked sixth) addresses riparian habitats. These objectives address known habitat limiting factors in the Lake Rufus Woods Subbasin.

Artificial production is a necessary element of fisheries management in the Lake Rufus Woods Subbasin because of the loss of the anadromous life history and impacts to resident fish. Several objectives, including 2D3 (ranked fifth), specify the use of artificial production. The Council's 2000 Fish and Wildlife Program acknowledges that, "there is an obligation to provide fish and wildlife mitigation where habitat has been permanently

lost due to hydroelectric development. Artificial production of fish may be used to replace capacity, bolster productivity, and alleviate harvest pressure on weak, naturally spawning resident and anadromous fish populations."

Protection and restoration of native stocks of salmonids is also a concern in the Lake Rufus Woods Subbasin. Objective 2A3 (ranked ninth) calls for preserving and enhancing native fish where historically present. Objectives 2A1 (ranked fifteenth) and 2A4 (ranked eighteenth) address protecting the genetic integrity of all focal and native fish species.

The lowest ranked objective in the Lake Rufus Woods Subbasin was walleye management. This species is not native to the Subbasin, but does provide a limited, but important, fishery resource. The second lowest ranked objective was bull trout surveys. Bull trout are not known to be present in the Subbasin, but this area was identified in the USFWS Draft Recovery Plan as a research need area.

50.4 Terrestrial Objectives and Strategies

The Columbia River Basin, Province Level, and Lake Rufus Woods objectives for terrestrial resources are presented below. The province objectives were prioritized by the OC and are presented in order of priority. The subbasin objectives were prioritized by the Work Team and the ranking is given in parenthesis after each objective. Strategies are presented beneath the objectives in order of priority. 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.

Provincial 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.

Lake Rufus Woods Subbasin Objective 1A: Fully mitigate for losses incurred from construction and inundation of the Chief Joseph Project per the requirements of the Northwest Power Act. Complete the compensation mitigation consistent with the HEP loss assessment by 2015. Protect, enhance, and manage mitigation properties to attain their highest habitat potential.

Objective 1A is the overall top priority objective within this Subbasin. The sub-objectives listed below have also been prioritized.

Objective 1A1: Protect, enhance or replace 2,290 habitat units of sharp-tailed grouse habitat to address shrub-steppe, rockland[4], and riparian losses resulting from construction of the Chief Joseph Project. (Priority 2)

Objective 1A2: Protect, enhance, or replace 1,179 habitat units of sage grouse habitat to address rockland[4] and shrub-steppe losses resulting from construction of the Chief Joseph Project. (Priority 1)

Objective 1A3: Protect, enhance, or replace 58 habitat units of yellow warbler habitat to address palustrine habitat losses resulting from construction of the Chief Joseph Project. (Priority 3)

Objective 1A4: Protect, enhance, or replace 213 habitat units of Canada goose habitat to address island/sandbar losses resulting from construction of the Chief Joseph Project. (Priority 9)

Objective 1A5: Protect, enhance or replace 239 habitat units of ring-necked pheasant wintering habitat to address agricultural losses resulting from construction of the Chief Joseph Project. (Priority 10)

Objective 1A6: Protect, enhance, or replace 286 habitat units of Lewis' woodpecker habitat to address ponderosa pine savanna and mixed forest losses resulting from construction of the Chief Joseph Project. (Priority 8)

Objective 1A7: Protect, enhance, or replace 920 habitat units of mink habitat to address riverine/riparian losses resulting from construction of the Chief Joseph Project. (Priority 4)

Objective 1A8: Protect, enhance, or replace 1,992 habitat units of mule deer winter range to address mixed forest, ponderosa pine savanna, shrub-steppe and rockland[4] losses resulting from construction of the Chief Joseph Project. (Priority 5)

[4] Rockland: Shrub-steppe habitat with scattered occurrence of small to large haystack basaltic rock deposits which support a higher diversity of shrubs in their micro-environments (Kuehn and Berger 1992).

Objective 1A9: Protect, enhance, or replace 401 habitat units of bobcat habitat to address rock and rockland[4] losses resulting construction of the Chief Joseph Project. (Priority 6)

Objective 1A10: Protect, enhance, or replace 1,254 habitat units of spotted sandpiper habitat to address the sand/gravel/cobble losses resulting from construction of the Chief Joseph Project. (Priority 7)

Strategies for Objectives 1A1 through 1A9, in priority order:

Strategy a: Protect habitat through conservation easements, lease, management plans, or habitat conservation plans. Identify and implement incentive programs.

