Wenatchee Subbasin Summary

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

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Table of Contents

Disclaimer

The Northwest Power Planning Council intended the production of this subbasin summary to be a collaborative effort. Therefore, any party with information relevant to existing natural resources and conditions with the Wenatchee River subbasin was provided an opportunity to participate in the production of this document. Consequently, the document was created using information collected from many sources. The parties participating in the development and submission of this summary do not imply that they agree with or otherwise support all or any of the information submitted by any other party. All parties reserve the right to respond to and rebut any information within this summary or any document appended to the same, as they may deem appropriate.

List of Figures

List of Tables

Wenatchee Subbasin Summary

Subbasin Description

General Description

Subbasin Location

The Wenatchee Subbasin encompasses approximately 1,371 square miles with 230 miles of major streams and rivers. The subbasin drains a portion of the east Cascade Mountains in north central Washington within Chelan County. A number of watersheds within the subbasin drain into the Wenatchee River, which in turn empties into the Columbia River at the City of Wenatchee. The subbasin is bounded by the Entiat Mountains in the north and east, the crest of the Cascade Range to the west, and the Wenatchee Mountains to the south.

Drainage Area

The drainages in the Wenatchee subbasin originate in the high Cascade mountains, with numerous tributaries draining subalpine regions within the Alpine Lakes, Glacier Peak and Henry M. Jackson Wilderness areas (Figure 1). The Little Wenatchee and White Rivers flow into Lake Wenatchee, the source of the Wenatchee River. Nason Creek enters the Wenatchee River near the lake outlet. Below the lake, the Wenatchee Rivers flows in an easterly direction for approximately three miles before turning south at the confluence of the Chiwawa River. The river then descends through Tumwater canyon, below which Icicle Creek joins the mainstem near the town of Leavenworth. Chumstick Creek also enters the Wenatchee at Leavenworth. From Leavenworth, the river flows southeastward to the City of Cashmere, where Mission Creek joins the mainstem. Peshastin Creek, another major tributary stream in the lower subbasin enters the Wenatchee River between Leavenworth and Cashmere.

Climate

Prevailing west winds uplift moist air from the Pacific over the Cascade Mountains. As a result, temperature and precipitation vary widely in the basin, depending upon elevation and nearness to the mountains.

The Cascade Mountain area of the subbasin is characterized by heavy precipitation, with nearly 150 inches of precipitation occurring annually at points along the Cascade crest. Snow depths in the mountains range from 10 to 25 feet, and snow covers the mountain areas from late fall through early summer. Winter daily temperatures average 25 to 40° F, while average summer temperatures range from 60° to 80° F (Andonaegui, 2001).

Air masses rapidly lose moisture as they move eastward resulting in semi-arid conditions in the lowermost portion of the subbasin. In contrast with the mountainous areas, the semi-arid city of Wenatchee has an annual precipitation of less than nine inches, with maximum summer temperature of 95 to 100°F (Andonaegui, 2001). Summer thunderstorms occur periodically and can result in flash flood conditions in local watersheds.

Geology/Topology/Soils

Bounded by mountain ranges on all sides, the subbasin as a whole is dominated by rugged mountains. From alpine and subalpine headwaters, tributaries flow into Wenatchee Lake. At the lake's outlet at RM 54.2, the Wenatchee River descends steeply through Tumwater Canyon, dropping into a lower gradient section near the town of Leavenworth. The narrow Wenatchee River Valley, extending 22 miles from the Wenatchee River's confluence with the Columbia River to the City of Leavenworth, provides the only significant continuous area of level ground in the basin. The huge elevation changes between the mountainous headwaters (e.g. 10,541 ft Glacier Peak in the White River watershed) and the lower Wenatchee River Valley (600 ft at the town of Wenatchee) are a result of the uplifting of the Cascade Mountains and the down-cutting of the Columbia River.

During the last large scale glaciation, more than 10,000 years ago, large masses of ice gradually moved from higher elevations down slope cutting through rock masses and filling the watershed. This glacial action also provided huge amounts of melt water that flowed downstream towards the Columbia River creating outwash deposits composed of deep deposits of silt, sand, and gravel.

More recently rivers have scoured the bedrock and glacial deposits and redeposited them as sand and gravel terraces and plains (CCCD 1996). A review of well logs indicates sediments thicken to over 170 feet along the main axis of the Lake Wenatchee valley (Economic and Engineering Services and Golder Associates 1998). In some places within the subbasin, (e.g., near the confluence of Icicle Creek and the Wenatchee River), the deposits may be up to 300 feet (Andonaegui, 2001).

Hydrology

Four large tributaries (the Chiwawa River, White River, Little Wenatchee River and Nason Creek) join at or near Wenatchee Lake to form the Wenatchee River, which flows 53 miles to the Columbia River. Snowmelt in the upper watershed is the principal source of water for the subbasin's larger streams and provides over 80% of the total runoff from the watershed. The total 1,328 square miles of subbasin drainage produces 2.5 million acre-feet of annual runoff.

Most of the stream flow in the Wenatchee River subbasin also originates from tributaries in the upper watershed. Five major tributaries (the Chiwawa, White, Little Wenatchee rivers and Nason and Icicle Creek) are the source of over 94% of the surface waters within the watershed even though their drainage area only represents 58% of the total watershed area (CCCD 1998).

Peak instantaneous flows for the year usually occur from mid-May through mid-June fueled by snow melt in the upper regions of the subbasin. Record high flows have been recorded in November and December due to rain-on-snow events. Average flows recorded at Monitor (RM 7) during the months of August (1500 cfs) and September (800 cfs) are16.7% and 9.2% of average June flows, respectively. Winter flows are generally nearly double that of September flows but they occasionally drop below 300 cfs (Chelan County PUD 1998).

Two major flow systems, a bedrock flow system and a surficial flow system present in sediments overlying bedrock, are the source of subbasin groundwater. The bedrock wells are not considered viable sources for significant groundwater development.

The alluvial and glaciological outwash sediments that fill river and stream valleys and depressions in the bedrock, are a source for much of the domestic and public water supply. Recharge to the aquifers is primarily in the form of precipitation infiltration, surface water infiltration and recharge from deeper bedrock aquifers. Groundwater flow is likely in a down valley direction. Reports indicate that groundwater and surface water interact throughout the watershed, depending on the subarea's morphology (CCCD 1998). Therefore, changes in groundwater use may affect stream water supply, dependent on the geologic conditions, which vary considerably throughout the subbasin.

Mandated instream flow requirements were established in 1983 for three reaches on the Wenatchee River, one reach on Icicle Creek and one reach on Mission Creek. In each case, these flow requirements are often not met during the winter and late summer as a result of naturally low flows and diversions (during summer). These flow requirements condition issuance of new water rights but do not affect water rights acquired prior to adoption. There are no minimum instream flow protection levels established for the upper watershed tributaries.

Water Quality

Although the Wenatchee River is rated Class AA (extraordinary) by the State of Washington from the headwaters to the WNF boundary near Leavenworth and Class A (excellent) from that point to the confluence with the Columbia River, significant water quality problems have been documented.

The 1998 approved 303(d) report from Washington State to the US EPA listed sections of the mainstem Wenatchee River, and Icicle, Chumstick and Peshastin creeks as exceeding standards for dissolved oxygen, temperature, instream flow and pH (Figure 2). Sections of Mission Creek were listed for violating instream flow standards, as well as for elevated pesticide and fecal coliform levels. Sections of Little Wenatchee River, Chiawakum and Nason creeks were also cited for exceeding temperature standards. Brender Creek, a tributary of Mission Creek was listed for low dissolved oxygen and elevated fecal coliform levels. Of these concerns, low instream flow and elevated temperatures pose the greatest threats to anadromous fish production.

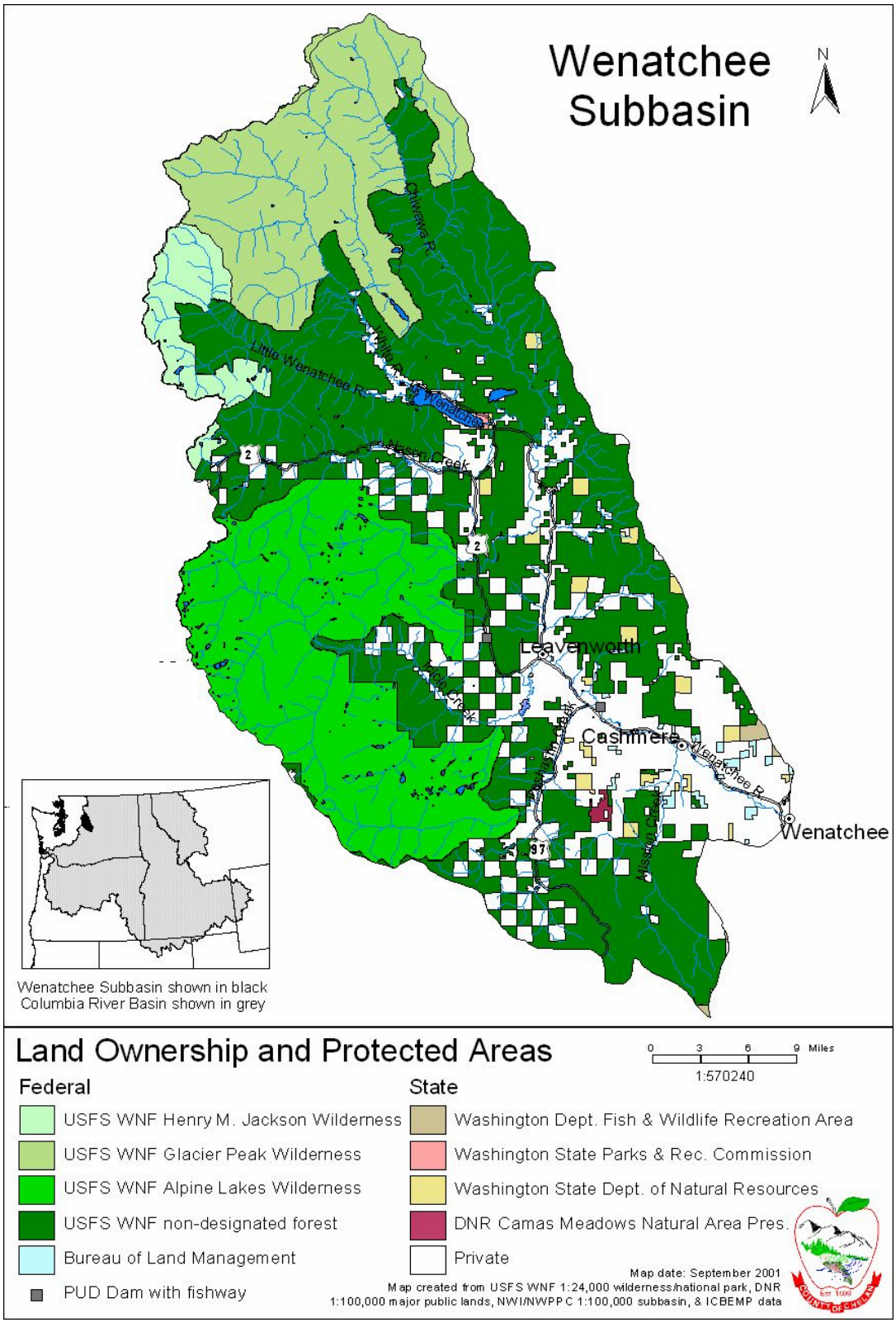

Figure 1. Land ownership and protected areas in the Wenatchee subbasin.

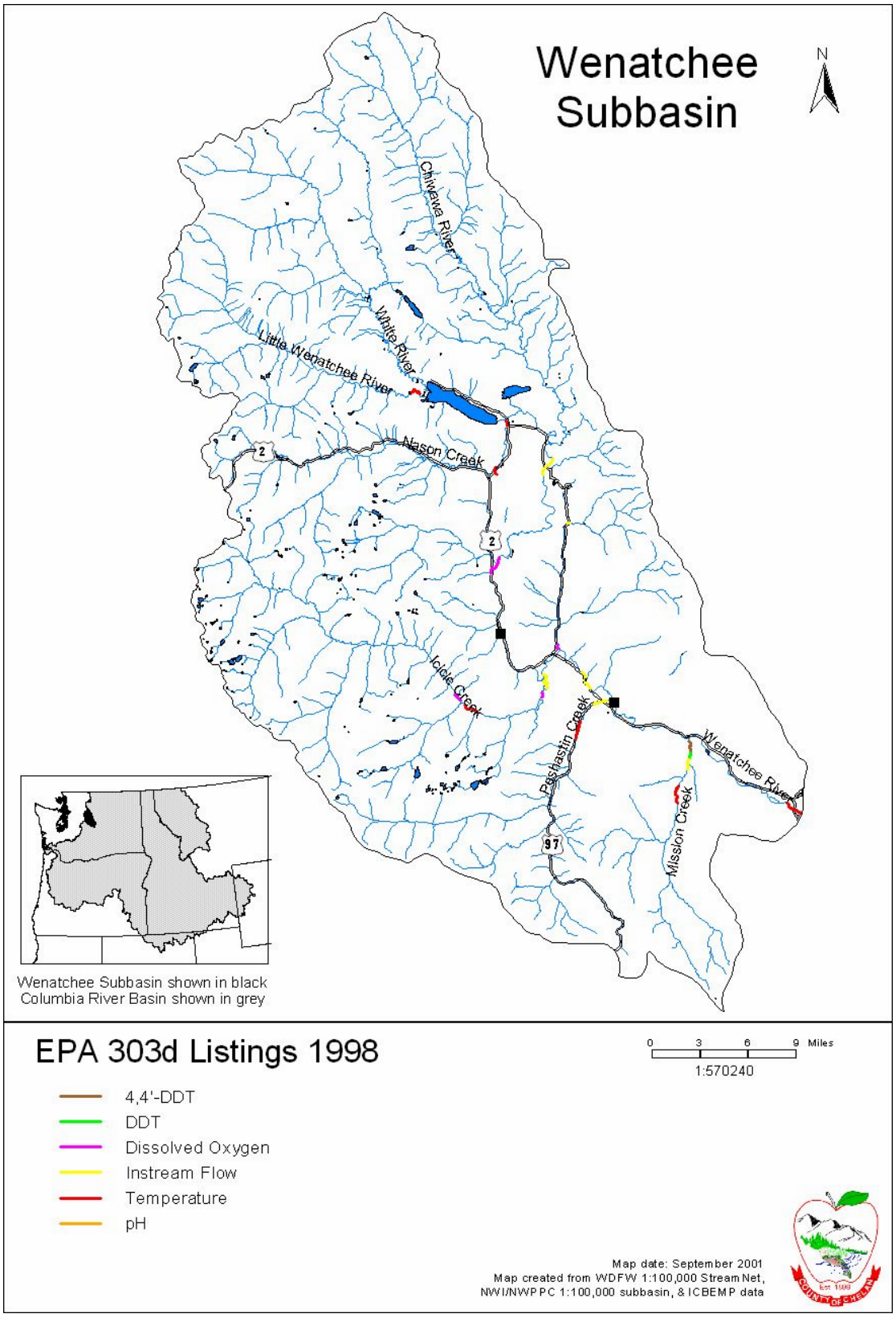

Figure 2. 1998 EPA 303d listings for the Wenatchee subbasin

Vegetation

The climatic, elevation and geologic diversity of the Wenatchee subbasin is also reflected in its plant communities. Although most of the subbasin is forested, the species composition of the forest plant communities changes as elevation decreases and distance from the Cascade Mountain crest increases. Non-forest vegetation occurs primarily at the lowest elevation (shrub-steppe communities) and the highest elevation (alpine meadow communities).

Watersheds closest to the Cascade Mountain Crest experience a maritime climatic influence as moist maritime air incursion occur. Maritime-influenced vegetation is dominant in the White, Nason Chiwawa and Little Wenatchee watersheds. Icicle Creek watershed supports significant amounts of both maritime and continental (arid) vegetation. Shrubs and herbs dominate the vegetated alpine areas of these watersheds; wetter areas support more herbaceous vegetation while red mountain heather and moss-heathers are found in well-drained areas. Mountain hemlock, silver fir and western hemlock dominate the maritime-influenced forest communities which also support numerous understory plants such as cascade huckleberry, rusty menziesia, devil's club, rosy twisted stalk and coolwort foamflower. Open forests of mountain hemlock, whitebark pine and subalpine larch can be found at the extreme upper elevation limit for trees (CCCD, 1996).

Watersheds further from the Cascade Mountain crest in distance and lower in elevation experience much less moisture, resulting in a more arid continental climate. Plant communities found in the Mainstem Wenatchee, Mission, Chumstick and Peshastin watersheds, as well as portions of the Icicle watershed are more continental in nature. Vegetated alpine areas can still be moist herb dominated or drier shrub or grasslands not often seen in maritime-influenced alpine areas. Green fescue usually dominates these high elevation dry grasslands. Forest areas in these watersheds are dominated at climax by subalpine fir, grand fir, Douglas fir, or ponderosa pine. Understory plants include pinegrass, elk sedge, heartleaf arnica, dull oregon grape, bigleaf sandwort, vanilla leaf, oceanspray, serviceberry and lupine. Non-forest plants occurring at the lowest elevation include bitterbrush, bluebunch wheatgrass, arrowleaf balsamroot, and yarrow among others.

Riparian areas are found around streams, lakes, wetlands, small meadows and forest openings. Aspen, black cottonwood, bigleaf maple, alder and red-osier dogwood are common in riparian communities. Wetter areas support moisture dependent species such as willows and sedges while dry forest openings favor forest understory species or plants from drier plant communities common to lower elevations.

Turn of the century sheep grazing, as well as on-going logging and agriculture (primarily orchards), has changed the subbasin's vegetative makeup. In some watersheds, residential growth is also having a significant impact on the landscape. In middle to lower elevation areas, significant changes have occurred due to fire suppression policies. Historically, the fire interval in these areas was 10-50 years. Fire suppression has lead to an increase in tree density in some areas as well as increased abundance of more shade tolerant trees such as Grand fir (Andonaegui, 2001).

Exotic plant species are having a significant deleterious impact on the vegetation of the subbasin. Introduced weed species include cheatgrass, knapweed, dalmation toadflax,

and purple loosestrife. These species have become established in some areas and are capable of excluding native vegetation, particularly in non-forest, riparian or open forest conditions (CCCD, 1996).

Some of the most rare plant species endemic to Washington State are found in the subbasin, including showy stickseed, Wenatchee larkspur, Oregon checkmallow, clustered lady's slipper, several grapeferns, Thompson's chaenactis, bristly sedge, bulb-bearing waterhemlock, pine broomrape, Ross' avens, and long-sepaled globe mallow. A number of other sensitive plants are also found in the subbasin (Andonaegui, 2001).

Land Use and Ownership

The largest landowner in the Wenatchee subbasin is the federal government (Figure 1). The United States Forest Service (USFS) is responsible for 76% of the subbasin (671,220 acres), while the Bureau of Land Management (BLM) manages about 200 acres. Forest service land is divided into 316,561acres Congressional-designated Wilderness, 242,957 acres multiple resource (including timber harvest) land, and 111,702 acres managed as "non-harvest" areas (CCCD1998). Washington Department of Natural Resources (WDNR) manages about 8,700 acres of state-owned land. Longview Fiber Company owns about 47,760 acres, while other private commercial and non-commercial landowners own the remaining 149,560 acres of the subbasin. Although less than 25% of the subbasin is privately owned, nearly two-thirds of the lineal area of the anadromous streams, primarily lower gradient streams, are bordered by private lands (Chelan County PUD 1998).

The primary land uses within the basin are forestry, agriculture, range, recreation and wilderness. Most of the agriculture is irrigated fruit tree production, occurring primarily in the low-lying areas in the mainstem Wenatchee, and the Icicle, Chumstick, Peshastin, and Mission watersheds. Some limited mining activity occurs, primarily in the Peshastin watershed (Chelan County PUD 1998).

Impoundments and Irrigation

There are four major irrigation districts in the Wenatchee subbasin: 1) Wenatchee Reclamation District, 2) Icicle and Peshastin Irrigation Districts, 3) Cascade Irrigation District, 4) Chiwawa Irrigation District, as well as two smaller irrigation groups. These districts have about 68% of the total issued water rights; other users are domestic (10%), commercial and industrial (8%), municipal (6%), fish hatcheries (3%) and all others (4%). Combined, these users have 420 cfs in Water Rights Permits and Certificates (357 surface water, 63 groundwater). The largest user is the Wenatchee Reclamation District, which serves over 9,000 users by diverting up to 200 cfs at Dryden Dam. Dams and other passage barriers in the Wenatchee subbasin are shown in Figure 3.