Strategy b: Management plans should include specifics that address fencing maintenance, noxious weeds, access management, grazing management, fire management, forestry management, recreational management, vegetation management, and threatened, endangered and cultural species management.

Strategy c*: Maintain research, monitoring, and evaluation of effectiveness of mitigation for habitat protection.

Strategy d: Assure funding source to maintain wildlife habitat values (Habitat Units) for the life of the project.

Strategy e*: Identify and evaluate habitats for suitability as mitigation sites.

Strategy f: Protect habitat through fee title acquisition. Identify and implement incentive programs.

Provincial 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 Dam, 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.

Lake Rufus Woods Subbasin Objective 1B*: Quantitatively assess operational impacts of the Chief Joseph Project on terrestrial resources by year 2008.

Objective 1B1*: Assess operational impacts of the Chief Joseph Project on terrestrial resources in the Lake Rufus Woods Subbasin by year 2008. (Priority 11)

Strategy a*: Assess localized and systemic impacts from reservoir fluctuation due to hydro-system management of both Grand Coulee and Chief Joseph projects, include effects of reservoir fluctuations, loss of specialized species habitat, loss of nutrients (anadromous fish), shoreline erosion, effects of cultural and threatened and endangered species, and transmission corridor effects.

Strategy b*: Assess project-related recreational activities effects on habitat.

Objective 1B2*: Upon completion of assessment of operational impacts, develop plan for mitigation of effects by year 2010 and implement initial plan measures by year 2015. (Priority 12)

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.

Provincial 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.

Objective 2A1: Maintain bald eagle at or above present levels (2004) in the Lake Rufus Woods Subbasin. Annually maintain and/or enhance the integrity of bald eagle nesting territories and winter roost sites. (Priority 15)

Strategy a*: Continue to maintain high level of bald eagle nest surveys and monitoring.

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 San Poil, Spokane, and Upper Columbia subbasins). (Priority 14)

Strategy a: Protect existing habitat and populations through conservation easements, lease or management plans. Identify and implement incentive programs.

Strategy b: Enhance potential habitat.

Strategy c*: Continue monitoring and evaluation.

Strategy d: Minimize conversion of existing sharp-tailed grouse habitat to other habitat types.

Strategy e: Protect existing habitat and populations through fee title acquisitions. Identify and implement incentive programs.

Strategy f: Augment existing populations.

Objective 2A3: Increase sage grouse populations within the Lake Rufus Woods and San Poil subbasins to a minimum of 500 grouse by 2015. (Priority 13)

Strategy a: Protect existing habitat and populations through conservation easements, lease or management plans. Identify and implement incentive programs.

Strategy b*: Continue monitoring and evaluation.

Strategy c: Enhance potential habitat.

Strategy d: Minimize conversion of existing sage grouse habitat to other habitat types.

Strategy e: Augment existing populations.

Strategy f: Protect existing habitat and populations through fee title acquisitions. Identify and implement incentive programs.

Objective 2A4: 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 within the Lake Rufus Woods Subbasin in order to prevent future declines and restore populations that have suffered declines. (Priority 16)

Strategy a: Improve enforcement of WDFW and Tribal hunting regulations.

Strategy b*: Increase and maintain high level of monitoring on selected state, federal and Tribal species of concern.

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 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 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 WDNR and IDL Forest Practices

Rules and Subbasin Forest Plans for all National Forests within the Subbasin.

Lake Rufus Woods Objective 2B: Protect, enhance, and restore native wildlife habitat function to maintain or enhance ecological diversity and security for native wildlife species. Emphasize maintenance and improvement of identified priority habitats (rocks/cliffs, caves, upland forest, steppe and shrub-steppe, riparian, and wetland) to provide cover, forage, and food for desired wildlife species.

> **Strategy a*:** Assess loss due to disruption of habitat continuity, fragmentation, and quality.
>
> **Strategy b:** Reintroduction of extirpated species.

Objective 2B1*: Identify, maintain, restore, and enhance priority habitats (wetlands, riparian areas, upland forests, steppe and shrub-steppe, cliffs and rock outcrops, caves, and other priority habitats) within the Lake Rufus Woods Subbasin, including their structural attributes, ecological functions, and distribution and connectivity across the landscape. (Priority 17)

> **Strategy a:** Ensure coordination between terrestrial and aquatic strategies with regard to riparian/wetland mitigation activities.