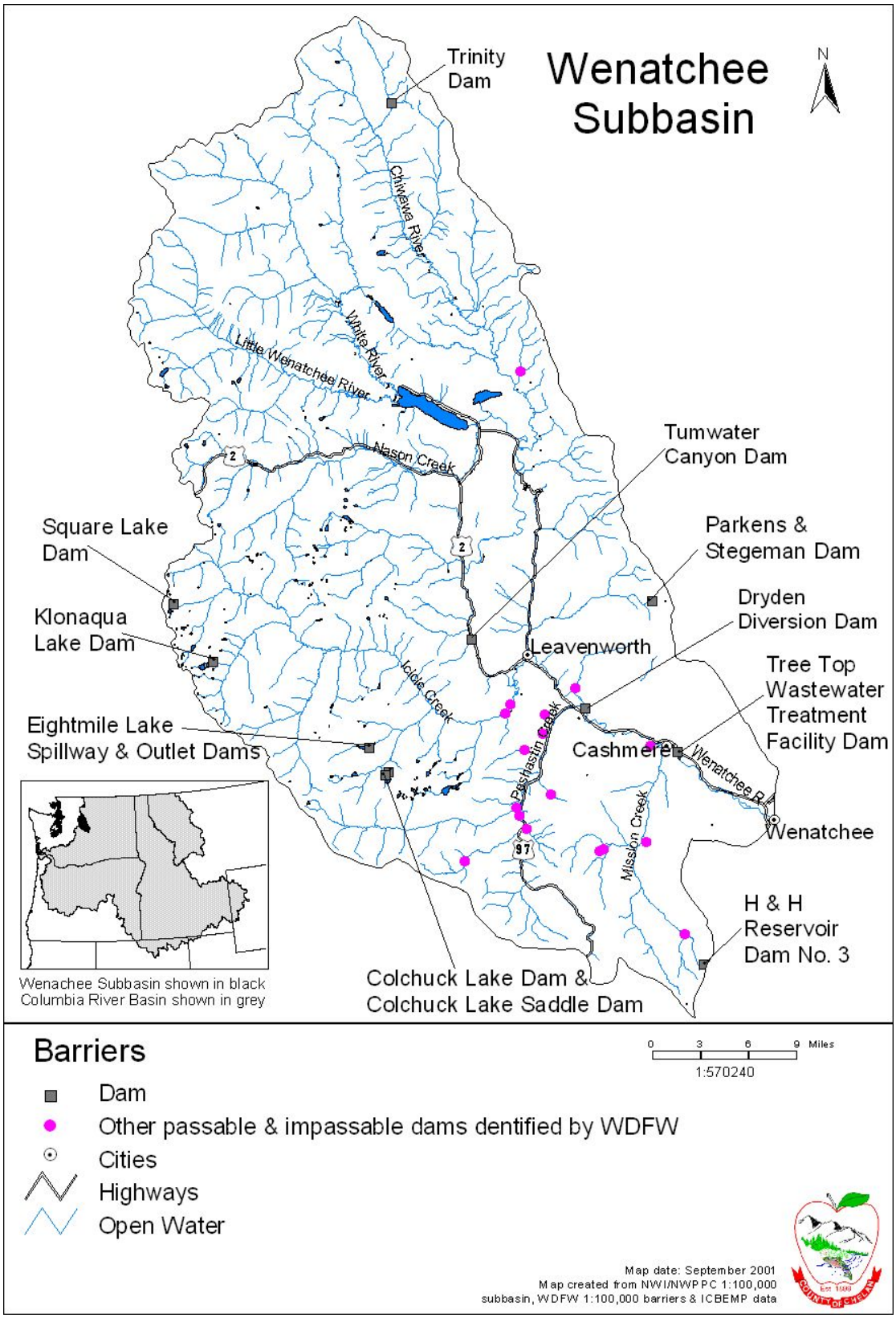

Figure 3. Dams and other passage barriers in the Wenatchee subbasin

Domestic Water Supply

Chelan Co. PUD provides water supply for portions of the Wenatchee urban area. The City of Wenatchee also operates a large system and supplies water to three-quarters of the city's population. The Columbia River is one source of supply to the Wenatchee system; the city treats the water at a filtration plant before distribution. The remaining source of supply is from ground water wells (DOE 1982).

The town of Cashmere has a municipal water supply system with ground water serving as the main source of supply. During periods of high water demand, surface water from the Wenatchee River is pumped into an artificial recharge area where several of the city wells are located to supplement the ground water supply.

The communities of Dryden, Monitor, and Peshastin obtain adequate quantities of ground water for their needs. The town of Leavenworth uses Icicle Creek and a well as their source of supply. Water from the creek is treated at a filtration plant located a short distance downstream from the diversion (DOE 1982).

Irrigation canals traverse most of the populated sections of the basin. This water is sometimes used as a source of domestic supply. Homes in the orchard lands between communities rely mainly on individual wells or springs as a source of supply.

Irrigation

Irrigation has been practiced in the Wenatchee River Valley from the time of the first settlers. The Gunn ditch began taking water from the Wenatchee River in 1891, and in the years that followed, several other ditches were constructed on tributary streams. The Peshastin ditch was built about 1898 to irrigate lands near Peshastin, Dryden, and Cashmere. The Peshastin Irrigation District took over the operation of this canal in 1917 and added lands served by the Tandy and Gibb ditches. The three irrigation entities have a cooperative service area agreement among them for distribution of irrigation water (19). The Icicle Irrigation District, which serves lands near Leavenworth and Cashmere, is also integrated with the Peshastin District and Tandy-Gibb Company (DOE 1982).

The Wenatchee Reclamation District was formed in 1915. Highline Canal, the principal canal of the district, was constructed during the early years of the century. Water is diverted into the canal at Dryden Dam above Dryden, and carried down the north bank of the Wenatchee River to a point near its mouth. There the canal divides, one branch extending a short distance upstream along the west bank of the Columbia and the other extending downstream along the Columbia and across the river into Douglas County.

Other irrigation developments in the basin include the Jones-Shotwell ditch; Cascade Orchards Irrigation Company; and the Wenatchee-Chiwawa Irrigation District near Plain.

Industrial Use

Several industries in the Wenatchee area rely on ground water for processing requirements and others are able to use the untreated Columbia River water to meet their needs. Industrial water use is not great in the basin and includes principally fruit packing, processing, and warehouse operations.

Hydroelectric Power Developments

Presently there is no commercial hydroelectric power produced in the Wenatchee Basin, although the small dams on the main stem Wenatchee River at Tumwater and Dryden were

once used for this purpose. Both the Tumwater and Dryden plants were built in the early 1900s. Power generation was discontinued at both sites during the 1950s, due to their higher costs as compared to the Columbia River projects.

Protected Areas

Camas Meadows Natural Area Preserve

The Camas Meadows Natural Area Preserve was established through the WDNR Washington Natural Heritage Program in October 1980. The 1,334 acre site provides protection to three indigenous species of state and federally listed plant species. These species and their state and federal classifications are listed in Table 1.

Table 1. Camas Meadows Natural Area Preserve Listed Species

Species		Classification	
Common Name	Scientific Name	State	Federal
Wenatchee Mountains checker-mallow	*Sidalcea oregana var. clava*	Endangered	Proposed Endangered
Wenatchee larkspur	*Delphinium viridescens*	Threatened	Species of Concern
Tall agoseris	*Agoseris elata*	Sensitive	N/A

USFS Wilderness Areas

Through Congressional legislation, 1964 Wilderness Act as well as the 1984 Washington Wilderness Act, a percentage of the Wenatchee National Forest is legally designated as Wilderness. A wide variety of plants and animal life found in these areas have helped in the designation of these areas as Wilderness. Each Wilderness provides a unique solitude and primitive experience as well as scientific, educational and historical values.

Alpine Lakes Wilderness

The Alpine Lakes Wilderness was created when Congress passed the 1976 Alpine Lakes Wilderness Act to protect the area in its unique natural state. It is jointly administered by the Mt. Baker-Snoqualmie and Wenatchee National Forest, and encompasses approximately 394,000 acres accessed by 47 trailheads and 615 miles of trail. The Pacific Crest National Scenic Trail traverses the Wilderness from Snoqualmie Pass to Stevens Pass. With nearly 150,000 visitors each year, many with little understanding of wilderness ethics, the Alpine Lakes is hard to manage under the guidelines of the 1964 Wilderness Act. Too many visitors and careless behavior result in campsites stripped of vegetation, trampled meadows, a dizzying network of trails, and reduced levels of solitude. In order to preserve the integrity of the Wilderness it has become necessary to impose restrictions in many areas.

Glacier Peak Wilderness

The Glacier Peak Wilderness, created by Congress in the original 1964 wilderness legislation, is located within portions of Chelan, Snohomish, and Skagit Counties in the North Cascade Mountains of Washington State. The area, 576,900 acres in size, is characterized by heavily forested stream courses, steep-sided valleys, and dramatic glacier crowded peaks. It features very mountainous terrain with elevations between 2,000 and 10,541 feet. Forest vegetation is comprised of true firs, spruce, and hemlock, as well as stands of pine on its eastern slopes. Various species of wildlife inhabit the area and include

deer, elk, bear, mountain goat, cougar, marten, and lynx. The primary fishery is cutthroat trout, however, other species do exist there as well.

At 10,541 feet, Glacier Peak is the dominant geologic feature of the area. It's also the most remote of the major volcanic peaks in the Cascade Range and has more active glaciers than any other place in the lower forty-eight states. No roads approach the mountain, and one must hike many miles through extremely rough terrain to reach its base.

Henry M. Jackson Wilderness

The 103,591-acre Henry M. Jackson Wilderness is located within both the Mt. Baker-Snoqualmie and Wenatchee National Forests and is adjacent to the Glacier Peak Wilderness. The terrain is rugged, with steep slopes and finger ridges dissected by small drainages. This area contains approximately 30 scenic high mountain lakes. Elevations range from 2,350 to 7835 feet, and there are 49 miles of hiking trails.

Approximately 27,242 acres of the Henry M. Jackson Wilderness lie in the Wenatchee National Forest. The terrain is steep and forested, and the climate is more typically west-side-like with heavy winter snows that melt out slowly. Mountain meadows abound with wildflowers that follow the snowline into the fall months.

Fish and Wildlife Resources

Fish and Wildlife Status

Fish

Three species of anadromous salmon, spring chinook and summer chinook (*Oncorhynchus tshawytscha*), sockeye (*Oncorhynchus nerka*), and summer steelhead (*Oncorhynchus mykiss*) are present in the Wenatchee subbasin. Coho stocks (*Oncorynhcus kisutch*) were historically abundant in the subbasin but have been an extirpated stock since the early 1900s. A number of other resident fish also occur throughout the subbasin, including bull trout (*Salvelinus confluentus*), which is present in fluvial, adfluvial and resident life history forms.

The rivers of the Wenatchee subbasin historically were excellent salmonid producing streams. However, by the 1930s, the anadromous runs were decimated because of overfishing in the lower Columbia River fisheries, irrigation diversion practices in the subbasin, and habitat degradation related to poor mining practices, grazing and logging. By 1971, this situation was exacerbated by the construction of seven dams on the Columbia River between the mouth of the Columbia River and the confluence of the Wenatchee River.

Spring Chinook (*Oncorynhcus tshawytscha*)

The Upper Columbia Evolutionarily Significant Unit (ESU) of spring chinook was listed as endangered under the federal ESA on March 16, 1999. The Washington State Salmon and Steelhead Stock Inventory (SASSI) has identified four spring chinook stocks in the Wenatchee subbasin; the Chiwawa River, Nason Creek, Little Wenatchee River, and White River stocks (Figure 4). All were classified as "Depressed" based on chronically low production (Andonaegui, 2001). A fifth stock, the Leavenworth National Fish Hatchery stock is unlisted and supports the only spring chinook fishery in the mid and upper Columbia Basin.

Spring chinook are considered a "stream-type" salmonid (spending one or more years in freshwater). Spring chinook begin migrating into the Columbia River in late March to early April (WDF/WDW 1993) after spending 2 to 3 years in the ocean (Chapman et al. 1995a). Spring chinook enter the Wenatchee River from May to August (WDF/WDW 1993). Spawning begins in early August, peaks in mid-to-late August, and is completed by mid-September (WDF/WDW 1993). The eggs remain in the substrate and incubate through winter. The young (fry) emerge that following spring in April and May (Andonaegui 2001). The young will remain in freshwater environments for one year, not migrating out as smolts until the following spring (Healey 1991), passing the Mid-Columbia dams between mid-April and mid-June (NMFS 2000). This extended freshwater period for both adults and juveniles makes spring chinook salmon more susceptible than the summer/fall (ocean-type) chinook salmon to impacts from habitat alterations in the tributaries.

Although historic run size within the Wenatchee subbasin is not known, run size was substantially greater than that of today. Chapman (1986) estimated historic spring chinook runs entering the Columbia River of 420,000 to 650,000. In 1935 counting of spring chinook began at Rock Island Dam, the last dam before fish enter the Wenatchee River. Total runs of salmon were very low at this time (Peven 1992) with less than 3,000 fish counted at Rock Island Dam during the period 1935 to 1938. Following reduction of harvest and the initiation of the Grand Coulee Fish Management Plan (GCFMP) in 1939-1943, counts of returning spring chinook increased at Rock Island Dam. The GCFMP did not allow for any natural spawning of anadromous salmonids during that time, since all fish were collected for brood stock.

Numbers of spring chinook rose somewhat erratically to a peak of about 26,000 in the mid-1980's. The counts dropped off dramatically after 1993 and have averaged about 2,900 between 1994 and 1998 (Chapman et al. 1995; NMFS 2000).

Summer Chinook (*Oncorynhcus tshawytscha)*

The summer chinook run in the Upper Columbia is not listed under the ESA. The Washington State Salmon and Steelhead Stock Inventory (SASSI) has identified one summer chinook stock in the Wenatchee subbasin, the Wenatchee River summer chinook (Figure 5), and classified it as "Healthy" based on escapement. This run is one of the largest naturally produced chinook populations in the Columbia Basin. Only the fall chinook runs in the Hanford Reach and the Lewis River are larger (WDF/WDW 1993).

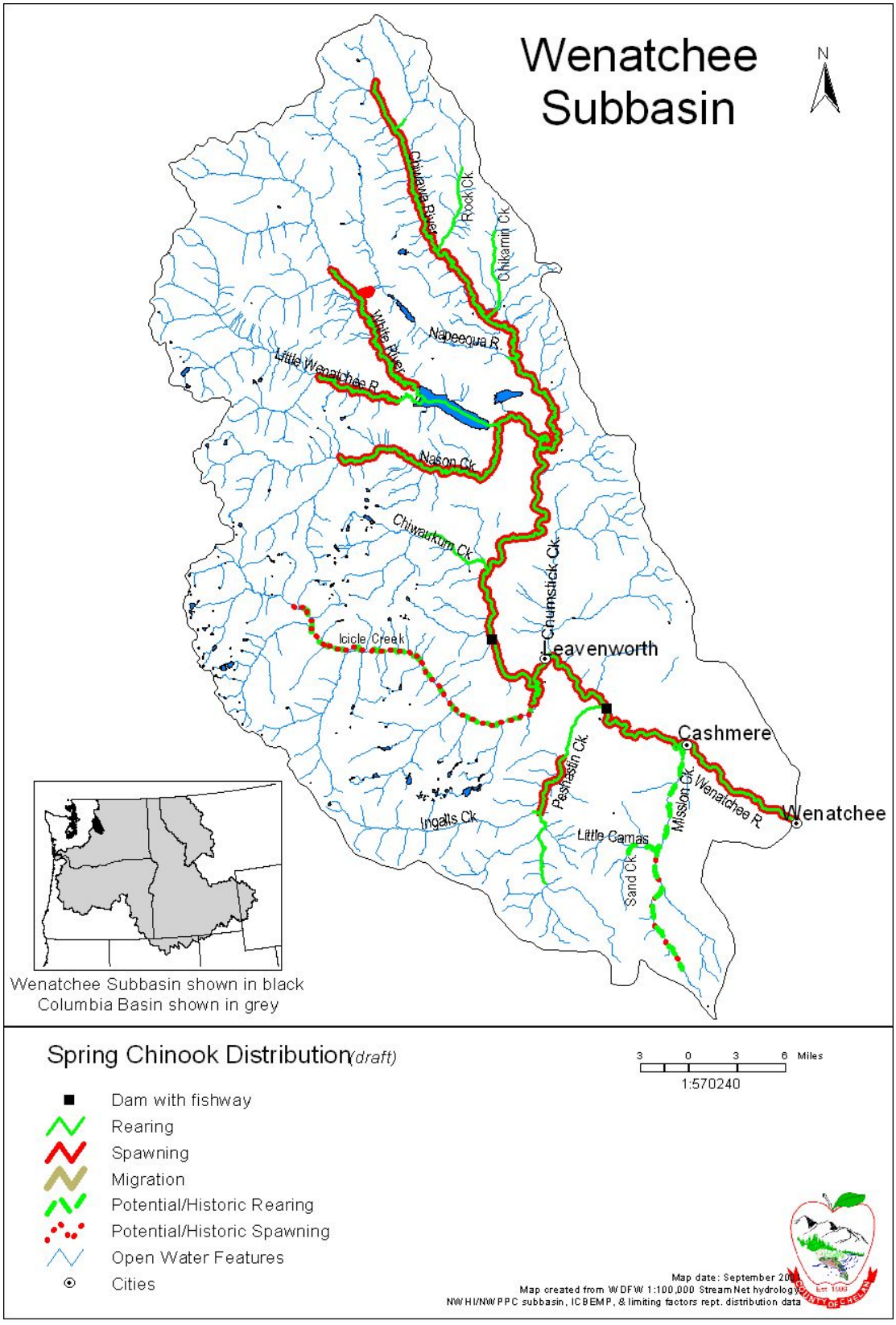

Figure 4. Spring Chinook distribution in the Wenatchee subbasin

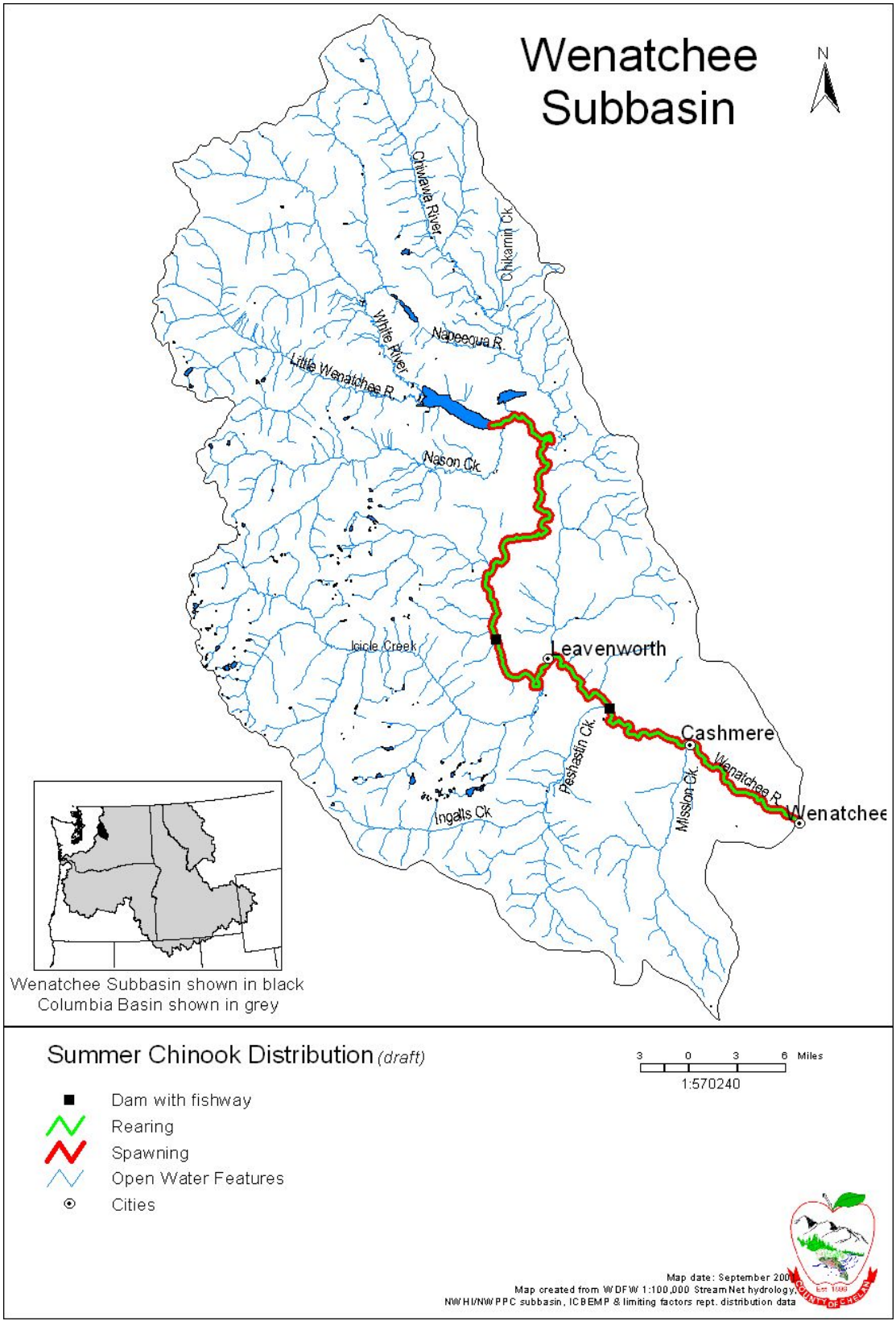

Figure 5. Summer Chinook distribution in the Wenatchee subbasin

In general, summer chinook spend less than one year in freshwater before migrating to the ocean as subyearlings. Most juvenile summer chinook exit the subbasin prior to the lowest flows in fall. However, some subyearling summer chinook exhibit a slow rearing migration and forage behavior as they pass the reservoir system, thereby delaying their arrival at the estuaries until they are yearlings and of a larger size (MCMCP 1998). This phenomenon suggests that mainstem reservoirs influence the success of ocean-type salmonids.