Objective 2B2: Reverse long-term mule deer population decline by providing for a 25-year increasing trend in the quantity and quality of mule deer habitats, particularly winter and spring habitats, in Okanogan County. (Priority 18)

> **Strategy a:** Secure and enhance winter and spring ranges; protect from human development.
>
> **Strategy b*:** Identify specific factors limiting/affecting mule deer populations in the Lake Rufus Woods Subbasin.
>
> **Strategy c:** Manage motorized traffic in critical mule deer spring and winter ranges.
>
> **Strategy d:** Improve enforcement of state and Tribal hunting regulations.
>
> **Strategy e:** Modify state and Tribal hunting regulations to help increase mule deer populations.

Strategy f: Restore grasses and forbs where noxious weeds have impacted mule deer habitat.

Strategy g: Increase the area of aspen stands.

Strategy h: 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.

50.4.1 Prioritization of Terrestrial Objectives

A detailed discussion of the methods used to prioritize the objectives and strategies is found in Section 1.2. In Lake Rufus Woods 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 ranking criteria were finalized by the IMP OC, but each Work Team was offered the option of adding additional subbasin specific criteria to the ranking. In the Lake Rufus Woods Subbasin, the Work Team decided not to add any additional subbasin specific criteria.

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 and strategies for the Lake Rufus Woods Subbasin is displayed in Table 50.4-1.

Table 50.4-1 Summary of prioritized terrestrial objectives and strategies for the Lake Rufus Woods Subbasin

Objectives in Priority Order	Strategies	Limiting Factor(s) Addressed
Provincial Priority 1 – Mitigate for construction and inundation losses		
(1) Protect, enhance, or replace 1,179 sage grouse Habitat Units to address rockland[5] and shrub-steppe losses resulting from construction of the Chief Joseph Project. **Objective 1A2**	**Strategy a:** Protect habitat through conservation easements, lease, management plans, or habitat conservation plans. Identify and implement incentive programs. **Strategy b:** Management plans should include specifics that address fencing maintenance, noxious weeds, access management, grazing management, fire management, forestry management, recreational management, vegetation management, and threatened, endangered and cultural species management. **Strategy c*:** Maintain research, monitoring, and evaluation of effectiveness of mitigation for habitat protection. **Strategy d:** Assure funding source to maintain wildlife habitat values (Habitat Units) for the life of the project. **Strategy e*:** Identify and evaluate habitats for suitability as mitigation sites. **Strategy f:** Protect habitat through fee title acquisition. Identify and implement incentive programs.	Inundation of sage grouse habitat by Chief Joseph Project
(2) Protect, enhance or replace 2,290 sharp-tailed grouse Habitat Units to address shrub-steppe, rockland[5], and riparian losses resulting from construction of the Chief Joseph Project. **Objective 1A1**	**Strategies a - f**, as noted in 1A2, above.	Inundation of sharp-tailed grouse habitat by Chief Joseph Project
(3) Protect, enhance, or replace 58 yellow warbler Habitat Units to address palustrine habitat losses resulting from construction of the Chief Joseph Project **Objective 1A3**	**Strategies a - f**, as noted in 1A2, above.	Inundation of yellow warbler habitat by Chief Joseph Project

[5] Rockland: Shrub-steppe habitat with scattered occurrence of small to large haystack basaltic rock deposits which support a higher diversity of shrubs in their micro-environments (Kuehn and Berger 1992).