Summer chinook salmon enter the Wenatchee River beginning in late June (WDF/WDW 1993). Spawning begins in late September and continues through early November (MCMCP 1998). Spawning reaches a peak in early to mid-October (WDF/WDW 1993). Eggs incubate in the gravel through winter with fry emerging from the substrate probably from January through April (MCMCP 1998b) and rapidly emigrating from the mainstem Wenatchee River (Hillman and Chapman 1989).

Historically, summer chinook were abundant in the middle to upper Columbia River and may have been the most plentiful of the chinook runs (Chapman 1986, Mullan et al. 1992). Historic run size of summer chinook entering the Columbia River is difficult to determine. Chapman (1986) estimated 2.0 to 2.5 million summer chinook historically entered the Columbia River. In recent years (1994 to 1998) the summer chinook counts at Rock Island dam have averaged about 18,400 summer chinook (NMFS 2000).

Sockeye (*Oncorhynchus nerka*)

Sockeye were once widespread and abundant in the Columbia River system, including the upper Columbia area now blocked by the Grand Coulee Dam. Neither of the two stocks that remain in the Upper-Columbia River region, the Wenatchee and the Okanogan, is listed under the ESA (Figure 6). The SASSI lists the Wenatchee Sockeye Stock as "Healthy" based on escapement (WDF/WDW 1993). This sockeye run supports a popular fishery in Lake Wenatchee.

Sockeye salmon differ from other species of salmon in their requirement of a lake environment for part of their life cycle. Adult sockeye begin entering the Columbia River in May and pass the Mid-Columbia River dams between late May and mid-August (BPA 1994). Spawners reach Lake Wenatchee July - September (Mullan 1986), and peak spawning activity occurs about the third week of September (Andonaegui, 2001). After sockeye fry emerge from the gravel in the following early to late spring, they move to the Lake Wenatchee for rearing, where they reside until the following spring. Some smolts will remain in the lake for an additional year. Sockeye salmon smolts typically pass the Mid-Columbia River dams between mid-April and late-May during their outmigration (Chapman et al. 1995b).

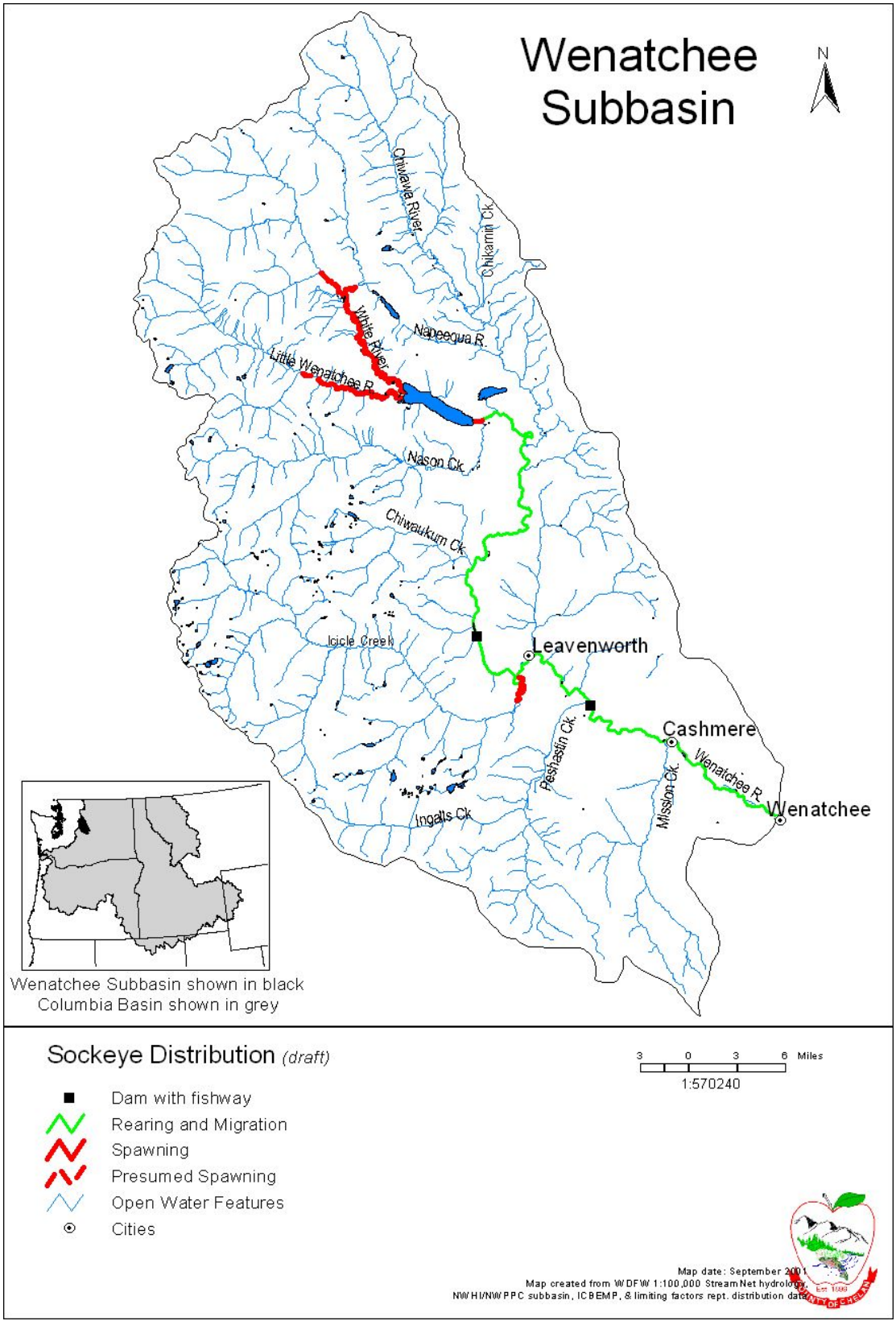

Figure 6. Sockeye Distribution in the Wenatchee subbasin

Sockeye are native to the Wenatchee subbasin but were drastically depleted by irrigation diversions and overfishing in the early 1900's (Peven 1992; WDF/WDW 1993). In the Wenatchee River system specifically, upstream passage conditions were historically a problem (Peven 1992). Prior to 1987, inefficient ladders at Dryden and Tumwater dams presented passage problems to adult fish. In 1986, fishways were rebuilt at both locations and passage problems have been eliminated to a large degree (Peven 1992). High flows in Tumwater Canyon may still cause a natural delay in upstream migration (Peven 1992). The current population is a mixture of native sockeye and descendants of transfers during the Grand Coulee Dam Fish Maintenance Project (GCFMP) that began in 1939. Since 1993, sockeye counts at Rock Island Dam have ranged between 8,500 and 41,500 (Chapman et al. 1995b; NMFS 2000).

Summer Steelhead (*Oncorhynchus mykiss*)

The Upper Columbia ESU of summer steelhead was listed as endangered under the federal ESA on August 18, 1997. The Washington State Salmon and Steelhead Stock Inventory (SASSI) identified one summer steelhead stock in the Wenatchee subbasin, the Wenatchee summer steelhead stock (WDF/WDW 1993) (Figure 7). The stock is classified as "Depressed" based on chronically low production.

Summer steelhead adults enter the river from May through October after spending one to two years in the ocean (NMFS 2000). These fish pass Rock Island Dam between July through May of the following year (counting at Rock Island ceases in November and resumes in April the following year), with the majority of fish passing between August and September. The fall migrants passing Rock Island Dam are thought to overwinter in the Columbia River and spawn the next spring. Summer steelhead are spring spawners with spawning beginning in March and continuing through June, although spawning has been known to occur as late as July in cold headwater tributaries (Fish and Havana 1948). Peak spawning is probably in late May (WDF/WDW 1993).

Time to hatching, as well as from hatching to fry emergence varies with water temperature. Emergence of fry occurs late spring to August (NMFS 2000). Mullan et al. (1992) indicates that median emergence time of steelhead fry in the coldest tributaries of the Upper Columbia River region occurs around September 15.

The length of time juvenile steelhead spend rearing in freshwater before beginning seaward migration is mostly a function of water temperature (Mullan et al. 1992). Most fish that do not emigrate downstream early in life from the coldest environments are thermally-fated to a resident (rainbow trout) life history regardless of whether they were the offspring of anadromous or resident parents (Mullan et al. 1992). The greatest proportion of steelhead spend two years in fresh water (Busby et al. 1996; Mullan et al. 1992). This extended period of freshwater residency places a heavy reliance by steelhead on freshwater habitat conditions.

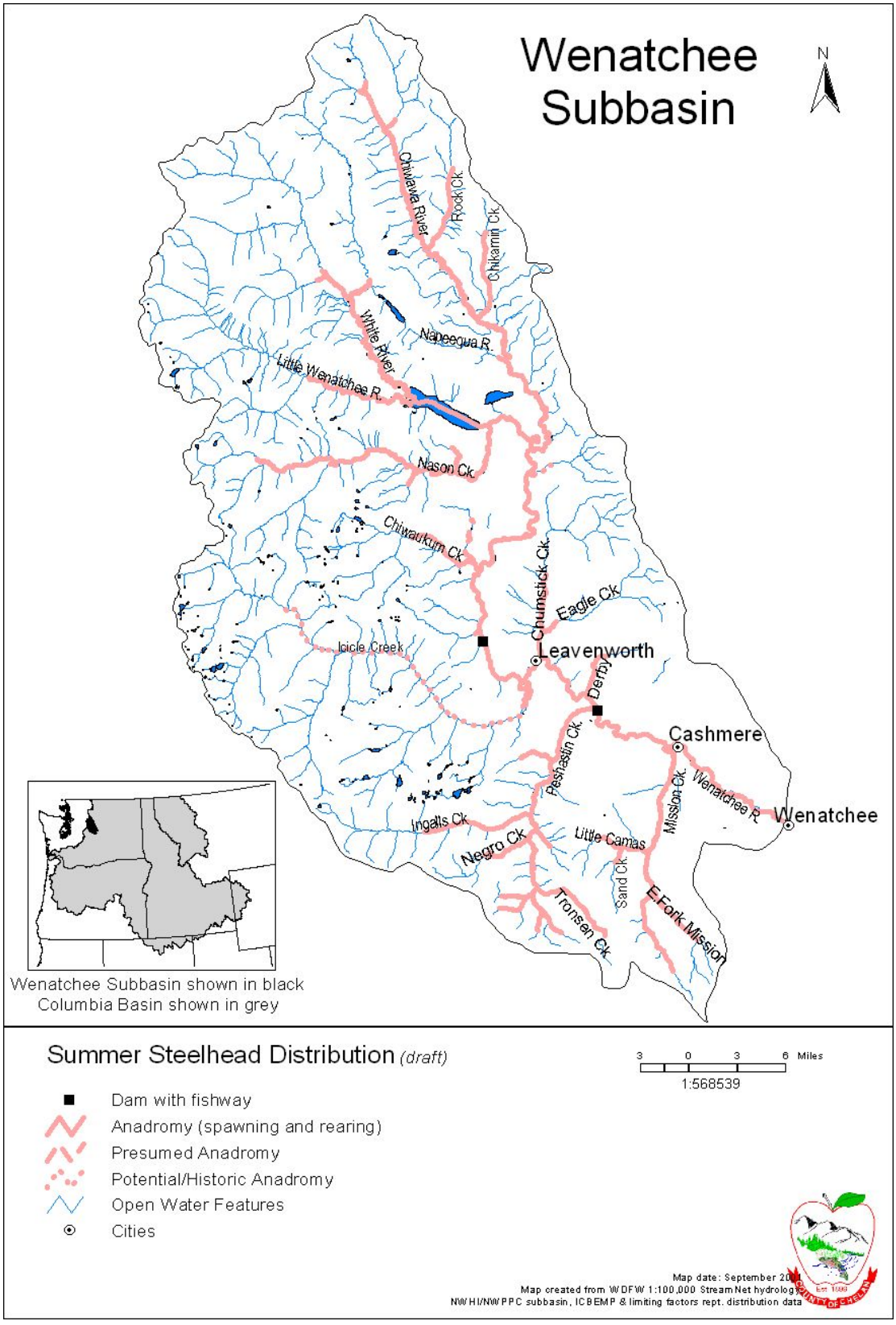

Figure 7. Summer Steelhead distribution in the Wenatchee subbasin

Smolts typically leave the Wenatchee River in March to early June (Peven et al. 1994). The timing of smolt migration is regularly indexed at Rock Island dam as part of a smolt monitoring program (Chapman et al. 1994b) since 1990. The majority of the composite (wild + hatchery) steelhead smolts pass Rock Island in May (Chapman 1994b). Upper Columbia River adults then spend one to three years in the ocean before returning to their natal streams (Mullan et al. 1992), with most spending one or two years in the ocean (Andonaegui, 2001).

Chapman (1986) estimated that the historic run size of Columbia River steelhead entering the Columbia River ranged between 449,000 to 554,000. By the 1930's the portion of the run destined for the mid-Columbia River runs was virtually gone (Craig and Suomela 1941). Since 1933, with the advent of hatchery programs following the construction of Columbia River dams, adult steelhead returns at Rock Island Dam and later at Wells Dam, demonstrated a long-term upward trend (Chapman et al. 1994b). However, between 1990 and 1998, the counts declined to about 4,600 to 12,400, averaging about 7,200 (Chapman et al. 1994b, NMFS 2000). Meanwhile, the natural spawning component of the run has declined over time. Peven (1992) reported that in 1987, hatchery steelhead made up 73% of the steelhead run entering the Columbia River. The major concern for this ESU is the clear failure of the natural component to replace themselves (MCMCP 1998).

Mullan et al. (1992) constructed spawner/recruitment curves that indicate that factors outside tributary subbasins (primarily mainstem passage mortalities) have significant impacts to wild steelhead. Hatchery practices in the past have also contributed to the stock declines, including the practice of planting catchable rainbow trout, which have caused an increase in the incidental catch of steelhead (Chapman et al. 1994a).

Coho (*Oncorhynchus kisutch)*

Indigenous coho salmon no longer occur in the Upper Columbia River region. By the early 1900's coho salmon populations were already decimated by lower Columbia River harvest rates, impassable dams, unscreened irrigation diversions, logging, mining, grazing, and water use practices in the tributaries (BPA et al. 1999). As mitigation for lost production resulting from the development of hydroelectric facilities on the Columbia River since the 1930's, forty-six million fry, fingerlings, and smolts from Leavenworth, Entiat, and Winthrop National Fish Hatcheries were planted in the mid-Columbia basins between 1942 and 1975 (BPA et al. 1999). Despite this effort, self-sustaining coho populations were not established for several reasons: construction and operation of Columbia River hydroelectric facilities; habitat degradation; and poorly administered coho hatchery programs (BPA et al. 1999). From 1933 to 1943 only 475 coho salmon were counted at Rock Island Dam, which counted fish bound for the Wenatchee, Entiat, Methow and Okanogan river systems. Mullan (1983) estimated historical adult coho populations in the Wenatchee basin at 6,000 to 7,000.

In 1996 the Northwest Power Planning Council (NPPC) recommended the Yakama Nation's Mid-Columbia Coho Reintroduction Feasibility Study for funding by the Bonneville Power Administration. This project was identified as one of the fifteen highest priority projects for the Columbia River basin and was incorporated into the NPPC's Fish and Wildlife Program. The Mid-Columbia Coho Reintroduction Feasibility Study seeks to increase the knowledge about coho and their interactions with the environment to make informed decisions regarding the feasibility of reintroducing coho to mid-Columbia

Tributaries (Wenatchee, Entiat, and Methow rivers). The long term vision of the Mid-Columbia Coho Reintroduction Program is to reestablish naturally reproducing coho salmon populations in mid-Columbia river basins, with numbers at or near carrying capacity that provide opportunities for significant tribal and non-tribal harvest. Reintroduction of coho salmon to the mid-Columbia is identified as a priority in the *Wy-Kan-Ush-Mi-Wa-Kish-Wit* document (Tribal Restoration Plan) developed by the four Columbia River Treaty Tribes (CRITFC 1995). The Mid-Columbia Habitat Conservation Plan (Rock Island Dam Hydroelectric Facility et al. 1998) considers the reintroduction of coho salmon to be outside the scope of their plan and will consider artificial propagation of coho only once natural populations are re-established.

Bull Trout (*Salvelinus confluentus*)

The Upper Columbia Distinct Population Segment (DPS) of bull trout was listed as threatened under the federal Endangered Species Act (ESA) on June 12, 1998. The 1998 Bull Trout and Dolly Varden Appendix to the Washington State Salmonid Stock Inventory identifies 11 bull trout/dolly varden stocks in the Wenatchee subbasin (Andonaegui 2001) They are the Icicle, Ingalls, Chiwaukum, Chikamin, Rock, Phelps, Nason, Panther, Little Wenatchee, Chiwawa and White River stocks. The Napeequa Stock is thought to be extinct. Four of the 11 stocks have been classified as "Healthy" (Chikamin, Rock, Phelps, Panther) with the remaining 7 listed as "Unknown" based on the trend of abundance data available at the time the classifications were made.

The Wenatchee subbasin supports adfluvial, fluvial and resident forms of bull trout. Historically, these three forms were probably dispersed throughout the Wenatchee subbasin with distribution and population levels dictated by temperature and gradient (Figure 8). The adfluvial form matures in lakes and ascends tributary streams to spawn, where the young reside for one to three years. Lake Wenatchee supports an adfluvial population, which spawns in both the White and Little Wenatchee rivers. Fluvial bull trout have a similar life history except they move from rivers to smaller tributaries to spawn. Presently fluvial populations spawn in the Wenatchee River, Nason Creek, the Chiwawa River, and Rock Creek, Chikamin Creek and Phelps Creek (all tributaries to the Chiwawa River). Adfluvials and fluvials often make extensive migrations, usually do not reach sexual maturity until age five or six, and can reach a size exceeding 22 pounds (Fraley and Shepard 1989). In the Wenatchee River, bull trout up to 32-36 inches and 12-15 pounds have been observed (Brown 1992). Non-migratory, stream-resident bull trout spend their lives in headwater tributaries, apparently migrating very little, and seldom reach a size of over 14 inches. Resident populations currently exist in Panther Creek and the Napeequa River (both tributaries to the White River), in Jack, Trout, Eightmile, and French Creeks of the Icicle watershed, and Ingalls Creek, a tributary to Peshastin Creek.

Bull trout are strongly influenced by water temperature during all life stages and for all forms. Most bull trout spawn from mid-September through October, with timing related to declining water temperatures. Adult redd site selection is determined by substrate size and quality, hiding cover, streamflow, and ground water sources (Spotts 1987, Baxter et al. 1999). Spawning sites are commonly found in areas of ground water interchange, both from the subsurface to the river, and from the river to the subsurface. Association with areas of ground water interchange can promote oxygen exchange and mitigate severe winter temperatures including the formation of anchor ice. Incubation time to hatching has

been documented at approximately 113 days, with emergence about 223 days from the date of deposition, depending on temperature (Brown 1992). Fry have been documented to remain in the gravel for three weeks after emergence (McPhail and Murray 1979). The long over-winter phase for incubation and development leaves bull trout vulnerable particularly to increases in fine sediment during snowmelt events, and degradation of water quality (Fraley and Shepard 1989).

Good hiding cover is also important to all life stages of all forms of bull trout. Juvenile bull trout, particularly young-of-the-year (YOY), have very specific habitat requirements. Bull trout fry less than 4 inches are primarily bottom-dwellers, often found on margins over fine depositions of detritus (Andonaegui, 2001). They occupy positions just above, in contact with, or even within the substrate. Fry and juveniles can be found in pools or runs in close proximity with cover provided by boulders, cobble, or large woody debris. Age 1+ and older juveniles utilize deeper, faster water than YOY, often in pools with shelter-providing large organic debris or clean cobble substrate. In large rivers, the highest abundance of juveniles can be found near rocks, along the stream margin, or in side channels. Fluvial populations overwinter in deep pools with boulder-rubble substrate or move further downstream to lower reaches of mainstem rivers where individuals make use of abundant woody debris and overhanging banks.

Other Resident Fish

A number of other resident fish are present in the watersheds comprising the Wenatchee subbasin. Table 2 lists the location of these species by subbasin.

Two of these species, mountain sucker and Umatilla dace are Washington State priority habitat species. Mountain suckers have been observed near the smolt trap by Lake Wenatchee during the past couple of years. Umatilla dace occur in three Columbia River drainages, including the Wenatchee subbasin. Umatilla dace have significance as forage for game fish. Little is known about the population status or distribution of either of these species, both of which have state candidate listings.

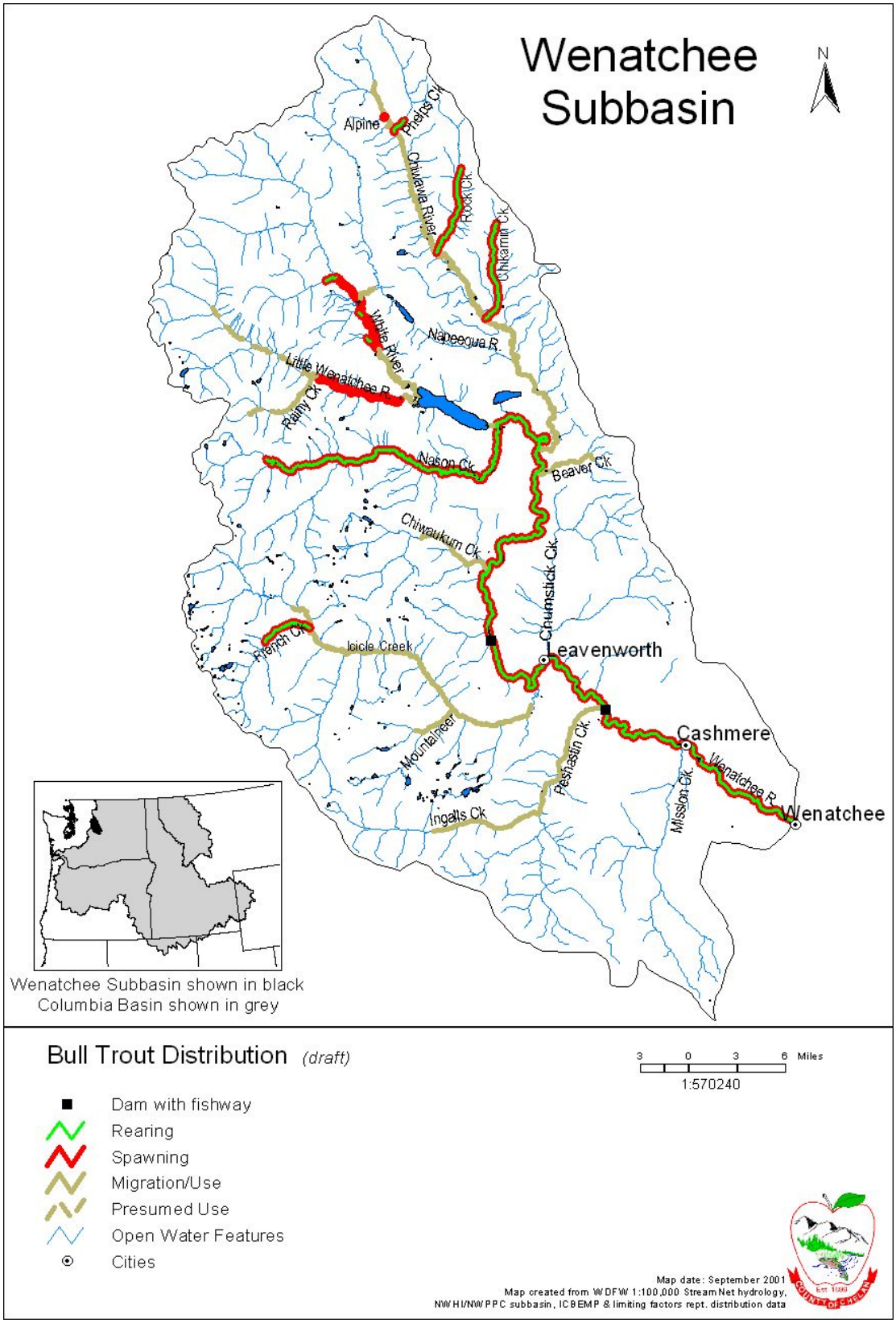

Figure 8. Bull Trout distribution in the Wenatchee subbasin

Table 2. Resident fish present in the Wenatchee subbasin, by watershed

Species Present	Watersheds Within Wenatchee Subbasin						
	White/Little Wenatchee	Chiwawa	Nason	Mainstem Wenatchee	Icicle	Mission	Peshastin
Bull Trout	X	X	X	X	X		X
Westslope Cutthroat	X	X	X	X	X		X
Rainbow Trout	X	X	X	X	X	X	X
Eastern Brook Trout	X	X		X	X		
Sculpin	X	X	X	X	X	X	X
Northern Pike Minnow	X			X			
White Amur-triploid	X						
Redside Shiner	X			X	X	X	
Mountain Whitefish	X	X		X			
Sucker	X	X	X		X	X	X
Bridgelip sucker				X			
Largescale sucker				X			
Kokanee salmon	X						
Pacific Lamprey	X			X	X		
Yellow perch				X			
Speckled dace				X		X	
Shiner perch				X		X	
Crappie				X		X	X

Wildlife

The wide diversity of available habitats in the Wenatchee River watershed indicates a high probability of diverse assemblages of wildlife species. Forests, riparian areas and wetlands are critical areas for the wildlife. Species success is dependent on the availability of habitat and forage, and ecological interactions within the functions of the habitat. More study is necessary to clearly define the wildlife-habitat ecological interaction in the Wenatchee River Subbasin.

A Status Review of Wildlife Mitigation was prepared to assess the impact of projects on wildlife and their habitat in 1984 (Howerton et.al 1984). Response letters in this review indicate that species assessments had not been conducted prior to project(s) initiation. In the 1990s, some watershed assessments include wildlife assessments for species known to inhabit the area, or did so some time during the past (USFS 1995, 1996, 1997, 1998, 1999a, 1999b, 1999c). These assessments are summary documents and do not

describe the population conditions such as available habitat, prey or predator abundance, and population estimates for many organisms.

Based on the habitat types found in the Wenatchee subbasin, 15 amphibian species, 227 bird species 90 mammal species and 19 reptile species are thought to occur. Minimal information is available for species of concern that may have an Endangered Species Act (ESA) designation of endangered, threatened or sensitive, and species of special management concern. Table 3 provides information on species of particular importance to the Wenatchee subbasin including their listing status under Washington State Species of Concern and federal ESA classifications. The types of habitat with which each of these species is associated is indicated. These habitat types are described more fully under the Habitat Areas and Quality section of this summary.

The US Forest Service (USFS) watershed assessments used for this summary describe a measure of habitat conditions as within or outside of natural reference conditions for the species (see below). Many species were not assessed, nor is adequate information readily available for assessment. In some cases, species may have an individual assessment; however, the information provided makes it difficult to determine if the habitat conditions are conducive to population success (may be labeled 'unk' for unknown, see below). Also, although habitat may be available, no sightings have occurred, or prey species may be unavailable (out of reference condition). Most of the habitat assessments were done on a landscape level to describe habitat conditions based on guilds of species using specific vegetation. Although the watershed assessments conducted in the later 1990s reflect more detail than previous assessments, much more information is needed within the Wenatchee River watershed for wildlife species and their ecological interactions.

Within each tributary basin, a notation is made as either 'In, Out or Unknown' (Unk) for a reference to a condition for a baseline natural range of variability (NRV) for the species identified as particularly important to the subbasin (Table 4). The NRV represents those elements predicted as 'natural' for habitat and population conditions. It is an index of condition for the species in its environment. The USFS Wenatchee National Forest Leavenworth District offices determined a baseline condition for species from available literature and internal studies. Knowing a baseline condition provides information for a range of potential variation that is predicted to occur naturally. Species that were found to exist within the reference condition of NRV are 'In' and those outside of the range of variability are 'Out'. Those species with a designation of 'unk' may have other information pertinent to the species or habitat, although not enough information exists to determine a NRV for the species. The USFS chose a subset of species to represent whole systems before management guilds were developed. The species used for the NRV assessments were initially Threatened, Endangered and Sensitive wildlife species, all of the management indicator species (MIS), and a few species of special management concern for the area. Table 4 presents a relative index of conditions for species as either 'In' a reference condition of NRV, or 'Out' of NRV. In some cases, the designation in this table (Table 4) for individual species was drawn from ecological knowledge that population and species success is limited in some manner. For example, reduced forest cover-story availability may present a challenge to species survival even though forage areas appear intact. Another example of species 'Out' of the reference NRV occurs when a problem is

evident, within an ecological context, such as prey unavailability due to extirpation (i.e., lynx [predator]) may be out of reference condition due to the extirpation of snowshoe hares [prey] in that area). The information presented in Table 4 indicates a fundamental need for additional study on wildlife species, ecological interactions within these ecosystems, restoration and monitoring activities, and coordinated management efforts.

For the purpose of summarizing the wildlife in the Wenatchee River Subbasin, the following is a description of the wildlife by tributary streams.

Chiwawa River Watershed

The Chiwawa watershed has a high diversity of habitats and species. It is one of the areas identified as a Center of Biodiversity, Endemism and Rarity in the Columbia River Basin (USFS 1997). Much of the upper watershed habitat is within reference condition (within NRV, see above) with 14 habitat types outside of reference condition. The featured species assessments in the Chiwawa Watershed assessment include: Gray wolf, mule deer, elk, grizzly bear, wolverine and mountain goat. The area is a deer migration and summer habitat area. The deer use the meadows, brush, hardwood and mesic-forested areas. Elk may use the flat areas. Wolverines are in the forested talus areas, and mountain goats use the mountain terrain, ice/snow, talus, and subalpine meadow areas. Lynx habitat is predominantly in the upper watershed in the young forest/subalpine fir areas. Timber harvesting has reduced spotted owl habitat in some of the watershed and fire suppression in other areas has increased successional advancement and habitat. Species directly affected by the loss of riparian and wetlands areas are: salamanders, harlequin ducks, common merganser, great blue heron, swallows, bald eagle, osprey, Vaux's Swift, marten, fisher, woodpeckers, owls, lynx, bear, and freshwater mollusks. Much of the lower watershed is outside of reference conditions due to habitat fragmentation from development, fire suppression, and management. Both the upper and lower watershed areas have experienced declines in species richness and abundance, and possibly extirpation of several ecological key species (i.e., Peregrine falcon, American beaver, fisher, marten; (USFS 1997).

Table 3. Species of particular importance in the Wenatchee subbasin

SPECIES		WDFW PHS Citeria	State SOC Listing/ Federal ESA Status	Habitat Types
AMPHIBIANS				
Larch Mountain Salamander	*Plethodon larselli*	1	C/SC	Talus slopes, caves, boulders, cirques
Columbia Spotted Frog	*Rana luteiventris*	1	C/SC	Montane coniferous wetlands, riparian-wetlands
BIRDS				
Common Loon	*Gavia immer*	1,2	S/	Open water
Harlequin Duck	*Histrionicus histrionicus*	2,3	/SC	Riparian wetlands, open water
Northern Goshawk	*Accipiter gentilis*	1	C/SC	Interior mixed conifer
Bald Eagle	*Haliaeetus leucocephalus*	1	T/T	Riparian-wetlands, open water
Peregrine falcon	*Falco peregrinus*	1	E/SC	Cliffs, talus slopes
Flammulated Owl	*Otus flammeolus*	1	C/	Montane mixed conifer, Ponderosa pine
Spotted Owl	*Strix occidentalis*	1	E/T	Interior mixed conifer, Lodgepole & Ponderosa pine
Vaux's Swift	*Chaetura vauxi*	1	C/	Montane coniferous wetlands, riparian-wetlands
White-headed Woodpecker	*Picoides albolarvatus*	1	C/	Ponderosa pine, montane mixed conifer, interior mixed conifer
Golden Eagle	*Aquila chrysaetos*	1		Shrub steppe, interior grasslands
MAMMALS				
Western Small-footed Myotis	*Myotis ciliolabrum*	2		Talus slopes, cliffs, Ponderosa pine
American Beaver	*Castor canadensis*			Upland aspen, montane coniferous wetlands, riparian-wetlands
Gray Wolf	*Canis lupus*	1	E/E	Lodgepole pine, sub alpine parklands, alpine grass/shrub
Black Bear	*Ursus americanus*			Urban and agricultural mixed environs, montane coniferous wetlands, Riparian-wetlands
Grizzly Bear	*Ursus arctos*	1	E/T	Montane mixed conifer, Lodgepole pine, montane coniferous wetlands, riparian-wetlands
American Marten	*Martes americana*	3		Alpine grass/shrub, montane mixed conifer, interior mixed conifer, riparian-wetlands
Lynx	*Lynx canadensis*	1	T/T	Montane mixed conifer, interior mixed conifer, alpine grasslands
Mule Deer	*Odocoileus hemionus*	3		Ponderosa pine, riparian-wetlands, Interior mixed conifer, agricultural (everywhere)
Mountain Goat	*Oreamnos americanus*	3		Cliffs, talus slopes
Elk	*Cervus elaphus*	3		Sub alpine parkland, alpine grasslands, agricultural, urban mixed, montane mixed conifer
Fisher	*Martes pennanti*	1	E/SC	
Wolverine	*Gulo gulo*	1	C/SC	Talus slopes, caves

WDFW Priority Habitat Criteria: 1=Species determined to be in danger of failing, declining, or vulnerable due to factors such as limited numbers, disease, predation, exploitation, or habitat loss or change; 2=Uncommon species, including Monitor species, occurring in forest environments and that may be affected by habitat loss or change; 3=Species in forest environments for which the maintenance of a stable population and surplus for recreation may be affected by habitat loss or change). WDFW Species of Concern State status: (E=Endangered, T=Threatened, S=Sensitive, C=Candidate). Federal ESA status (E=Endangered, T=Threatened, C=Candidate, SC=Species of Concern, PT=Proposed Threatened, PE=Proposed Endangered).

Table 4. Natural Range of variability for selected species in the Wenatchee subbasin.

SPECIES		Wenatchee Basin *	Wenatchee Mainstem	Chiwawa River	White and Little Wenatchee Rivers	Nason Creek	Chumstick Creek	Mission Creek	Peshastin Creek	Icicle Creek
AMPHIBIANS										
Larch Mountain Salamander	*Plethodon larselli*	X	Unk.	Out	In	Out		Out		
Columbia Spotted Frog	*Rana luteiventris*	X	In	Out	Out	Out				
BIRDS										
Common Loon	*Gavia immer*	X								
Harlequin Duck	*Histrionicus histrionicus*	X	In	In	Out					
Northern Goshawk	*Accipiter gentilis*	X	In	In	In	Out		Out		
Bald Eagle	*Haliaeetus leucocephalus*	X	In	Out	In	Out	Out			
Peregrine falcon	*Falco peregrinus*	X	Unk.	Out	Out	Out	Out	Out	Out	
Flammulated Owl	*Otus flammeolus*	X	In	In	In		Out	In	In?	
Spotted Owl	*Strix occidentalis*	X		Out	Out	Out				
Vaux's Swift	*Chaetura vauxi*	X	Out	Out	Out	Out	Out	Out	In/ Out	
White-headed Woodpecker	*Picoides albolarvatus*	X		Out	Out	Out				
Golden Eagle	*Aquila chrysaetos*	X		Out	Out	Out		In/Out		In
MAMMALS										
Western Small-footed Myotis	*Myotis ciliolabrum*	X	In	In	Out	Out				
American Beaver	*Castor canadensis*	X		In	In		Out	Out		
Gray Wolf	*Canis lupus*	X	Out	Out	Out	Out	Out	Out	Out	
Black Bear	*Ursus americanus*	X				Out			Out	
Grizzly Bear	*Ursus arctos*	X	Out	Out	Out	Out	Out	Out	Out	Out
American Marten	*Martes americana*	X	Unk.	Out	In	Out	Out	Out		In
Lynx	*Lynx canadensis*	X	Unk.	Out	Out	Out	Out	Out		Out
Mule Deer	*Odocoileus hemionus*	X	Out	Out	Out	Out	Out		Out	
Mountain Goat	*Oreamnos americanus*	X	Out	Out	Out	Out				
Elk	*Cervus elaphus*	X	Out	Out	In	Out	Out		Out	
Fisher	*Martes pennanti*	X	Out	Out	Out	Out		Out		Out
Wolverine	*Gulo gulo*	X	Out	Out	Out	Out		Out		Out

Within each watershed, reference condition to a baseline natural range of variability (NRV) is noted. The NRV represents those elements predicted as "natural" for habitat and population conditions, and is an index of condition for the species in its environment (see text for more information).

White and Little Wenatchee Rivers

The White and Little Wenatchee River watershed is an area of animal and plant rarity and endemism (USFS, 1998). Migratory species (mule deer, elk, mountains goats, black bear, grizzly bear, gray wolf, hoary bat, song birds, neotropical migratory birds, bald eagle, harlequin ducks, common loon, white pelican) forage on the herbaceous foliage in the

lower elevations during March and higher elevations in August. The biologically diverse watershed provides several types of micro-site habitats (open water, wetlands, meadows, shrub areas, forest, glaciers, cliffs and talus). The unique species include: spotted frog, tailed frog, bald eagle, peregrine falcon, merganser, spotted owl, Vaux's Swift, red-cross bill, white-headed and black-backed woodpeckers, six bat species, moose, marten, wolverine, wolf, and lynx. Some species in the watershed encounter areas that are in reference conditions and other areas out of reference conditions (Wilson's Warbler, Yellow-breasted Chat). The area provides important connectivity in the North Cascade range for spotted owl, gray wolf, wolverine, grizzly bear, and lynx. High road density, fire suppression and timber harvest have impacted vegetation and wildlife. Recreational use in the upper watershed and land development in the lower watershed provides several conflicts and impacts for wildlife. The amount and magnitude of these conflicts is not well understood. That portion of the Henry M. Jackson Wilderness Area east of the Pacific Crest Trail was closed to fall high hunting in 1998 to reduce potential conflicts between hunters and hikers (USFS 1998).

Nason Creek

Important habitat exists throughout the watershed for northern spotted owl, gray wolf, and grizzly bear. North Cascade ecosystem connectivity is important for many species within this watershed. The area is within the North Cascades Grizzly Bear Recovery Area and evidence indicates bears are recently present. The Nason Creek drainage has many areas of habitat modification due to the construction of highways, railroads, logging roads, and power lines. Recreational use is high. Timber harvest has created forest fragmentation, and loss of forest interior. The average for yearly wildfire events is approximately eight. Many of these have been small in the past with the exception of the Round Mountain fire during 1994 that consumed 3,400 acres. Fire suppression has impacted successional stages within this watershed and more study is necessary to determine the extent of these changes. Trail and road density is a problem in this watershed (USFS 1996).

Chumstick River

The Chumstick River watershed has a wide diversity of species that occur in a wide diversity of habitats. Many riparian dependent species use this watershed. At least 16 of the wildlife species are protected as endangered, threatened or sensitive (i.e., gray wolf, peregrine falcon, grizzly bear, bald eagle, northern spotted owl, tailed frog, olive-sided flycatcher, long-eared myotis, and northern goshawk). Several more species have special management considerations. The impacts to the watershed include timber harvest, road and railway construction, fire suppression, recreation activities and areas, and land development. Land development may be the most significant influence on the wildlife in the watershed. Cougar encounters have recently increased. Increased human disturbance, habitat loss and historic predator control activities has likely reduced gray wolf and grizzly bear numbers in the subbasin as a whole. Black bear numbers are healthy and stable. Fire management and the recent large fires have impacted the available wildlife habitat and successional stages of forest growth (USFS 1999).

Mission Creek

Species of particular concern in this watershed are the grizzly bear, gray wolf, spotted owl, goshawk, bald eagle, peregrine falcon, lynx, wolverine fisher, marten, ruffed grouse, beaver, harlequin duck, mule deer, elk, and bighorn sheep. Amphibians were included in the watershed assessment, however, no inventories existed for previous distribution in the

area. The construction of roads, orchards, and houses has negatively impacted wetlands along Mission Creek. Approximately 70% of the watershed is within a zone of human influence. The open road density for the area ranges from 0.5miles/square mile to 4.1miles/square mile (USFS 1998).