Objectives in Priority Order	Strategies	Limiting Factor(s) Addressed
(4) Protect, enhance, or replace 920 mink Habitat Units to address riverine/riparian losses resulting from construction of the Chief Joseph Project. **Objective 1A7**	**Strategies a - f**, as noted in 1A2, above.	Inundation of mink habitat by Chief Joseph Project
(5) Protect, enhance, or replace 1,992 mule deer winter range Habitat Units to address mixed forest, ponderosa pine savanna, shrub-steppe and rockland[5] losses resulting from construction of the Chief Joseph Project. **Objective 1A8**	**Strategies a - f**, as noted in 1A2, above.	Inundation of mule deer winter range habitat by Chief Joseph Project
(6) Protect, enhance, or replace 401 bobcat Habitat Units to address rock and rockland[5] losses resulting construction of the Chief Joseph Project. **Objective 1A9**	**Strategies a - f**, as noted in 1A2, above.	Inundation of bobcat habitat by Chief Joseph Project
(7) Protect, enhance, or replace 1,254 spotted sandpiper Habitat Units to address the sand/gravel/cobble losses resulting from construction of the Chief Joseph Project. **Objective 1A10**	**Strategies a - f**, as noted in 1A2, above.	Inundation of spotted sandpiper habitat by Chief Joseph Project
(8) Protect, enhance, or replace 286 Lewis' woodpecker Habitat Units to address ponderosa pine savanna and mixed forest losses resulting from construction of the Chief Joseph Project. **Objective 1A6**	**Strategies a - f**, as noted in 1A2, above.	Inundation of Lewis' woodpecker habitat by Chief Joseph Project
(9) Protect, enhance, or replace 213 Canada goose Habitat Units to address island/sandbar losses resulting from construction of the Chief Joseph Project. **Objective 1A4**	**Strategies a - f**, as noted in 1A2, above.	Inundation of Canada goose habitat by Chief Joseph Project
(10) Protect, enhance or replace 239 ring-necked pheasant wintering Habitat Units to address agricultural losses resulting from construction of the Chief Joseph Project. **Objective 1A5**	**Strategies a - f**, as noted in 1A2, above.	Inundation of ring-necked pheasant wintering habitat by Chief Joseph Project
Provincial Priority 2 – Quantify and mitigate for operational impacts		
(11) Assess operational impacts of the Chief Joseph Project on terrestrial resources in the Lake Rufus Woods Subbasin by year 2008. **Objective 1B1***	**Strategy a*:** Assess localized and systemic impacts from reservoir fluctuation due to hydrosystem management of both Grand Coulee and Chief Joseph projects, include effects of reservoir fluctuations, loss of specialized species habitat, loss of nutrients (anadromous fish), shoreline erosion, effects of cultural and threatened and endangered species, and transmission corridor effects. **Strategy b*:** Assess project-related recreational activities effects on habitat.	Lack of data on operational impacts
(12) Upon completion of assessment of operational impacts, develop plan for mitigation of effects by year 2010 and implement initial plan measures by year 2015. **Objective 1B2***	**Strategy a:** Develop and implement mitigation plan.	Need to mitigate operational impacts
Provincial Priority 3 – Mitigate for secondary effects of FCRPS and other subbasin effects		
(13) Increase sage grouse populations within the Lake Rufus Woods	**Strategy a:** Protect existing habitat and populations	Secondary effects of FCRPS

Objectives in Priority Order	Strategies	Limiting Factor(s) Addressed
and San Poil subbasins to a minimum of 500 grouse by 2015. **Objective 2A3**	through conservation easements, lease or management plans. Identify and implement incentive programs. **Strategy b*:** Continue monitoring and evaluation. **Strategy c:** Enhance potential habitat. **Strategy d:** Minimize conversion of existing sage grouse habitat to other habitat types. **Strategy e:** Augment existing populations. **Strategy f:** Protect existing habitat and populations through fee title acquisitions. Identify and implement incentive programs.	and other subbasin effects on sage grouse
(14) 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 is shared with San Poil, Spokane, and Upper Columbia subbasins). **Objective 2A2**	**Strategy a:** Protect existing habitat and populations through conservation easements, lease or management plans. Identify and implement incentive programs. **Strategy b:** Enhance potential habitat. **Strategy c*:** Continue monitoring and evaluation. **Strategy d:** Minimize conversion of existing sharp-tailed grouse habitat to other habitat types. **Strategy e:** Protect existing habitat and populations through fee title acquisitions. Identify and implement incentive programs. **Strategy f:** Augment existing populations.	Secondary effects of FCRPS and other subbasin effects on sharp-tailed grouse populations
(15) Maintain bald eagle at or above present levels (2004) in the Lake Rufus Woods Subbasin. Annually maintain and/or enhance the integrity of bald eagle nesting territories and winter roost sites. **Objective 2A1**	**Strategy a*:** Continue to maintain high level of bald eagle nest surveys and monitoring.	Secondary effects of FCRPS and other subbasin effects on bald eagles
(16) Maintain or enhance populations of federal, state, and Tribal species of special concern, and other native and desirable nonnative	**Strategy a:** Improve enforcement of Washington Department of Fish and Wildlife and Tribal hunting	Secondary effects of FCRPS and other subbasin effects

Objectives in Priority Order	Strategies	Limiting Factor(s) Addressed
wildlife species, within their present and/or historical ranges within the Lake Rufus Woods Subbasin in order to prevent future declines and restore populations that have suffered declines. **Objective 2A4**	regulations. **Strategy b*:** Increase and maintain high level of monitoring on selected state, federal and Tribal species of concern.	on special concern species
(17) Reverse long-term mule deer population decline by providing for a 25-year increasing trend in the quantity and quality of mule deer habitats, particularly winter and spring habitats, in Okanogan County. **Objective 2B2**	**Strategy a:** Secure and enhance winter and spring ranges; protect from human development. **Strategy b*:** Identify specific factors limiting/affecting mule deer populations in the Lake Rufus Woods Subbasin. **Strategy c:** Manage motorized traffic in critical mule deer spring and winter ranges. **Strategy d:** Improve enforcement of state and Tribal hunting regulations. **Strategy e:** Modify state and Tribal hunting regulations to help increase mule deer populations. **Strategy f:** Restore grasses and forbs where noxious weeds have impacted mule deer habitat. **Strategy g:** Increase the area of aspen stands. **Strategy h:** 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.	Secondary effects of FCRPS and other subbasin effects on mule deer habitats
(18) Identify, maintain, restore, and enhance priority habitats (wetlands, riparian areas, upland forests, steppe and shrub-steppe, cliffs and rock outcrops, caves, and other priority habitats) within the Lake Rufus Woods Subbasin, including their structural attributes, ecological functions, and distribution and connectivity across the landscape. **Objective 2B1***	**Strategy a:** Ensure coordination between terrestrial and aquatic strategies with regard to riparian/wetland mitigation activities.	Secondary effects of FCRPS and other subbasin effects on priority habitats

* = Objectives and strategies that are included in the RM&E plan.

50.4.2 Discussion of Terrestrial Prioritization

The overall top priority terrestrial objective for the Lake Rufus Woods Subbasin is to fully mitigate for terrestrial resource losses incurred from construction and inundation of the Chief Joseph Project per the requirements of the Northwest Power Act. Within this objective, there are ten sub-objectives that have been prioritized. The objectives addressing sage and sharp-tailed grouse were ranked at the top of the list because these species are designated as threatened species within the State of Washington. Yellow warbler and mink habitat losses were ranked third and fourth priority because of the importance of riparian habitat types to a wide array of species. Mule deer habitat was ranked fifth priority because there is considerable concern about mule deer populations in the Subbasin, and these species are particularly important for cultural and subsistence purposes to the Tribes. Ring-necked pheasant wintering habitat was the lowest ranked objective in this group of objectives because they are a nonnative species. However, it should be noted that habitat acquisition to mitigate for the construction and inundation losses, is the most important overall objective in the Subbasin and in the Province as a whole.

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 Lake Rufus Woods 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 by 2010 and to implement the mitigation plan by 2015.

The third priority in the IMP is to mitigate for secondary effects of the hydrosystem development in combination with other subbasin effects on wildlife populations. In this category of objectives, the Lake Rufus Woods Subbasin Work Team ranked increasing sage and sharp-tailed grouse as the highest priority. Bald eagles, as a federally listed threatened species and species of special concern are the next priorities.

In the category of mitigating for secondary effects of the FCRPS and other subbasin effects on habitat, mule deer habitats were considered top priority in the Lake Rufus Woods Subbasin; these are species of concern in the Subbasin. Mitigating for secondary impacts to priority habitat types was the final, but still important, objective.