Icicle Creek

A species assessment of conditions for grizzly bear, gray wolf, lynx, wolverine fisher, marten, mule deer, elk, mountain goats, spotted owl, goshawk, ruffed grouse, harlequin duck, primary cavity excavators (pileated woodpecker, white-headed woodpecker, three-toed woodpecker, red-breasted sapsucker, Williamson sapsucker, and northern flicker), bald eagle, peregrine falcon, white-tailed ptarmigan, olive-sided flycatcher, and willow flycatcher was conducted to determine habitat quality (USFS 1995). Approximately 16% of the Icicle Creek watershed is in a zone of influence of high-use trails and open roads. Over 70% of the watershed is in the Alpine Lakes Wilderness. The watershed has a high level of recreation use. Historic predator control activities within the area significantly reduced grizzly bear and wolf populations. At the time of the watershed assessment, road density ranged from 0mile/square mile to 1.2miles/square mile in the Icicle Creek Forest Production Unit. Prescribed natural fire events may provide an opportunity for habitats to return to a quality within a natural range of variability. Snag density (for primary cavity excavator use) is considered similar to a predicted natural range of variability. Fire management may have an impact on snag density. Restoration of riparian areas in the Icicle watershed increases the probability of success for many species within the area. For example, the beaver, ruffed grouse and harlequin duck all depend on riparian areas for forage and cover (USFS, 1995).

Peshastin Creek

The Peshastin wildlife includes endangered and threatened species: bald eagle, gray wolf, peregrine falcon, grizzly bear, and northern spotted owl. Other species with special management concerns are: Cascades frog, fringed myotis, larch mountain salamander, long-eared myotis, North American lynx, northern goshawk, olive-sided flycatcher, Pacific fisher, Pacific western big-eared bat, small-footed myotis, spotted frog, tailed frog, western big-eared bat, wolverine, Harlequin duck, Townsend's big-eared bat, black-backed woodpecker, flammulated owl, great gray owl, pygmy nuthatch, white-headed woodpecker, beaver, mountain goat, mule deer, northern three-toed woodpecker, pileated woodpecker, pine marten, other primary excavators, Rocky mountain elk, and ruffed grouse. A grizzly bear track was seen in the Lower Peshastin in 1991. No wolves have been sighted in the watershed. Approximately 50% of the watershed has been inventoried for spotted owl. The density of open roads or motorized trails is 2.1miles/square mile. Approximately 80% of the area is within a zone of influence and includes private property ownership. Timber harvest, road development and fire suppression have created a low distribution of late-successional habitat, and fragmented riparian habitat (USFS 1999).

Mainstem Wenatchee

Species of special management concern in the Mainstem Wenatchee watershed consist of threatened and endangered, and big game species: grizzly bear, gray wolf, northern spotted owl, bald eagle, peregrine falcon, mountain goat, black bear, mule deer and elk. Although habitat conditions may be suitable for a given species they may not be present in the area. For example, some bats, amphibians, and invertebrate organisms are known to use the area but current status is unknown. The mule deer and elk may have adequate forage habitat but

cover habitat is low. Many species are impacted by the loss of cover habitat and continuity of available cover habitat. The wolverine, fisher, and lynx are directly impacted by high road density in the area. Other human influence, including land development (residential and commercial), timber harvest, and fire suppression, has also directly impacted the use of the area by wildlife (USFS 1999).

Habitat Areas and Quality

The Wenatchee Subbasin contains some of the most pristine habitat found throughout the Columbia River Basin while also experiencing considerable habitat degradation in some drainages. In general, watersheds in the headwater areas of the Wenatchee Subbasin are in better condition than areas further downstream, which have been more affected by human activities.

Fish

The following information is summarized from the Wenatchee Limiting Factors Analysis (Andonaegui 2001), which provides much more detailed habitat information for each watershed.

Upper Wenatchee Subbasin Watersheds

The Little Wenatchee, White River, Chiwawa River and Nason Creek watersheds make up the upper Wenatchee Subbasin. Maintaining and improving habitat functionality and connectivity among these watersheds is critical for sustaining salmonid populations in the subbasin.

Little Wenatchee and White River Watersheds

The Little Wenatchee and White River watersheds contain some of the best aquatic habitat and strongest native fish populations found in the Columbia basin (USFS 1998). The connectivity between these two watersheds and the rest of the Wenatchee Subbasin, including the large, undammed Lake Wenatchee, add to their regional importance.

The Wenatchee sockeye stock, one of only two remaining Columbia basin sockeye runs, spawns in both these watersheds. The White and Little Wenatchee watersheds are also critical to maintaining an adfluvial bull trout population in the Wenatchee subbasin. Spring chinook and steelhead also spawn and rear in these watersheds. Functioning floodplain and riparian habitat, especially mature riparian stands and shallow-water/shoreline habitat of Lake Wenatchee, are of critical importance in maintaining the health of these populations. Limited road, residential, and agricultural development, as well as past timber harvest, has degraded some habitat within the channel migration zone of the lower 11.0 - 13.0 miles of the White River. Impacts include some channel confinement, disconnected associated wetlands, and decreased LWD levels and recruitment (USFS 1998). Timber harvest practices in the lower Little Wenatchee River (RM 0.0 – 16.9/Cady Creek) and the Rainy Creek drainage have also decreased LWD input, increased sediment delivery, and disrupted the delivery pattern of debris to the channels from debris slides. High road density and harvest activities in the mainstem Little Wenatchee River below wilderness boundaries may contribute to high stream temperatures by increasing runoff and decreasing water storage potential (USFS 1998).

Nason Creek Watershed

The significance of the Nason Creek watershed lies in its potential contribution to spring chinook production in the Wenatchee subbasin and its connectivity to the upper Wenatchee subbasin salmonid populations, especially the bull trout subpopulation. Nason Creek

supports the second largest spring chinook spawning populations in the Wenatchee subbasin (28.23% by redd count, Chelan PUD redd counts 1958 –1999). The available quantity of steelhead habitat indicates the watershed's high potential to contribute to steelhead production. Although no concentrations of spawning or rearing bull trout have been observed, given the large amount of available habitat, the watershed may be important for restoration in order to strengthen the upper Wenatchee bull trout metapopulation (McDonald et al. 2000).

Although significant functioning floodplain and riparian habitat exists, timber harvest, road development and conversion of the floodplain to residential uses in Nason Creek and its tributaries have degraded and reduced spawning and rearing habitat in the watershed. Location of roads, railroads and powerline corridors adjacent to Nason Creek have confined and straightened the channel. Roads are the primary human-related source of sediment transported to stream channels in the watershed (USFS 1996). Timber harvest activities are a secondary source of sediment delivery to streams through increased surface erosion, mass failures and surface runoffs. Increased sediment delivery has contributed to changes in stream flow timing and duration. Human-related alterations have also accelerated bank erosion in vulnerable reaches and resulted in braided channel conditions, particularly after the floods of 1990 and 1995 (USFS 1996).

Chiwawa River Watershed

In this watershed, over 90% of spring chinook spawning, a substantial portion of spring chinook, steelhead, and bull trout rearing, and the majority of bulltrout spawning occurs above Chikamin Creek (RM 13.7). Forty-four percent of all spring chinook spawning in the Wenatchee subbasin occurs in the Chiwawa watershed (by redd count, Chelan PUD redd counts, 1958 –1999). Maintaining fish passage through the lower reach of the Chiwawa River is critical to sustaining spring chinook salmon, steelhead, and bull trout populations in the Wenatchee subbasin. Although passage is not yet thought to be hindered, there is some concern that potentially elevated late summer temperatures could affect fish passage through the lower reach of the Chiwawa River. More data is needed to determine whether temperature concerns exists, and if so, whether temperatures are naturally elevated or affected by reduced flows from the Chiwawa Irrigation District diversion at RM 3.6 (Andonaegui, 2001). While some human-related impacts have occurred (brook trout introduction, mining, roads, and recreation), the Chikamin Creek drainage habitat remains healthy due to its excellent riparian vegetative condition and the channel's ability to interact with the floodplain overall.

Mainstem Wenatchee Watershed

The Wenatchee River serves as the migratory corridor for adult and juvenile salmonids as well as providing essential rearing habitat for steelhead and chinook salmon. The mainstem Wenatchee River is the only place in the Wenatchee subbasin that supports summer chinook spawning; steelhead trout and spring chinook also spawn in the Wenatchee River. In the mainstem Wenatchee River, habitat conditions are better upstream of the town of Leavenworth (RM 25.0) than below. Total juvenile salmonid densities in the Wenatchee River are primarily limited by the availability of high flow refuge habitat for post-emergent fry (Andonaegui, 2001). Fry densities that exceed the river's late summer rearing capacity may then be limited by available habitat quality and quantities during late summer. The Beaver Valley Road (State Hwy. 209) and State Hwy 207 have been the principal cause of habitat degradation and channel simplification to the Wenatchee River from the outlet of

Lake Wenatchee downstream to Tumwater Canyon (RM 54.2 – 35.6). The Beaver Valley highway cuts off a couple of old oxbows, limiting floodplain use. State Highway 207 crosses the head of the river, acting as a dam during extreme high water to force all water down the main channel (USFS 1999c).

High flow problems during spring run-off are exacerbated by habitat alteration caused by human-related activities from Leavenworth downstream. A history of settlement and on-going development (including roads, railroads, orchards and towns) have altered the riparian and channel condition resulting in: floodplain abandonment; reduced sinuosity; increased channel entrenchment; reduced side channel/wetland habitat; and reduced LWD input/pool frequency (USFS 1999c). These human-related impacts greatly reduce the availability of high flow refuge habitat for juvenile salmonids (Hillman and Chapman 1989).

During the late summer and early fall, water diversions and withdrawals that contribute to lower instream flows further reduce available habitat quality and quantities in the Wenatchee River. Particularly during years of low snowpack, water diversions and withdrawals impact salmonid spawning and rearing habitat downstream of Dryden Dam (RM 17.0). Impacts may be significant during August through mid-October of average years and potentially lethal during dry years. High instream water temperatures have been reported in the month of July and August throughout the entire mainstem Wenatchee River, potentially having a detrimental effect on the migration of bull trout and the migration/rearing of steelhead trout (Andonaegui 2001).

Derby Creek and Beaver Creek lack the natural hydrology and size to potentially contribute to or negatively impact anadromous fish production in the mainstem Wenatchee River watershed or the subbasin as a whole. Chiwaukum Creek drainage, important because of its potential contribution to bull trout production, is relatively unaffected by human land use. The principal impact occurs at the mouth where the campground is situated in the alluvial fan and the stream has been channelized.

Icicle Creek Watershed

A number of human-made barriers exist in the watershed (e.g., the Leavenworth National Hatchery spillway at RM 2.8). Reestablishing fish passage at human-made barriers on Icicle Creek, while protecting existing functioning floodplain and riparian habitat would provide access to a Wenatchee subbasin watershed that is relatively unimpacted by human land-use activities and is the largest tributary drainage by area to the Wenatchee River.

Reconnecting the Icicle Creek watershed to the rest of the Wenatchee subbasin has the potential to contribute to: maintaining resident bull trout populations and restoring the fluvial bull trout life history form to the Icicle Creek watershed; reestablishing a strong, wild steelhead run in the Icicle Creek watershed; and strengthening the spring chinook spawning population in the Wenatchee subbasin. To fully realize the potential benefits of reestablishing connectivity between the majority of the Icicle Creek watershed and the rest of the Wenatchee subbasin, low instream flows and high instream temperatures must also be addressed in Icicle Creek from the mouth upstream to RM 5.7. During late summer and fall, low flow conditions and associated high instream temperatures occur in the lower

reaches of Icicle Creek from RM 5.7 at the Icicle/Peshastin creek water diversion downstream to the mouth

Floodplain and riparian habitat and function below the wilderness boundary (RM 17.0) have been degraded by campground development, road development, past timber harvests, and private development. Forest fires, both natural and human-induced, also frequently impact the habitat in the Icicle Creek watershed. The severity of the degradation increases dramatically below RM 2.8, primarily as a result of housing development and other private development. Bank stabilization, flood control and loss of riparian habitat limit the stream's ability to adjust to sediment, debris and high flows. This loss of function exacerbates bank destabilization in a naturally mobile stream section, which in turn contributes additional sediment to the stream channel. Decreased in-channel complexity and roughness from the loss of LWD further degrades channel conditions in the lower 2.8 miles (Andonaegui, 2001).

Lower Wenatchee Watersheds

The watersheds and drainages in the lower Wenatchee subbasin (Chumstick Creek drainage, Peshastin Creek watershed and Mission Creek watershed) have been severely altered from their naturally functioning condition and are highly fragmented.

Chumstick Creek Drainage

All habitat attributes, except pool frequency, are highly degraded in Chumstick Creek primarily as a result of private land development and road densities on forest service lands (USFS 1999a). Some of these attributes affect channel morphology (e.g., loss of floodplain connectivity, alteration of disturbance regimes, loss of refugia and loss of off-channel habitat). In addition, Chumstick Creek experiences very low instream flows (2 cfs in August/September) which are exacerbated to an undetermined extent by private diversions and wells affecting surface flows. Presently, fish passage into the drainage is blocked at RM 0.3 for all fish species except steelhead trout; some adult individuals can navigate the culvert barrier at some flows. However, there are about 20 additional fish passage barrier culverts upstream of the barrier at RM 0.3, water quality is degraded and high fine sediments may limit spawning success and food production (Andonaegui 2001). Given removal of fish passage barriers in the drainage, degraded habitat quality and low flow conditions will continue to limit salmonid production.

Mission Creek Watershed

Cumulative disruption of both stream channel and upland habitat throughout the watershed, except in the Devils Gulch reach of Mission creek, has resulted in a declining population of spring chinook and steelhead in the watershed since the mid-1880s (Rife 1999). The most severe contemporary concerns are dewatering, low flows and associated high instream temperatures in Mission Creek below Sand Creek. These factors prevent or impede access to spawning grounds for spring chinook, reduce the available rearing habitat in these areas and constrain access to rearing habitat elsewhere in the watershed (Andonaegui 2001).

Diversion dams and culverts create fish passage barriers from the lower end of the watershed and progressing upstream, significantly reducing access to spawning and rearing habitat. A severe loss of floodplain and riparian habitat functions has occurred as a result of channel alterations to accommodate roads, urban and residential development and agriculture. These alterations have resulted in channelized streams within the floodplain

and have eliminated or reduced woody riparian vegetation to a narrow band of mostly shrubs and with some mature trees. Conditions in this highly unstable stream system are worsened by high sediment loads and soil compaction associated with timber harvest and agricultural activities (NRCS, 1996).

Peshastin Creek

The loss of channel sinuosity, floodplain function and riparian habitat (including off channel habitat) within the channel migration zone of Peshastin creek has had the greatest impact on salmonid production in the watershed (Andonaegui 2001). The channelization of Peshastin creek has reduced spring chinook and steelhead spawning habitat, as well as juvenile rearing habitat for all salmonid species, especially overwintering habitat for steelhead/rainbow trout (Andonaegui, 2001). The channelization of Peshastin Creek is the result of the construction of State Highway 97. Additional impacts to floodplain and riparian habitat functions of Peshastin Creek are the result of residential/urban development, agriculture uses, timber harvest and mining activity that has been active for over 100 years. The severely reduced amounts of large woody debris in Peshastin Creek, further reduces habitat quality. Low LWD is primarily related to the effects of stream channelization and reduced riparian habitat along the mainstem and in tributaries.

Reduced flows and elevated instream temperatures below the Peshastin Irrigation District water diversion (RM 4.8) precludes the upstream movement of migrating adult bull trout. In some years, dependent on spring runoff characteristics, the reduced flow can act as a passage barrier to spawning spring chinook. During summer and fall, flows can become extremely low below the diversion, at times dewatering the channel. This reduces the total amount of available rearing habitat and may lead to direct mortality of juveniles by stranding (MCMCP, 1998).

Fish passage barriers in some tributary streams reduce available habitat in the watershed. Additionally, some tributary streams have been severely impacted by forest roads, mining and riparian harvest, reducing LWD recruitment and increasing sediment delivery.

Wildlife

The Wenatchee Subbasin is comprised of 14 different types of wildlife habitats (Figure 9). Identification and description of these habitats is based on a five-year cooperative effort between 33 federal, tribal, state and private organizations. WDFW priority species and habitat elements are found in most of these habitats (Johnson and O'Neil 2001 Table 5 lists the acreage of each of the wildlife habitats found in the Wenatchee Subbasin (IBIS, 2001).

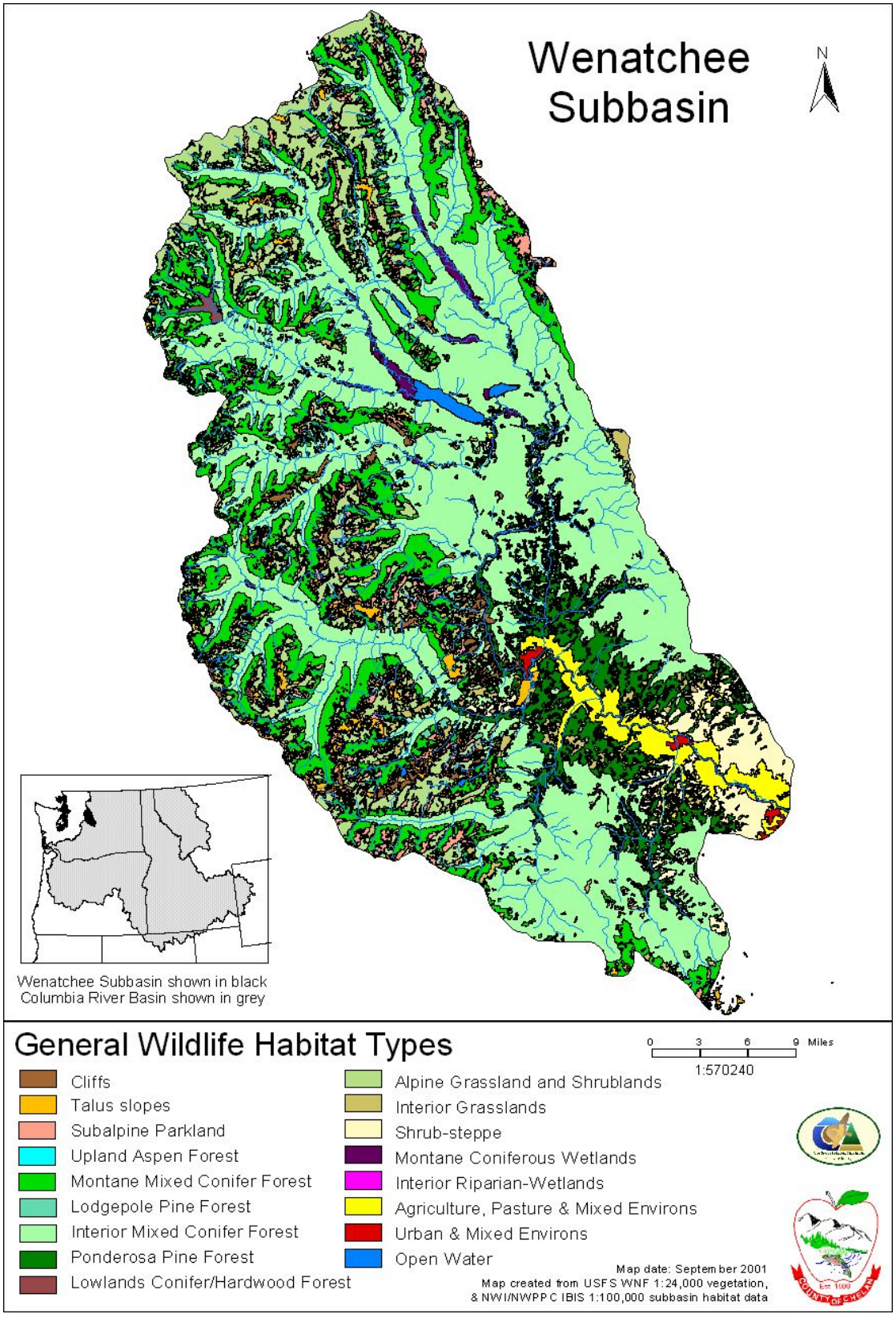

Figure 9. Wildlife habitat types found in the Wenatchee subbasin

Table 5. Acreage of wildlife habitat types found in the Wenatchee subbasin (IBIS 2001)

Habitat Name	Acreage within Subbasin
Eastside (Interior) Mixed Conifer Forest	397,818
Montane Mixed Conifer Forest	151,327
Alpine Grasslands and Shrublands	106,902
Ponderosa Pine Forest and Woodlands	54,770
Subalpine Parkland	35,398
Eastside (Interior) Grassland	31,988
Agriculture, Pastures, and Mixed Environs	26,937
Shrub-steppe	25,937
Open Water – Lakes, Rivers and Streams	8,218
Montane Coniferous Wetlands	7,854
Lodgepole Pine Forest and Woodlands	3,447
Urban and Mixed Environs	1,782
Westside Lowlands Conifer-Hardwood Forest	1,362
Eastside (Interior) Riparian-Wetlands	41

Alpine Grassland and Shrubland

Alpine Grassland and Shrubland occurs at the highest elevations in the subbasin, primarily above treeline, but also in a mosaic with Subalpine Parkland. Nearly 107,000 acres of the subbasin is Alpine Grassland and Shrubland, making it the third largest wildlife habitat type. The climate is the coldest of any found in the subbasin which experiences heavy snowfall in the winter and a short growing season due to persistent snowpack. In the drier areas, the bunch grasslands are dominated by green fescue and other fescue species. Alpine serb turfs may be moist or dry, depending on whether incursions of moist maritime air occur. In drier areas shrubs such as red mountain heather and moss-heather are found, while wetter areas tend to support more herbaceous vegetation. Cliffs, talus and other barren areas are common features within or adjacent to this habitat. Natural disturbance such as trampling by larger mammals such as elk or mountain goats can occur, but is small scale and infrequent in nature. Human-related impacts include some minor impacts from recreational use (trampling and tent sites) and larger impacts from domestic sheep grazing. Sixty-seven species of birds, 42 mammals species, 4 amphibian and one reptile species are associated with this habitat (Chappell and Kagen in Johnson and O'Neil 2001). Three WDFW priority species (wolverine, mountain goat, and bighorn sheep) depend on this habitat for part or all of their life history requirements.

Subalpine Parkland

The Wenatchee subbasin's Subalpine Parkland habitat lies below Alpine Grassland and Shrubland and above Mixed Montane Conifer Forest or Lodgepole Pine Forest habitat. A 10 to 30% canopy cover characterizes subalpine parkland, with highly variable openings between trees. Some of the habitat appears as parkland with small patches of trees, while other areas have savanna-like stands of scattered trees. Moist areas of subalpine parkland have more heather shrublands than drier areas, which are dominated by grasses or sedges (Crawford and Chappell in Johnson and O'Neil 2001). Open forests of mountain hemlock, whitebark pine and subalpine larch can be found at the extreme upper elevation for trees (CCCD, 1996). Mountain hemlock and silver fir dominate in maritime-influenced areas, while dried areas are predominantly subalpine fir, whitebark pine and grand fir. The habitat is generally stable with local changes to particular tree variants. Whitebark may be

declining because of the effects of blister rust (an introduced pathogen) or fire suppression leading to a shift from parklands to more closed forest (Crawford and Chappell in Johnson and O'Neil 2001). Livestock trampling has also impacted this habitat in some areas. Species associated with subalpine parklands within the Wenatchee subbasin include 102 bird species, 57 mammal species, 9 amphibian species and one reptile specie. Sixteen WDFW priority species frequent this habitat, while three (wolverine, mountain goat and bighorn sheep) are dependent on subalpine parklands during part of their life history.

Montane Mixed Conifer Forests

The Montane Mixed Conifer Forests habitat lies below subalpine parklands and above Eastside Mixed Conifer Forests. Montane Coniferous Wetlands are interspersed within areas of Montane Mixed Conifer Forests. The 151,327 acres of Montane Mixed Conifer Forests habitat lies within the Wenatchee National Forest, some of which is in wilderness areas. Evergreen conifers dominate this forest habitat with one species usually predominate (Chappell in Johnson and O'Neil 2001). Where there is a maritime influence, Pacific silver fir and mountain hemlock usually dominate, often in association with western hemlock. In drier areas, subalpine fir is dominant, in association with Douglas fir. Understory plants include cascade huckleberry, rusty meniesia, devil's club, rosy twisted stalk, coolwort foamflower and Oregon grape.

Fire is the major natural disturbance in this habitat. After a forest fire, early seral tree species may be any of the dominant species, Douglas fir or lodgepole pine. Shade-intolerant species such as Douglas fir or lodgepole pine become less dominant as the stand matures. Forest management practices, particularly clearcutting has also affected this habitat, resulting in less diverse tree canopies with an emphasis on Douglas fir. This habitat is one of the best protected because large areas are found within wilderness areas. However, continued road building and clear cutting in unprotected areas can reduce the quality and quantity of this habitat available (Chappell in Johnson and O'Neil 2001).

Species associated with this habitat include 98 bird, 66 mammal, 10 amphibian and four reptile species. Seventeen WDFW priority species are found within this habitat.

Eastside (Interior) Mixed Conifer Forests

Eastside Mixed Conifer Forest is the most extensive habitat in the Wenatchee subbasin, covering a total of 397,818 acres. While stand canopy in this habitat was generally diverse historically, single-layer canopies with fewer snags and large woody debris are currently more common (Crawford in Johnson and O'Neil 2001). Douglas fir is the most common tree species in this habitat. In moist areas, grand fir and western hemlock are co-dominant with the Douglas fir, while ponderosa pine is the most common co-dominant species in lower elevation or drier areas. Other tree species present include lodgepole pine and subalpine fir. Understory is complex and diverse, including shrubs (e.g., service berry, oregon grape, oceanspray), herbaceous broad-leafed plants (e.g., vanilla leaf, lupines, heartleaf arnica), and craminoids (e.g., pinegrass and elk sedge).

Taken together, timber harvesting practices and fire suppression have had a significant impact on Eastside Mixed Conifer Forests. Logging priorities have focused harvest on large shade-intolerant species. Fire suppression has enforced these harvesting practices, and the resulting stands tend to lack snags, have high tree density and are composed of smaller and more shade-tolerant trees (Crawford in Johnson and O'Neil

2001). Combined with these activities, roads and periodic grazing have compromised this forest habitat, altering its natural status as functional habitat for many species.

Sixty-six mammal species, 113 bird species, 10 amphibian species and 11 reptile species are associated with Eastern Mixed Conifer Forests habitat, including 14 WDFW priority species. Of these priority species, fishers, lynx, and spotted owls depend on this habitat for at least part of their life history requirements (Johnson and O'Neil 2001).

Montane Coniferous Wetlands

The Montane Coniferous Wetlands habitat occurs along streams or in small patches within a matrix of Montane Mixed Conifer, or less commonly Eastside Mixed Conifer Forest or Lodgepole Pine Forest and Woodlands. There are 7,854 acres of Montane Coniferous Wetlands within the Wenatchee subbasin.

Forested wetlands or floodplains with a persistent winter snow pack typify Montane Coniferous Wetlands. Seeps and springs are common in this forest habitat dominated by evergreen conifer trees. Indicator species include subalpine fir, lodgepole pine, western hemlock or western red cedar. Shrubs, forbs and ferns, or graminoids dominate the understory. An important feature in productive sites is large woody debris (Chappell and Kagen in Johnson and O'Neil, 2001).

Logging and road building have impacted these wetlands, modifying the composition and structure of montane riparian habitats. Five of the 32 plant associations representing this habitat listed in the National Vegetation Classification are considered imperiled or critically imperiled (Chappell and Kagen in Johnson and O'Neil 2001). Fifty-four mammal species, 75 bird species, 8 amphibian species and 2 reptile species are associated with this habitat, including 11 WDFW priority species.

Lodgepole Pine Forest and Woodlands

About 3,447 acres of Lodgepole Pine Forest and Woodlands habitat exists in the Wenatchee subbasin, primarily as early successional forest vegetation following fires that have occurred in Montane Mixed Conifer Forest and Eastside Mixed Conifer Forest habitats. Lodgepole pine is the dominant tree species but it usually associated with other conifers, often shade-resistant species, and representative of these other habitats. Evergreen or deciduous medium-tall shrubs, evergreen low shrubs or graminoids with few shrubs dominate the understory. The forb component of this habitat is diverse including such species as false solomonseal, heartleaf arnica, lupines, and meadowrue among many others (Crawford in Johnson and O'Neil 2001).

Fire suppression has allowed lodgepole pine habitats to develop into more multi-layered stands over time. Other human-related impacts include fragmentation by roads, timber harvest, and periodic livestock grazing. Eighty-one bird species, 49 mammal species, 8 amphibian species and 12 reptiles are associated with this habitat, including 14 WDFW priority species. Two priority species, lynx and northern Goshawk, are dependent on this habitat for at least part of their life history requirements.

Ponderosa Pine Forest and Woodlands

Lower elevation forests near the mainstem Wenatchee River are primarily Ponderosa Pine Forests and Woodlands. While some Ponderosa Pine Forests are intermixed with Eastern Mixed Conifer Forest, this habitat is often a transition zone between the Eastern Mixed Conifer Forest and Agricultural and Pasture or Shrub-Steppe habitats. Ponderosa Pine

Forests are relatively open, with tree canopy coverage of 10-60% (Crawford and Kagen in Johnson and O'Neil 2001). Where the forest is multi-layered, the lower layers often contain broadleaf deciduous trees. Grasses sedges or forbs, with some shrubs, dominate the undergrowth. Low-severity fires customarily maintained an open, park-like habitat structure with few undergrowth trees. Fire suppression has lead to a build up of fuels, increasing the likelihood of stand-replacing fires. In areas where heavy grazing occurs, grass cover is removed and the understory contains more shrubs and conifers. The habitat has been negatively affected by the introduction of exotic plants and the diminished presence of native bunchgrasses. Species associated with this habitat include 118 birds, 57 mammals, 10 amphibians and 18 reptiles. Of these species, seventeen are WDFW priority species. Eighteen species rely on this habitat for part of their life history requirements, including three WDFW priority species (blue grouse, Northern goshawk and white-headed woodpecker).

Eastside Grasslands

Eastside Grasslands are found interspersed among Ponderosa Pine Forest and Woodlands and, to a lesser extent, Eastside Mixed Conifer Forests in the Wenatchee Subbasin. The grassland habitat is typically upland vegetation but it may also include riparian bottomlands dominated by non-native grasses (Crawford and Kagen in Johnson and O'Neil 2001). The predominant vegetation is short to medium tall grasses, particularly native bunchgrasses such as bluebunch wheatgrass and Idaho fescue. Rough fescue can be dominant in moist sites. Annual grasses such as cheatgreass are also usually present. The density of forbs varies depending on location, but can include balsamroots, fleabane, lupines and milkvetches among others. In areas where livestock grazing has been persistent, drier native bunchgrass grasslands have changed irreversibly to persistent annual grass and forb lands. Conversion to agriculture has been one of the principal reasons for loss of this type of habitat. Eighty-four bird, 42 mammal, 8 amphibian and 14 reptile species are associated with Eastside Grasslands. None of the eight WDFW priority species are highly dependent on Eastside Grasslands for their life history requirements, but a number of other birds and small mammals are closely associated (i.e., rely on the habitat for some part of their life history requirements).

Eastside Riparian-Wetlands

Although the total acreage of Eastside Riparian-Wetlands is small (41 acres), the habitat is essential for the health of both wildlife and fish stocks. There are 143 species of birds, 65 mammals, 12 amphibians and 10 reptiles that frequent Eastside Riparian-Wetlands. Of these species, 24 birds 20 mammal, 10 amphibian and one reptile species are dependent upon this habitat for life requirements at one or more stages of their lives.

Eastside Riparian-Wetlands, as opposed to Montane Mixed Conifer Wetlands, occurs in warm montane and adjacent valley and plain riparian environment. The habitat can be highly varied, often characterized by a mosaic of forest, woodland and shrubland patches along a stream course. Underbrush of tall shrub layers is often deciduous and very dense. Black cottonwood, quaking aspen, white alder and peachleaf willow are characteristic dominant tree species. With the exception of shrub-steppe areas, evergreen trees are rarely abundant. (Crawford and Kagen in Johnson and O'Neil 2001).

Human related activities affecting Eastside Riparian-Wetlands within the Wenatchee subbasin include timber harvest practices, livestock grazing, road building, and agricultural and other private development.

Shrub-steppe

This habitat type primarily occurs in the subbasin east of the towns of Cashmere and Wenatchee but is found in also found in mosaic patterns with Ponderosa Pine Forests and agricultural lands. Shrub-steppe is a savanna shrubland with shrub cover of 10-60%, with more shrub coverage in heavy grazed areas. The habitat is characterized by an open shrub layer over a moderately open to closed bunchgrass layer. The shrubs component of the habitat is dominated by all three sub-species of big sagebrush (basin, mountain and antelope bitterbrush) and two shorter species, silver and three-tip sagebrush. Along the edges of streams, moist meadows and ponds, silver sagebrush is usually dominant. A brushgrass steppe layer is characteristic of this habitat when it is in good condition. The amount of available steppe-shrub habitat has been reduced through conversion to agricultural and residential/urban use. Livestock grazing tends to increase shrub density and annual cover, decreasing bunchgrass density. Exotic plant introduction has also changed the character of shrub-steppe habitat. Species that occur in Shrub-steppe habitat in the Wenatchee subbasin include 83 bird, 43 mammal, 16 reptile and 9 amphibian species.

Westside Lowlands Conifer-Hardwood Forest

Maritime air intrudes into the southwestern edge of the Wenatchee subbasin, producing a small section (1,362 acres) of habitat characteristic of Westside Lowland Conifer-Hardwood Forests. The moist evergreen forest habitat is dominated by Douglas fir and western hemlock (Chappell and Kagen in Johnson and Neil, 2001). The understory shrub species include plants more associated with forests west of the Cascades. Fire is the major natural disturbance.

Ninety-nine species of birds, 50 mammals, 12 amphibians and 10 reptiles have been associated with this habitat. Fishers and spotted owls are the two WDFW priority habitat species dependent on this habitat for part of their life requirements (Johnson and O'Neil 2001).

Open Water – Lakes, River and Streams

There are over 8,218 acres in open water habitat throughout the Wenatchee subbasin. The principal lake in the subbasin is Lake Wenatchee. The structure of these habitats is described more fully in the fish habitat areas and quality sections. Loss of riparian habitat bordering the open water is a concern for wildlife dependent on this habitat. Of the 70 species of birds that occur in this habitat, 25 are waterfowl dependent upon the habitat for part of their life history requirements. Nineteen mammals, 11 amphibian and one reptile species are also associated with this habitat in the Wenatchee subbasin.

Agricultural, Pasture and Mixed Environs

Most of the Agricultural, Pasture and Mixed Environs habitat is located in the Wenatchee River valley between Leavenworth and Wenatchee. This habitat occurs within a matrix with other habitats such as Ponderosa pine forests, steppe-shrub, eastside riparian-wetlands and open water. Fruit orchards are the predominant agricultural use. Species associated with this habitat include 155 species of birds, 65 mammals, 11 amphibians and 13 reptiles (Johnson and O'Neil 2001).

Urban and Mixed Environs

About 0.2 percent of the Wenatchee subbasin is defined as Urban and Mixed Environs, and most is medium to low density. Activities within this habitat can affect riparian habitats and streams as discussed in the fish habitat section. Often in this habitat, native vegetation is replaced with exotic plants (Ferguson in Johnson and O'Neil 2001).

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Watershed Assessments

The Washington State Conservation Commission is preparing the final report for a limiting factor analysis of the Wenatchee Subbasin (Water Resource Inventory Area 45) and Portions of the WRIA 40 within Chelan County (Squilchuck, Stemilot and Colockum drainages) (Andonaegui, 2001). The report examines historic and current salmonid habitat conditions and distribution within the Wenatchee subbasin, and identifies key factors limiting the ability of habitat to fully sustain salmonid populations; e.g., loss of access to spawning and rearing habitat, floodplain function, streambed sediment conditions, riparian zone condition, water quality and quantity, and introduced species. The limiting factor analysis is required by Chapter 75.46 Revised Code of Washington and will be used to prioritize appropriate projects for funding under Washington's salmon recovery program, as well as assist potential project sponsors in identifying projects. This report has been a primary source of information found in this subbasin summary. The Wenatchee National Forest has prepared watershed assessments for the Chumstick, Mission, Peshastin, Icicle, Nason, White-Little Wenatchee, Chiwawa, and Mainstem Wenatchee rivers, which describe historic and existing terrestrial and aquatic species habitat, and soil, water, range, fire, and scenic/recreation conditions. They also present key issues and provide resource management recommendations and preliminary desired future conditions (USFS 1999a, 1999b, 1999c, 1998, 1997,1996,1995a, 1995b).

The USFS Wenatchee-Okanogan National Forest has also prepared several biological assessments for salmonid species to satisfy section 7 consultation requirements for various management activities within the subbasin (Rife 1998, Rife 1999, Rife and Haskins 1998, Rife and MacDonald 1999, Haskins 1998, Driscoll et al. 1998, Dawson et al, Dawson et al 1999).

The Rock Island, Rocky Reach and Wells Dam hydroelectric facilities, which are managed by the Chelan and Douglas County Public Utility Districts, filed an application with the NMFS for individual incidental take permits as part of their relicensing process. A comprehensive aquatic species and habitat assessment exhibit was produced to accompany the application (Rock Island Dam Hydroelectric Facility et.al. 1998). This document provides a detailed analysis of aquatic species and habitat conditions in the Wenatchee subbasin, and provides recommended strategies for habitat protection and restoration.

Many other stock assessment and habitat studies have been conducted for the Wenatchee subbasin and its associated watersheds. Some of the most recent studies are discussed under Existing and Past Efforts. Appendix A provides a bibliography of research and assessment studies that have been conducted within the subbasin.

Limiting Factors

Fish

Within the Wenatchee subbasin, human alterations to the environment are exacerbating naturally limiting conditions by reducing habitat quality and quantity, thereby reducing a species' chances of successfully completing its life cycle. These alterations have primarily occurred in the lower gradient, lower reaches of watersheds in the lower subbasin and include road building and placement, conversion of riparian habitat to agriculture and residential development, water diversion, reduced large woody debris (LWD) recruitment, and flood control efforts that include LWD removal, berm construction, and stream channelization.

Maintaining the present level of habitat functionality and connectivity in watersheds of the upper Wenatchee subbasin is of primary importance for sustaining salmonid populations in the subbasin. Therefore, a primary limiting factor is the risk of losing this floodplain connectivity through development activities in transportation/utility corridors and on privately owned floodplains in lower reaches of the upper subbasin (Andonaegui 2001).

Loss of spawning, rearing and migratory habitat in the mainstem Wenatchee, particularly below the town of Leavenworth also limits fish production in the Wenatchee subbasin. Human activities have resulted in a loss of habitat complexity, including both high velocity refugia and low flow rate habitat. Maintaining and restoring an adequate quantity of naturally-forming, accessible, high quality, watered, off-channel habitat in the mainstem Wenatchee River is essential to provide for the year-round spawning, rearing and migratory habitat needs of all life history stages of spring and summer chinook salmon, steelhead trout, sockeye salmon and bulltrout in the subbasin (Andonaegui 2001).

Finally, loss of accessible tributary habitat is an important factor currently limiting production in the subbasin. For example, human-made fish passage barriers on Icicle Creek prevent access to a Wenatchee subbasin watershed that is mostly in a highly functional condition. Re-establishing connectivity and ecosystem function within such watersheds such as Nason Creek, Icicle Creek and Peshastin Creek is important to salmon recovery within the subbasin.

Wildlife

Most of the disturbances in this subbasin are caused by human activity. Some examples of human disturbance are timber harvest, road development, fire, mining of rocks and minerals, and recreation associated disturbances.

Past timber harvest has created early to mid successional stand stages that affect forest-story function in the upper and lower layers, reduced forest interior habitat, created homogenous stands, and impacted the effectiveness of riparian functions in this watershed. Early to mid-successional stages across the landscape provide for homogenous stand structures that provide potential for increased pathogen and insect infestation. Log driving in the past removed large woody debris from streams.

The over-all road density in the subbasin is high in zones of human influence and riparian areas. Roads and motorized trails have significantly altered habitat for many species, particularly for the Grizzly bear, gray wolf, mule deer, elk and lynx. Species

proximity to roads and trails also impacts their behavior. Road development and agriculture have also impacted riparian function.

Fire ecology has a natural role in this ecosystem. Fire suppression policies have altered stand structure, species composition and patch size and distribution, particularly in the mid-elevation mixed coniferous forest and lower elevation dry-coniferous forest. Fire exclusion and suppression has impacted the fuel loading, and prominence of ponderosa pine in the limited dry forest stands. The higher elevation forests have evolved with high fire severity regimes, and fire suppression effects are not detectable. Thunderstorms bring lightning ignition to forested areas susceptible to fire. Heavy recreational use accounts for 60% of fire ignitions in the Chiwawa River watershed (25 year period approximately 1972-1997). As forest stands become more layered, homogenous, and loaded, the potential for catastrophic fire increases. Fire suppression has altered habitat structure and function, and impacted many wildlife species.