SECTION 51 – Table of Contents

51 Lake Rufus Woods 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, 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 51.1 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 51.1. Rufus Woods 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 1A2: Determine baseline data on relative abundance, condition, size structure, growth, distribution, and species composition for all fish that inhabit the Lake Rufus Woods Subbasin.	2,8,9,10		1,2 and 3	1,2,3,4	1,2,3,4,8,12,13,17,24,28
Subbasin Objective 1B2: Inventory and prioritize all passage barriers within the Lake Rufus Woods Subbasin	1,2,3,4,5,6,9,10	2?		1,2,3,4	1,4,5,6,9,10….
Subbasin Objective 1B6: strategy d: Develop Minimum-flows for all fish-bearing streams within the Rufus Woods Subbasin that meet the needs of focal species were present.	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 2A1: strategy a: Determine and map the genetic and geographic distribution of all focal species.	1,2,3,4,5,6,8,9,10			1,2,3,4	4,5,6,7,8,12,14,15,16,17,18,19,20,21,23,24,25,26,27,28
Subbasin Objective 1B1: Identify limiting factors and management strategies specifically designed to enhance physical habitats for salmonids.	All	All		1,2,3,4	All
Subbasin Objective 2B1: Determine the appropriateness, economic, and ecological impacts of Walleye on salmonid populations in Lake Rufus Woods.	2,8,9			1,2,3,4	1,4,5,6,9,10….
Subbasin Objective 2C1: Study potential methods of adult reintroductions for anadromous Chinook and steelhead above Chief Joseph Dam and providing downstream passage for smolts.	All	All habitat		1,2,3,4	Basic Research
Subbasin Objective 1B1: Develop EMAP sites for water quality, focal species production, habitat quality, and habitat quantity data needed to determine progress toward objectives in the San Poil Watershed. (65 sites)	All			1,2,3,4	6,10,14,16,26,28
Subbasin Objective 1B7: Continuously monitor water quality (flow, temperature, etc.) at all selected EMAP sites (5 sites annually, 15 sites every fourth year).	All			1,2,3,4	6,10,14,16,26,28

AQUATIC					
Strategy & Objective	**Strategy Type[1]**	**Monitoring Type[2]**	**Tier[3]**	**Scale[4]**	**Tool Box Tool[5]**
Subbasin Objective 1B5: Develop baseline width-to-depth ratios for at all selected EMAP sites (5 sites annually, 15 sites every fourth year).	1.5			1,2,3,4	6,10,14,16,26,28
Subbasin Objective 1B3: Develop GIS layer of historic riparian habitats	1,6			1,2,3,4	1,2,4,5,6,7,9,10,11,12,14,15,16,17,18,21,25,26,28
Subbasin Objective 1B3: Survey and monitor existing riparian habitats to determine the percent of remaining functional riparian areas compared to historic at all selected EMAP sites (5 sites annually, 15 sites every fourth year).	1,6			1,2,3,4	1,2,4,5,6,7,9,10,11,12,14,15,16,17,18,21,25,26,28
Subbasin Objective 1B4: Determine stream embeddedness at all selected EMAP sites (5 sites annually, 15 sites every fourth year).	1,5			1,2,3,4	1,2,4,5,6,7,9,10,11,12,14,15,16,17,18,21,25,26,28
Subbasin Objective 2A2: Conduct annual creel surveys at Lake Rufus Woods and along the Nespelem River to estimate harvest rates of focal species.	2,9			1,2,3,4	3,4,5,6,8,12,17,24
Subbasin Objective 2A4: Estimate annual adult returns of kokanee salmon to the Nespelem River	2,4,8,9,10			1,2,3,4	3,4,5,6,8,12,17,24
Subbasin Objective 2B2: Report species, stocks, size, return-to-creel and locations of all artificial production planted into waters contained within the Lake Rufus Woods subbasin.	9			1,2,3,4	3,4,5,6,8,12,17,24
Subbasin Objective 1C2: Develop a database to store all monitoring, evaluation, and research data throughout the intermountain province and make data available by the internet for all managers.	All			1,2,3,4	12
Subbasin Objective 1A1: Monitor all entrainment into and out of Lake Rufus woods for all focal species.	1,7,10			1,2,3,4	3,5,8,13,17,22,23,28
Subbasin Objective 2C2: Identify adult and juvenile annual habitat utilization for all focal species.	All			1,2,3,4	1,2,4,5,6,7,9,10,11,12,14,15,16,17,18,21,25,26,28