Artificial Production

Production of the salmonid species occurs at several locations in the Wenatchee Subbasin (Figure 10) The Leavenworth National Fish Hatchery currently concentrates on spring chinook production, while the Chelan County PUD Rock Island Fish Hatchery Complex programs produce spring and summer chinook smolts, as well as sockeye smolts. At this time there is no central facility for coho salmon in the Wenatchee River Basin. The Yakama Nation's Mid-Columbia Coho Reintroduction Feasibility Study relies on the transfer of lower Columbia River coho stocks for the development of a localized broodstock. Currently in a feasibility phase, the project utilizes hatchery facilities associated with Leavenworth NFH Complex and the Rock Island Fish Hatchery Complex as well as natural acclimation sites.

Leavenworth National Fish Hatchery

Leavenworth National Fish Hatchery (LNFH) is a mitigation hatchery established by the Grand Coulee Fish Maintenance Project (1937) to help compensate for anadromous fish losses above Grand Coulee Dam. The hatchery is funded by the Bureau of Reclamation and operated by the U.S. Fish and Wildlife Service.

LNFH is situated on Icicle Creek near Leavenworth, Washington. Icicle Creek flows into the Wenatchee River, tributary to the Columbia River. The principle fish production facilities of the LNFH include a gravity water intake on Icicle Creek, sand settling basin, screen chambered water distribution system, seven groundwater wells, 108 early rearing tanks, 78 concrete incubation troughs, 45 8'x80' raceways, 1410'x100' covered raceways, a fish ladder for returning adults, two adult holding ponds, and a pollution abatement pond.

Prior to the mid-1970's, several salmonid species were propagated at LNFH. These include cutthroat, rainbow, and brook trout, kokanee, sockeye, summer steelhead, coho, and spring and summer chinook salmon. Current production focuses on spring chinook salmon, utilizing the unlisted "Carson ancestry stock.

The LNFH's fish production program supports restoration and mitigation efforts in the Columbia River Basin. The Columbia River Fisheries Management Plan under the U.S. v Oregon decision of 1969 sets production goals. Currently, the LNFH rears 1.625 million spring chinook salmon smolts annually (Table 6).

Smolts are released into Icicle Creek in mid-April of each year. A return of 1,000 adult spring chinook salmon is necessary to collect a sufficient number of eggs for production of 1.625 million fish. Adult fish returning to LNFH must travel about 800 km (497 miles; 2.8 miles Icicle Creek, 26 miles Wenatchee River, and 468 miles Columbia River), and must negotiate passage through seven Columbia River dams.

Rearing conditions for spring chinook salmon at LNFH are dictated by a number of factors including the number and size of fish to produce, the size and number of rearing units available, and the quantity and quality of the water supply. The current rearing cycle for spring chinook salmon is 18 months. Eggs hatch by mid-November and fry are ready for outdoor rearing by the following February. Rearing continues for an additional 15 months after which the young are released as yearlings directly into Icicle Creek, below the spillway. All yearling spring chinook salmon are released in April of their second year of life. Adults return to the ladder/holding ponds from May to July and are spawned in August and early September.

The number of adult salmon returning to the facility is influenced by rearing conditions at the hatchery, downstream migration, ocean conditions, and the harvest rates in the various fisheries. Returning adults in excess to production needs contribute to a successful tribal and sport fishery in Icicle Creek. From 1990 to 1999, an average of 2,579 adults have returned to the facility, and an additional 2,050, on average, are harvested by sport and tribal fishers annually (Table 7 (USFWS 2000)). Managers are currently developing a HGMP for the Leavenworth National Fish Hatchery.

Coho Reintroduction

The Leavenworth NFH also serves as a coho incubation facility and one acclimation site in the Wenatchee River Basin. The first release of coho in the Wenatchee River Basin occurred in 1999 and totaled 525,000. Approximately 450,000 were acclimated and released from the LNFH pollution abatement pond. The remaining 75,000 were acclimated and released from a backwater slough of Nason Creek at RM 4.5. Coho from subsequent releases in 2000 and 2001 were acclimated and released from the Icicle Creek acclimation site located at RM 2.8 on a side channel to the Icicle River directly behind the LNFH and the Butcher Creek acclimation pond, a natural beaver pond located at RM 8.2 on Nason Creek. The 2000 and 2001 release numbers can be found in Table 8. Future acclimation sites identified in the HGMP (1999) include Chumstick Creek, Beaver Creek, Brender Creek, and the Little Wenatchee River and are currently under development for use beginning in 2002 and 2003. Considering the relative newness of the program in the Wenatchee River Basin, the early results are promising.

The Mid-Columbia Coho Reintroduction Feasibility Study is centered on the development of a localized broodstock while minimizing potential negative interactions among coho and listed and sensitive species. Juvenile coho from appropriate lower river hatcheries are acclimated in ponds or hatcheries prior to release. As the program transitions from the exclusive use of lower Columbia River hatchery coho to ultimately the exclusive use of in-basin returning broodstock during the development of a locally adapted broodstock, it is expected that positive trends in smolt-to-adult survival will be observed.

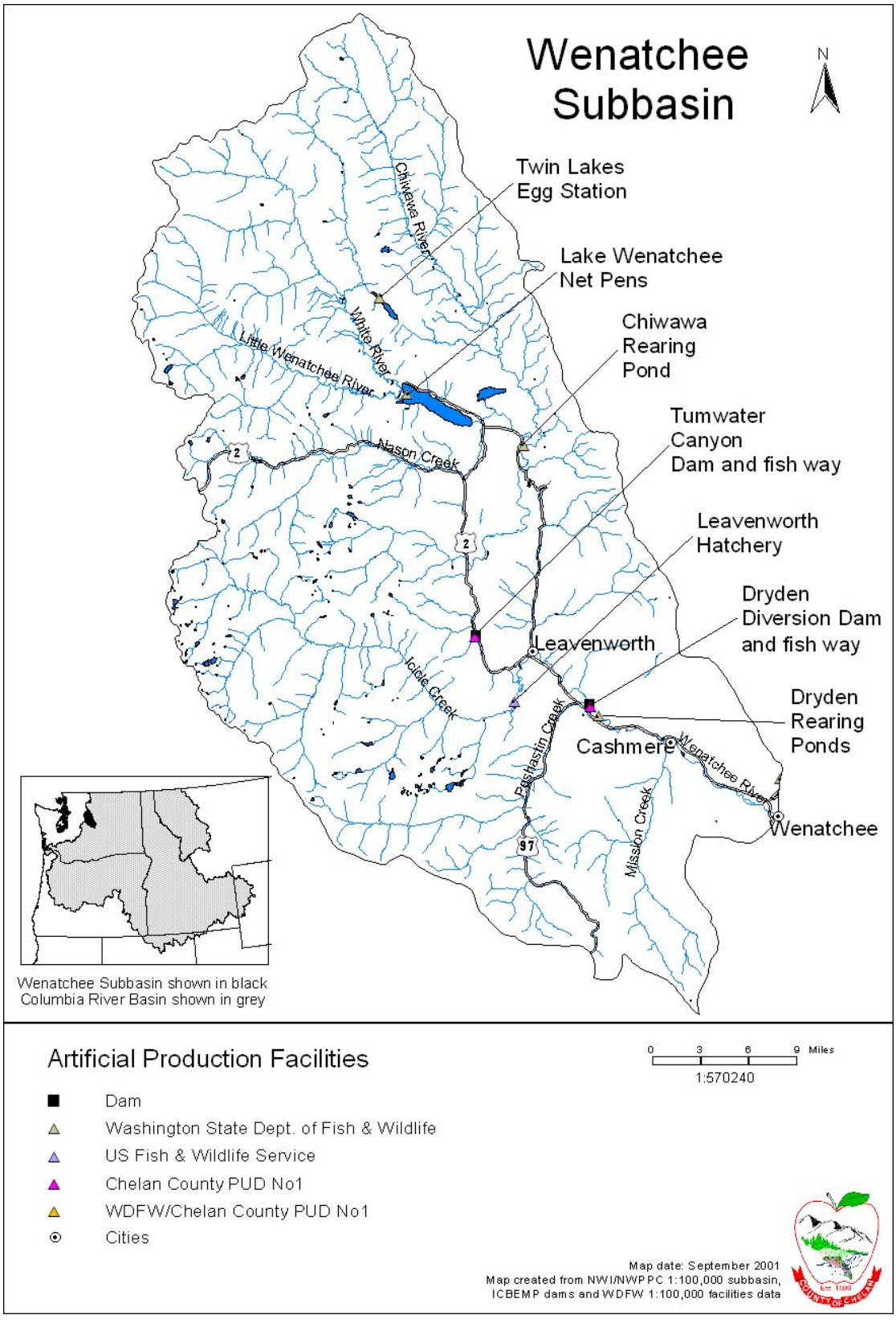

Figure 10. Wenatchee artificial production facilities

Table 6. Yearling spring chinook salmon released from LNFH, 1990 to 1999.

Year	# Released	Year	# Released
1990	2,304,237	1995	1,712,648
1991	2,258,034	1996	1,706,060
1992	2,286,828	1997	919,025
1993	1,757,931	1998	1,701,753
1994	1,522,846	1999	1,636,402

Table 7. LNFH adults returning to the Wenatchee Basin, 1990 to 1999.

Year	# of returning adults	Year	# of returning adults
1990	4,373	1995	484
1991	3,858	1996	1,327
1992	11,117	1997	4,533
1993	13,862	1998	2,158
1994	1,124	1999	2,042

Table 8. Release years, numbers, locations and smolt-to-adult survival estimates for all coho release in the Wenatchee sub-basin, 1999 – 2001.

Release Year	Release Location	Release Number	Returning Adults	Smolt-to-Adult Survival (%)	Adult Counting Location
1999	Leavenworth NFH	450.000			
	Nason Creek	75,000			
		525,000 Total	1113 to 2014	0.21% to 0.38%	Dam Counts Trapping, and Redd surveys
2000	Leavenworth NFH	891,845			
	Nason Creek	76,893			
		968,738	N/A	N/A	N/A
2001	Leavenworth NFH	855167			
	Nason Creek	142291			
		997,458	N/A	N/A	N/A

Rock Island Fish Hatchery Complex (RIFHC)

The RIFHC originated from the Rock Island Settlement Agreement (1989) as part of a comprehensive mitigation agreement between the Chelan County Public Utility District, and co-managing federal, state and tribal entities. The primary goal of the RIFHC is to compensate for lost adult production due to mortality of juvenile salmon migrating through Rock Island Dam. The RIFHC is funded by Chelan County PUD and currently operated by Washington Department of Fish and Wildlife (WDFW).

The RIFHC consists of a central hatchery on the mainstem Columbia River near Rocky Reach Dam (Eastbank Fish Hatchery) and several associated satellite rearing facilities for juvenile salmon and steelhead. Satellite facilities located in the Wenatchee subbasin include Lake Wenatchee net pens, Chiwawa River Ponds, and Dryden Ponds. Broodstock stock collection facilities are located at Dryden Dam and Tumwater Dam.

The production goals as outlined in the Rock Island Project Settlement Agreement (RIPSA) have been 200,000 subyearling Wenatchee sockeye smolts, 864,000 yearling Wenatchee summer chinook smolts and 672,000 yearling Chiwawa spring chinook smolts. The sockeye and summer chinook programs are supplementation programs designed to help augment the naturally spawning population. Due to low escapement and subsequent ESA listing of Chiwawa spring chinook, the spring chinook program is a recovery program.

Fish production for the Wenatchee sockeye, summer chinook and Chiwawa spring chinook programs began in 1989. The first release of juvenile sockeye was in 1990, and the first yearling releases of spring and summer chinook were in 1991. The average production of sockeye for the 1989-1999 broods has been 227,901 smolts, exceeding the production goal. Average annual production during this same time period for summer chinook has been 612,880, slightly less than the goal agreed upon under the RIPSA. The Chiwawa spring chinook program has fallen far short of its goals, with an average annual production of 77,408 smolts. Low adult returns and low trap efficiency have been the limiting factors resulting in the low production rates.

The Chiwawa spring chinook program collects returning adults from the end of May through mid July at a weir constructed in the Chiwawa River at the Chiwawa acclimation site. Adults are transported to Eastbank Fish Hatchery (FH) and held in a large concrete raceway until they mature sexually. Sexual maturity for this particular stock usually begins the later part of the third week in August and spawning usually terminates around the fourth week of September.

The resultant progeny are incubated throughout the winter and reared in ponds at Eastbank FH. The juveniles are held at the Eastbank FH until they are large enough to have coded wire tags inserted and their adipose fins clipped. The fish are then transferred to the Chiwawa acclimation site in October where they are held until April of the following year and subsequently released as yearling smolts.

Adults for the Wenatchee summer chinook program are collected at both Tumwater and Dryden dams on the Wenatchee River. Upon collection they are transferred to Eastbank FH and held the same way as the spring chinook. Once the adults have matured, the progeny are incubated, early reared, and tagged at Eastbank FH. Around February of

their second year they are transferred to Dryden Pond and held for the better part of three months and released in May as "yearling" smolts.

The Lake Wenatchee Net Pens are part of the sockeye program used to acclimate juvenile sockeye prior to release. Juveniles are moved to the net pens from the Eastbank FH around the first of July, shortly after they have been adipose fin clipped and coded wire tagged. Currently two releases occur annually from the pens, one at the end of August and the other at the end of October. The juveniles will then overwinter in Lake Wenatchee and migrate out of the lake the following spring.

Existing and Past Efforts

Fish

Planning Efforts

Chelan County Water Quality Action Plan

The Chelan County Conservation District, under a WDOE Centennial Clean Water Grant, initiated the development of a Water Quality Action Plan in 1994 to address water quality concerns in the Wenatchee sub-basin identified by multiple stream listings in the sub-basin under Section 303(d) of the Federal Clean Water Act. The CCCD assembled a diverse committee representing governmental agencies, non-governmental organizations, business and private landowners who developed the Plan. Completed in 1998, the Plan identifies nonpoint sources affecting water quality and outlines voluntary measures to address water quality concerns in the Wenatchee sub-basin. The members of the Implementation Committee that was developed under the Action Plan are now active as members of the Water Quality Technical Subcommittee operating under WRIA 45 Watershed Planning Unit. The District recently received additional grant funds to continue the effort and develop TMDLS on selected bodies of water.

Wenatchee Watershed Planning Unit

The WWPU was established in late 1999 as mandated under the Watershed Management Act (RCW 90.82). The WWPU has recently entered the Assessment Phase (Phase II) of the watershed plan development process. The Water Quantity/Instream Flow sub-committee has completed basic review of instream flow issues, analytical techniques and potential solutions. The subcommittee has recommended that a comprehensive re-assessment of flow in the Wenatchee watershed be conducted, since both the science of instream flow analysis and the types of issues needed to be address have changed since the original Wenatchee River Basin Instream Resources Protection Program was developed.

Upper Columbia Regional Technical Team Report

The Upper Columbia Salmon Recovery Board Regional Technical Team submitted a draft technical report titled, *"A Strategy to Protect and Restore Salmonid Habitat in the Upper Columbia Region"* to the Upper Columbia Salmon Recovery Board. The draft report outlines priority watersheds and restoration activities within the Wenatchee subbasin. This report may be used by the Lead Entities in the Upper Columbia as guidance in the final selection of project proposals submitted to the State Salmon Recovery Funding Board.

Regulatory Activities

Chelan County Habitat Conservation Plan (HCP)

Chelan County has initiated preliminary discussions regarding the development of a County wide programmatic Habitat Conservation Plan (HCP) for compliance with the

Federal Endangered Species Act. Potential parties to the HCP will include the County, cities, irrigation and special districts, private landowners and others. Activities covered under the HCP will include road maintenance standards, stormwater management, vegetation management, planning and development, water supply infrastructure, parks and open space management, agricultural activities, public facilities and buildings, and planning and development. Species covered under the HCP will include salmon, steelhead, bull trout, and various terrestrial species. The County expects to complete the HCP by 2005.

Rock Island and Rocky Reach Habitat Conservation Plan

A proposed Habitat Conservation Plan (HCP) for the Rock Island and Rock Reach dam facilities is in regulatory review and is scheduled to be completed in spring 2002. The plan has an outcome-based approach and is designed to protect spring chinook, fall/summer chinook, sockeye, coho and steelhead after naturally spawning populations are established. The Chelan and Douglas County PUDs will establish a HCP Tributary Fund to support tributary habitat improvement projects to mitigate the 9 percent unavoidable mortality associated with the operation of the Rock Island and Rocky Reach dams once the HCP is signed.

Growth Management Habitat Protection Plan and Regulations

Chelan County adopted a comprehensive plan and development regulations in 2000 that include significant regulatory protection for riparian areas, wetlands, frequently flooded areas, geologically hazardous areas, aquifer recharge zones, and fish and wildlife habitat. The plan and regulations are compliant with Washington Growth Management Act (GMA) requirements.

Fish Passage and Artificial Production –Related Efforts

Artificial Production in Subbasin

Hatchery production of spring chinook occurs at Leavenworth National Fish Hatchery (LNFH) and the Chelan County PUD Eastbank Hatchery. Summer chinook, steelhead and sockeye production occurs at the Eastbank Hatchery. Information on these programs and their production goals can be found under Artificial Production.

USFWS Hatchery Performance Monitoring

USFWS Mid-Columbia River Fishery Resource Office (MCRFRO) staff has prepared annual reports entitled *Adult salmonid returns to Leavenworth, Entiat, and Winthrop National Fish Hatcheries* since 1994, which assess annual spring chinook salmon escapement and survival for the three hatcheries. These reports include long-term hatchery performance information and document the performance of several brood years, using biosampling and coded-wire-tag information.

Rock Island Hatchery Evaluation

This on-going monitoring and evaluation program is funded by Chelan County PUD and conducted by WDFW. The program has the following four objectives:

(1) Determine if the Eastbank Hatchery Complex is capable of meeting the production requirements of the Rock Island Settlement Agreement.

(2) Determine whether the survival from release-to-adult of fish from the Eastbank Hatchery Complex is sufficient to achieve the program goal of compensating for fish filled by the Rock Island Hydroelectric Project.

(3) Determine if actions taken under the Rock Island Settlement Agreement's Phase I hatchery program conserve the reproductive success, genetic integrity and long-term fitness of natural spawning populations of salmon in the mid-Columbia system above Rock Island Dam.

(4) Determine whether smolts released from the Eastbank Hatchery Complex's rearing and acclamation facilities disperse and migrate downstream without impacting the natural production.

Mid-Columbia Coho Reintroduction Feasibility Study Project

In 1996, BPA initiated funding of the multi-year Mid-Columbia Coho Reintroduction Feasibility Study Project, managed by the Yakama Nation. The project is designed to gather data and develop and implement plans for coho restoration in the Wenatchee, Entiat, and Methow river sub-basins. The study focuses on the development of a localized broodstock while minimizing potential negative interaction among coho and listed and sensitive species. As the program transitions from the exclusive use of lower Columbia River hatchery coho to ultimately the exclusive use of in-basin returning broodstock, it is expected that positive trends in smolt-to-adult survival will be observed. The first phase evaluates the initial feasibility and risks associated with coho restoration through intensive experimental monitoring and evaluation. .

Monitoring and evaluation activities in the Wenatchee sub-basin have focused on evaluating the success of broodstock development, associated survival rates, and examining interactions between coho and listed species, particularly spring chinook salmon, steelhead, sockeye salmon, and bull trout. The program relies on the transfer of non-basin specific information from the Methow and Yakima river basins where concurrent releases of coho and associated studies are occurring. Studies designed to examine the impact of direct predation by hatchery coho on salmonid fry have been conducted in the Wenatchee and Yakima river basins. Snorkel surveys to determine the abundance of residual hatchery coho have been conducted annually in the Methow, Wenatchee, and Yakima sub-basins following volitional releases. Studies to examine the potential for chinook redd superimposition by later spawning coho salmon, coho micro-habitat use and overlap by naturally spawned coho salmon, and carrying capacity are currently on-going or planned for 2002 and beyond. Project performance is evaluated annually through the Mid-Columbia Technical Workgroup to coordinate, expand or adapt studies as data indicate is necessary. The scope, magnitude and biological approach of the second phase will be determined by the results of the risk/feasibility phase. The program, if successful, is expected to continue until at least 2020.

Icicle Creek Restoration Project

The USFWS in cooperation with the USFS has initiated a National Environmental Policy Act (NEPA) process to address fish passage at LNFH. The LNFH, built in 1939-41, is located on Icicle Creek, Washington. The original design of the hatchery involved diverting the majority of Icicle Creek's flow through a canal with an energy control dam at the base and construction of holding dams and weirs in the original creek channel. These structures effectively block fish passage to the upper Icicle and are no longer needed for

hatchery operations. Migration of threatened bull trout, spring chinook, endangered steelhead, and many other fish species are affected.