AQUATIC					
Strategy & Objective	**Strategy Type[1]**	**Monitoring Type[2]**	**Tier[3]**	**Scale[4]**	**Tool Box Tool[5]**
Subbasin Objective 2B2: Monitor all upland lakes that receive hatchery production for return to creel, age and growth, species composition, natural reproduction, and habitat suitability once every 10-years and adjust management or stocking rates accordingly.	1,2,8,9			1,2,3,4	4,8,12,22,24
Subbasin Objective 2A3: Determine natural production and recruitment for all focal species at Lake Rufus Woods.	2,8,9,10			1,2,3,4	3,5,8,12,13,17,24,28
Subbasin Objective 2A2: Compare cost and return rates for net pen and hatchery-reared trout stocked into Lake Rufus woods at several different sizes.	9			1,2,3,4	Basic Research
Subbasin Objective 1B1: Collect data necessary to conduct an EDT analysis for all tributary streams for all focal species.	1,3,4,5,8			1,2,3,4	See Mobrand Biometrics
Subbasin Objective 2C2: Research and develop food-web models and energy flow diagrams for Lake Rufus Woods.	2,8,9,10			1,2,3,4	Basic Research
Subbasin Objective 1B8: Research and monitor the impacts of TDG on focal species and suckers during years of high flows and during use of discharge tubes at Grand Coulee Dam.	8,10			1,2,3,4	Basic Research
Subbasin Objective 1B8: Research and monitor the impacts of TDG on focal species and suckers during years of high flows downstream of Chief Joseph Dam.	8,10			1,2,3,4	Basic Research
Subbasin Objective 1B1: Strategy I: Determine possible lake elevation changes to enhance salmonid production.	1,2,5,9,10			1,2,3,4	Basic Research
Subbasin Objective 2C3: Implement the Chief Joseph Dam Hatchery Master Plan RM&E component.	2,8,9			1,2,3,4	5,6,10,14,16,17,28

AQUATIC					
Strategy & Objective	**Strategy Type[1]**	**Monitoring Type[2]**	**Tier[3]**	**Scale[4]**	**Tool Box Tool[5]**
ADDITIONAL RESEARCH, MONITORING, AND EVALUATION NEEDS					
Research: Determine the economic costs and benefits to the Lake Rufus Woods Subbasin from implementing the measures called for in the Subbasin plan.	8			1,2,3,4	Standard environmental economic accounting protocols
Research: Determine the keystone species that can be used to indicate the quality of environments for focal salmonid fish species.	All			1,2,3,4	Basic Research
Research: Determine contaminant levels in fish and provide information to the public	8,10			1,2,3,4	Use standardized fish contaminant protocols
Research: Establish population estimates for all focal species in all established stream reaches and determine viability thresholds to meet recovery/restoration/management goals.	2,9			1,2,3,4	Basic Research
Research: Determine limiting factors and abundance of white sturgeon and burbot.	1,2,4,5,9,10			1,2,3,4	Basic Research

[1]Strategy types:

1) Habitat Assessments
2) Population Assessments
3) In-stream Diversion
4) In-stream Passage
5) In-stream 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]**
Columbia 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.	1,6,7			1,2,3,4	29,30,31,32,33,34,35
Province Level Objective 1B: Quantitatively assess and mitigate **operational impacts** of 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. 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.	1,6,7			1,2,3,4	29,30,31,32,33,34,35
Subbasin Objective 1B: Quantitatively assess operational impacts of the Grand Coulee Project on terrestrial resources by year 2008.	1,6,7			1,2,3,4	29,30,31,32,33,34,35
Subbasin Objective 1B1: Quantitatively assess operational impacts of the Grand Coulee Project on terrestrial resources by year 2008.	1,6,7			1,2,3,4	29,30,31,32,33,34,35
Subbasin Objective 1B1: Strategy a: Conduct the assessment and include, but not limit to, fluctuation zone effects on vegetation and wildlife, loss of nutrients in watershed from loss of salmon, recreational effects to terrestrial resources, BPA transmission lines, etc.	1,2,6,7			1,2,3,4	29,30,31,32,33,34,35
Subbasin Objective 1B1: Strategy b: Assess project-related recreational activities effects on habitat.	1,2			1,2,3,4	30
Subbasin Objective 2A1: Strategy a: Continue or increase monitoring of nesting and wintering bald eagles.	1,2,9			1,2,3,4	30

TERRESTRIAL					
Strategy & Objective	**Strategy Type[1]**	**Monitoring Type[2]**	**Tier[3]**	**Scale[4]**	**Tool Box Tool[5]**
Subbasin Objective 2A2: Strategy a: Determine limiting factors on sharp-tailed grouse populations within the Intermountain Province and associated subbasins by 2006.	1,2,6,7,9			1,2,3,4	29,30,31,32,33,34,35
Strategy d: Continue and increase monitoring.	1,2,6,7,9			1,2,3,4	29,30,31,32,33,34,35
Subbasin Objective 2B3: Strategy a: Inventory existing and historic habitat.	1,6,7			1,2,3,4	29,30,31,32,33,34,35
Subbasin Objective 2A2: Strategy d: Assess and, if deemed needed, limit/restrict nonnative invasive species interaction/competition and habitat degradation.	1,6,7			1,2,3,4	29,30,31,32,33,34,35
Subbasin Objective 2A3: Strategy a: Identify specific factors limiting/affecting sage grouse populations in the San Poil Subbasin.	1,2,6,7,8,9			1,2,3,4	29,30,31,32,33,34,35
Strategy d: Continue and increase monitoring.	1,2,6,7,8,9			1,2,3,4	29,30,31,32,33,34,35
Subbasin Objective 2A4: Strategy a: Increase and maintain high level of monitoring on selected state, federal and Tribal species of concern.	1,2,6,7,8,9			1,2,3,4	29,30,31,32,33,34,35
Subbasin Objective 2A6: Strategy a: Determine limiting factors for golden eagles by 2006.	1,2,6,7,9			1,2,3,4	29,30,31,32,33,34,35
Subbasin Objective 2A6: Strategy c: Continue and increase monitoring of golden eagles.	1,2,6,7,9			1,2,3,4	29,30,31,32,33,34,35
Subbasin Objective 2A6: Strategy b: Develop, prioritize, and implement projects and/or research to address identified golden eagle limiting factors by 2007.	1,2,6,7,8,9			1,2,3,4	29,30,31,32,33,34,35
Strategy c for Objective 1A and Sub-objectives 1A1-1A9): Maintain research, monitoring, and evaluation of effectiveness of mitigation for habitat protection.	1,2,6,7,8,9			1,2,3,4	29,30,31,32,33,34,35

TERRESTRIAL					
Strategy & Objective	**Strategy Type[1]**	**Monitoring Type[2]**	**Tier[3]**	**Scale[4]**	**Tool Box Tool[5]**
Subbasin Objective 1B2: Upon completion of assessment of operational impacts, develop plan for mitigation of effects by year 2010 and implement initial plan measures by year 2015.	1,2,6,7,8,9			1,2,3,4	29,30,31,32,33,34,35
Subbasin Objective 2B3: Strategy j: Develop technical and policy working groups that meet regularly to identify problems and implement solutions for the Rufus Woods Subbasin.	8			1,2,3,4	Coordinated activities
Subbasin Objective 2B2: Strategy f: Inventory existing and historic mule deer habitat and identify limiting factors.	1,2,6,7,8,9			1,2,3,4	29,30,31,32,33,34,35
Subbasin Objective 2B4: Strategy a: Inventory existing and historic upland forest habitat.	1,2,6,7,8,9			1,2,3,4	29,30,31,32,33,34,35
Subbasin Objective 2B4: Strategy d: Monitor upland forest habitat.	1,2,6,7,8,9			1,2,3,4	29,30,31,32,33,34,35
Subbasin Objective 2B5: Strategy f: Identify specific factors limiting/affecting mule deer populations in the Rufus Woods Subbasin.	1,2,6,7,9			1,2,3,4	29,30,31,32,33,34,35
Subbasin Objective 2B1: Identify, maintain, restore, and enhance priority habitats (wetlands, riparian areas, upland forests, steppe and shrub-steppe, cliffs and rock outcrops, caves, and other priority habitats) within the Lake Rufus Woods Subbasin, including their structural attributes, ecological functions, and distribution and connectivity across the landscape.	1,2,6,7,8,9			1,2,3,4	29,30,31,32,33,34,35
Subbasin Objective 2B1: Strategy b: Assess loss due to disruption of habitat continuity, fragmentation, and quality.					
Subbasin Objective 2A5: Strategy a: Assess feasibility of translocating extirpated/historic species.	9			1,2,3,4	Basic Research
Subbasin Objective 2B5: Strategy c: Monitor translocations.	2,9			1,2,3,4	29,30,31,32,33,34,35

[1]Strategy types:

1) Habitat Assessments
2) Population Assessments
3) In-stream Diversion
4) In-stream Passage
5) In-stream 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 – 52 Lake Rufus Woods Tables and Figures

Tables and figures are embedded within the text in sections 45 through 51.