The USFWS has developed a $5.7 million plan to provide passage and access fish habitat (Wenatchee World, July 24, 2001). A draft EIS was completed in June 24 to present a range of alternatives for providing riverine fish passage past the main hatchery complex and assessing, if implemented, their affect on the baseline environment. This document also contains a complete assessment of fish and stream habitat in Icicle Creek. Information from all past and present studies conducted by MCRFRO and others are included in the document.

Dryden Fish Screens

Chelan County PUD conducted an environmental analysis, and designed and constructed fish screen facilities in the Dryden Canal on the Wenatchee River during this BPA funded project. The project was continuously reviewed by the Wenatchee Technical Work Group. The new facilities will reduce mortality of juvenile summer chinook and sockeye salmon in the Wenatchee River. The project diverts juvenile salmon and steelhead out of the irrigation canal and back to the Wenatchee River near the Dryden Dam location.

The fish screen at the Chelan County Public Utility District #1 diversion for the Wenatchee Reclamation District irrigation canal was renovated in 2001 for compliance with current federal fish screen standards. The project was sponsored by Chelan County Public Utility District #1 and was funded by the District from their general fund. The project was completed in winter 2001.

Dryden Dam Passage

Dryden Dam was an obstruction to adult salmon and steelhead at low river flows. BPA and Chelan PUD cooperatively funded the improvements of two fishways at Dryden Dam. The new vertical slot fishways were completed in 1986.

Tumwater/Dryden Passage

Biologists requested new fish passage structures at Tumwater Dam and Dryden Dam. Ott Water Engineers developed alternatives and prepared a preliminary passage design for passage at Tumwater Falls and Dryden dams in this BPA funded project. The contractor investigated various flow conditions and turbulence in the field in order to draw up practical fish passage designs. Those facilities would pass more salmon and steelhead upstream to historic spawning areas. A report, Natural Propagation and Habitat Improvement: Volume IIA – Washington: Tumwater Falls and Dryden Dam fish Passage DOE/BP 246 was published in 1984.

Peshastin Creek Fish Bypass

Fish passage is being provided at the Peshastin Irrigation District diversion dam. The project is sponsored by Chelan County and was funded by the Governor's Salmon Recovery Office in 1998. The project will be completed in fall 2001.

Chumstick Creek Culvert Replacements

Multiple private landowner culverts are being removed, and additional project funding is being sought to replace the primary and first fish passage barrier at North Road, approximately one-quarter mile upstream from the Wenatchee River. The private culvert projects are sponsored by the Chelan County Conservation District and funded by the Bonneville Power Administration. The North Road project is sponsored by Chelan County and is partially funded by the Washington Salmon Recovery Funding Board. Preliminary

design and engineering is complete, and the project could begin in summer 2002 with additional funds.

Stock Assessment and other Fishery Research Efforts

Grand Coulee Fish Maintenance Project

MCRFRO staff of the USFWS collaborated on studies to evaluate the Grand Coulee Fish Maintenance Project. Objectives of the studies were to 1) quantify rearing area and number of chinook salmon and steelhead spawners in the Wenatchee, Entiat, and Methow river drainages; 2) estimate production through rearing areas used and observed standing crop; and 3) assess the impacts of settlement on production and habitat. The results of these evaluations are presented in the 1992 report *Production and habitat of salmonids in mid-Columbia River tributary streams* by Mullan, J.W., K.R. Williams, G. Rhodus, T.W. Hillman, and J.D. McIntyre. U.S. Fish and Wildlife Service Monograph 1.

Native Trout Genetic Study

MCRFRO conducted a collaborative study with the World Salmonid Research Institute and Colorado State University on the genetic and meristic composition of native trout species in the Methow, Wenatchee, and Entiat watersheds. D.S. Proebstel, R.J. Behnke, and S.M. Noble present the results of the study in the report *Identification of salmonid fishes from tributary streams and lakes of the mid-Columbia Basin.*

USFW Stream Surveys

MCRFRO biologists have conducted two stream surveys on tributaries in the Wenatchee Basin. The information is presented in the following reports: *Peshastin Creek 1997 Stream Survey Report* by Malenna M.J. Cappellini and *Stream Survey Report: Chumstick Creek, WA* by Keely Titus.

The MCRFRO has assisted the U.S. Forest Service and the WA State Department of Fish and Wildlife in conducting bull trout spawning ground surveys in the Wenatchee River Basin since 1996. Information on these surveys can be obtained from the USFS Wenatchee/Okanogan National Forests. As part of this larger effort, the MCRFRO has completed reports entitled *Bull trout spawning ground surveys of Panther, Mill, and Nason creeks, Washington* for years 1996 through 1999 (2000 in draft) by B. Kelly Ringel.

MCRFRO conducted a fish survey by snorkeling French Creek (tributary to Icicle Creek, Wenatchee basin) in 1998. Objectives were to collect baseline information on fish species present, species composition, and species distributions. In particular, researchers were interested in determining the presence of bull trout and westslope cutthroat trout. A report was completed entitled *Survey of fish populations in French Creek, Washington, 1998* by B. Kelly Ringel and L. Murphy.

MCRFRO staff worked with the Wenatchee National Forest, USFS, in a joint effort to inventory aquatic resources in the Icicle Creek and Peshastin Creek watersheds. Staff compiled information on fish distribution and relative abundance using direct observation techniques (snorkeling). In total, 65 km of stream were surveyed. Completed reports for these surveys are *Analysis of fish populations in Icicle Creek, Trout Creek, Jack Creek, Washington, 1994* by Dan Free; *Analysis of fish populations in Icicle Creek, Trout Creek, Jack Creek, Peshastin Creek, Ingalls Creek, and Negro Creek, Washington* 1994- 1995 by B. Kelly Ringel.

Icicle Creek Aquatic Habitat and Fish Population Assessments

USFWS staff at MCRFRO conducted aquatic habitat and fish population assessments in Icicle Creek in 1998 and a report entitled *Analysis of habitat and fish populations in Icicle Creek form the upper barriers of the Leavenworth National Fish Hatchery to upstream of Snow Creek at the boulder falls (river miles 3.8 to 5.5), 1998* by B. Kelly Ringel was completed.

WDFW Juvenile Salmon and Steelhead Monitoring Program

The Washington Department of Fish and Wildlife (WDFW) set a fish trap on the Wenatchee River, just northwest of the city of Wenatchee, in March 2000 to begin a 6-month period of monitoring juvenile salmon and steelhead. The 24-foot-long, 8-foot-diameter cone-shaped trap will be operating through August, primarily at night when juvenile fish move downstream. Fish caught will be identified, measured and release back into the river. The goal of the project is to estimate the number of naturally produced juvenile salmon and steelhead migrating out from the Wenatchee River each year. The monitoring project is expected to provide an estimate of the number of juvenile steelhead, spring chinook, summer chinook and sockeye salmon that were produced in the Wenatchee River subbasin**.**

Bull Trout Surveys

Annual Bull Trout redd surveys are conducted throughout the Wenatchee subbasin through a collaborative USFS/USFWS/WDFW effort. The streams that are targeted are Chiwaukum (Mainstem Wenatchee watershed); Peshastin and Ingalls (Peshastin watershed); White River and Panther Creek (White River watershed) Chiwawa and its tributaries, and Nason Creek (Nason watershed). This survey project is ongoing.

USFWS Bull Trout Telemetry Studies

The USFWS is currently conducting bull trout telemetry studies to look at migration and behavior. Fish were captured on the Chiwawa River and Lake Wenatchee, and ten stationary sites were set up throughout the basin, primarily near the mouths of known spawning streams and at other points to strategically monitor bull trout movement. Stationary sites were located at: Wenatchee River at Dryden Dam (rm 17.6), Wenatchee River at Tumwater Dam (rm 32.7), Wenatchee River at the Highway 207 bridge at the mouth of Lake Wenatchee (rm 53.6), Little Wenatchee River near a mouth (~rm. 0.5), White River (rm 6.4), Chiwawa River at the weir (rm 0.5), Chikamin Creek (rm 0.5), Chiwawa River at Rock Creek (rm 21.3), Rock Creek near the mouth (rm 0.1), and Phelps Creek (rm 0.3). Flights have been flown to tract movement. This project is ongoing.

Cutthroat and Rainbow Trout Genetic Study

Cutthroat and rainbow trout are the focus of an ongoing USFWS genetic study in Wenatchee subbasin (and the whole upper Columbia region). The purpose of this initiative is to look at the genetic integrity of stocks, the impacts of stocking, native species numbers and how much hybridization has occurred.

NMFS Watershed Assessment

The National Marine Fisheries Service conducted an assessment of aquatic species and habitat for the Wenatchee, Entiat, Methow, and Okanogan watersheds (1998). This assessment summarized information on aquatic species and their habitats in the four major tributaries to the mid-Columbia River. The emphasis was on anadromous salmonids.

Mid-Columbia PUDs-sponsored stock assessments

The Mid-Columbia PUDs sponsored stock status reviews for summer/fall chinook, spring chinook, steelhead and sockeye in the mid 1990s. The results of these assessments were published in a series of reports (Chapman et. al. 1994a, 1994b, 1995a, and 1995b).

Habitat-related Efforts

Mainstem Wenatchee Channel Migration Study

A channel migration zone study, proposed by the Regional Technical Team and funded through the SRFB, is ongoing on the mainstem Wenatchee from the confluence with the Columbia up to the mouth of Tumwater Canyon, just west of Leavenworth. The focus of this study is to look at historic and current riparian conditions and channel locations, potential areas that could be impacted by future channel migration, and identification of potential habitat restoration and property acquisition sites.

Temperature Monitoring

The USFS has monitored stream temperatures in the Chiwawa, White, Little Wenatchee, Mission, Icicle and Nason creek watersheds for over 10 years. Not all streams are monitored annually in this on-going program.

USFS Stream Surveys and Channel Cross Section Monitoring

Stream surveys are conducted annually throughout the whole subbasin, although not every stream is surveyed annually. This has been ongoing throughout the past 12 years or so. Surveys examine habitat features like pools and riffles, and look at substrate composition (wohlman pebble counts are performed), and Large Woody Debris (LWD) counts as well. This program is ongoing.

Channel cross sections with monumented survey points have been installed on the Chiwawa, White, Icicle, and Mission. They have been in place since 1994, and the USFS has been able to collect pre and post flood data about channel geometry and alterations via use of the monumented survey points and established stream transects. These are currently monitored to keep tabs on changes that may be occurring in these streams (e.g., channel changes, aggradation/degradation, erosion, etc.).

The stream survey data and monumented cross sections are used together over time to monitor change and characterize stream geometry and habitat conditions.

Sediment Monitoring

Sediment monitoring has been conducted by the USFS over the past 5-8 years, and is ongoing. Not every stream is examined every year, although some streams like the Chiwawa River are monitored annually. Mission, White, Nason all are monitored, and some data have been collected for Peshastin creek. Chikamin creek has also been targeted for sediment monitoring, as well as water quality and macroinvertebrate monitoring for about the past 4 years. This data collection is being done in anticipation of future mining activities. The Chikamin mactroinvertebrate data collection has been conducted in conjunction with the WDOE.

Conservation Easement Program

Chelan County is currently implementing a $1.5 million conservation easement program that will protect riparian areas along salmon-bearing streams of the Wenatchee and Entiat sub-basin. In addition to conservation easements, the program includes long-term agricultural leases of orchard property within the sub-basins that will be restored with in-

kind assistance from the Chelan County Public Utility District #1. The program will be completed by December 2002.

Partner's for Fish and Wildlife Program Restoration Projects

USFWS staff at MCRFRO works with the Eastern Washington Ecological Services Suboffice (USFWS-Ephrata) to implement the Partners for Fish and Wildlife Program in Central and Eastern Washington. The program provides technical and financial assistance for private landowners to voluntarily conduct habitat restoration for fish and wildlife on their property. USFWS biologists also monitor restoration projects on private and public lands. Restoration sites (past or future) in the Wenatchee subbasin include Icicle Creek and Chumstick Creek.

WDFW White River Habitat Acquisition Project

The Washington Department of Fish and Wildlife obtained $2 million through the Washington Wildlife and Recreation Program in 1999 to buy critical fish and wildlife habitat in the White River. The project will conclude in 2002.

Chelan-Douglas Land Trust Land Acquisition Project

The Chelan-Douglas Land Trust is currently working with various property owners in the Wenatchee sub-basin to acquire and protect their property from development. In particular, the Trust is working with various landowners in the White River valley.

Blackbird Island Project

The Blackbird Island Project was designed to provide additional off-channel rearing habitat and winter refugia for salmonids. The project was sponsored by Trout Unlimited and funded primarily by the Washington Department of Fish and Wildlife in 1997. The project was completed in summer 2001.

Brender Creek Project

The Bender Creek Project is designed to provide additional off-channel rearing habitat and winter refugia for salmonids as well as act as a catchment basin for this high-sediment stream. The project is sponsored by Trout Unlimited and the Chelan County Conservation District and was funded by the Washington Department of Fish and Wildlife, Trout Unlimited, and the Chelan County Conservation District in 1997. The project was completed in summer 2001.

Harriman Stream Restoration Project

Additional off-channel rearing habitat for salmonids is provided through this project, sponsored by Chelan County and funded by the Washington Salmon Recovery Funding Board. The project will be completed in summer 2002.

White River Floodplain Restoration Project

The White River Floodplain Restoration Project is designed to re-connect the floodplain that has been modified from road construction. The project is sponsored by the Eastern Washington Regional Fisheries Enhancement Group and funded by the Washington Salmon Recovery Funding Board. The project will be completed in summer 2002.

Peshastin Creek Habitat Development

This project provides additional off-channel habitat for salmonids. The project is sponsored by Chelan County and was funded by the Governor's Salmon Recovery Office in 1998. The project will be completed in summer 2002.

Mission Creek Pilot Projects by CD

Various in-stream and riparian restoration projects have been implemented by Chelan County Conservation District over the past five years to improve water quality and

facilitate landowner participation in restoration projects. The projects were sponsored by the Chelan County Conservation District and funded by District water quality grants. Three demonstration projects utilizing the placement of large wood within the lower Mission Creek stream channel for fish habitat enhancement have been sponsored by CCCD and the WDFW.

Camas Meadows Natural Area Preserve

The Camas Meadow Natural Area Preserve area was established by Washington Department of Natural Resources to protect various species of indigenous and federally protected plants.

FLIR Flights

A FLIR (forward looking infrared) flight was recently flown on the upper Wenatchee subbasin streams to look at thermal refugia for bull trout and other salmonids, and potential hyporeic zones. Another flight is scheduled for sometime this winter, so that temperature extremes can be recorded for winter habitat use analysis as well

Lower Pesharin Creek Irrigation Bypass

This CCCD project created a method of dumping water from the Icicle Irrigation Canal into the lower section of Peshastin Creek to provide flows in the lower 2 miles of the Peshastin during late summer.

Storm Drain Project

The CCCD has been working with the City of Leavenworth and Cashmere to present sewage overflows during storms and spring runoff. Storm drains in the city of Leavenworth have been disconnected form the sewer treatment plant to prevent overflows at the treatment plant that would occur during storms and spring runoff , resulting in untreated sewage spilled into the river. Additionally markers have been placed on storm drains in the cities of Cashmere and Leavenworth to make the public aware of the connection between storm drains and surface water. Cashmere has not yet disconnected all of the storm drains from the sewage treatment plant or alternative, created settling ponds. More funds are being sought to complete this effort.

Education Efforts

Return of the Salmon, Wenatchee River Festival

BPA provided program support for the "Return of the Salmon – Wenatchee River Salmon Festival" with the USFS at Leavenworth, Washington on October 12-13, 1991. The objectives of the program were to improve the public's knowledge of fish and aquatic resources. This festival has since become a very popular and well-attended annual event for the last ten years.

Wildlife

Mule Deer Monitoring

Over the past three years, mule deer have been radio collared and monitored throughout the Wenatchee and Entiat sub-basins. Approximately 40 different radio collars have been attached to deer while they are in their winter range in the lower Entiat River valley. The study objectives examine nutritional aspects of both summer and winter ranges; examine sources of mortality and track deer movement. Collared deer are monitored every week via a fixed winged airplane. This study is supported by the U.S. Forest Service, Washington Department of Fish and Wildlife, the Confederated Tribes of the Colville Indian

Reservation, Chelan County PUD and the Bonneville Power Administration. This study is expected to continue for several more years.

Interior Columbia Basin Ecosystem Management Database Development

The USFS Pacific Northwest Research Station has completed a research, development and application database of research information needs on selected invertebrates and all vertebrates of the interior Columbia River basin and adjacent areas in the United States. The database includes 482 potential research study topics on 232 individual species and 18 species groups of animals, representing significant gaps in scientific knowledge.

Habitat Mapping for Spotted Owls in Washington's East Cascade Range

This project, completed in 1998, focused on the development of vegetation maps around spotted owl activity centers along the eastern slope of the Cascade Mountains in Washington, including some locations in the Wenatchee subbasin. The data will enable development of a habitat suitability model for the spotted owl that can be evaluated for its ability to predict owl locations in the area. The spatially referenced habitat information also will be used as input for a model of owl population demographic parameters. More information can be found at the National Council for Air and Stream Improvement, Inc. website, www.ncasi.org.

Other recent projects related to Wenatchee subbasin wildlife include the following:

- Ground Squirrel and Chipmunk Study (University of Washington- Jim Kenegy, Fish Lake and Entiat Ridge)
- Meadow Creek Burn Recovery (Evergreen State College, Cascade High school, North Central Washington Audubon, USFS and PNW Research)
- Marten Study (USFS and PNW Research, Entiat Ridge from Goose Creek to Clear Creek 1989-1997)
- Forest Carnivore Study (WDFW and USFS, Chiwawa main valley, winter camera study)
- Amphibian and Songbird Study (WSU- Susan Piper, Brush Creek and Elder Creek)

Present Subbasin Management

Existing Management

Tribes

Yakama Nation

The Yakama Nation, also known as the Confederated Tribes and Bands of the Yakama Indian Nation, is a fish and wildlife co-manager of the Entiat basin. The Yakama Nation is responsible for protecting and enhancing treaty fish, wildlife and other natural resources for present and future generations. The 14 tribes and bands that compose the Yakama Nation ceded over 10 million acres, including the Entiat basin, in the June 9, 1855 treaty with the United States. The Yakama Nation's ceded lands still contain the traditional natural resources upon which the Yakama people depend for subsistence and spiritual and cultural sustenance. They are many and include salmon, deer, elk, huckleberries, and other food and medicinal plants and the most sacred, water.

In the treaty, the tribe reserved rights and responsibilities involving these resources. The treaty's Article 3 states: The exclusive right of taking fish in all the streams, whether running through or bordering said reservation, is further secured to said confederated bands and tribes of Indians, as also the right of taking fish at all usual and accustomed places, in common with the citizens of the Territory, and of erecting temporary buildings for curing them; together with the privilege of hunting, gathering roots and berries, and pasturing their horses and cattle upon open and unclaimed land. The Entiat basin includes traditional (or "usual and accustomed") fishing areas. As a result of these treaty-reserved rights, the tribe retains substantial governmental authority over activities that affect hunting and fishing. In the 1969 *Sohappy v. Smith /U.S. v. Oregon* decision and the 1974 *U.S. v. Washington* or Boldt decision, the federal courts reaffirmed treaty provisions. These decisions entitle the tribe to one half of the harvestable fish that pass through usual and accustomed tribal fishing grounds. *U.S. v. Washington* rulings includes hatchery-bred fish as part of the harvestable population, and provides for the protection of the fishery from environmental degradation. The court-ordered *U.S. v. Oregon Columbia River Management Plan* sets harvest, escapement, and production goals pertaining to Indian and non-Indian allocation of anadromous fish resources.

The Yakama Nation, along with the Umatilla, Nez Perce and Warm Springs tribes, developed an anadromous fish restoration plan Wy-Kan-Ush-Mi Wa-Kish-Wit: Spirit of the Salmon (CRITFC 1996). Based on tribal culture and sovereignty as well as science, the plan makes institutional and technical recommendations for Columbia Basin salmon restoration and presents a Entiat subbasin plan, which calls for instream flow restoration, enforcement of water quality standards and new fish production initiatives to supplement or reintroduce anadromous fish runs, among other measures.

Confederated Tribes of the Colville Reservation

The Confederated Tribes of the Colville Reservation, a federally recognized tribe, is located on 1.4 million acres in north central Washington. Many of the names of Colville's 12 aboriginal tribes indicate the geographic range and interest of today's Colville confederation. They include the Nespelem, the San Poil, the Lake, the Palus, the Wenatchi (Wenatchee), the Chelan, the Entiat, the Methow, the southern Okanogan, the Moses Columbia and others.

Their aboriginal territories were grouped primarily around waterways, including those in the Entiat Subbasin as well as many other Columbia Basin watersheds. These watersheds, including the Entiat, contain traditional fishing, hunting and food-gathering places still used by tribal members for subsistence and ceremonial purposes.

The Colville tribe manages natural resources on the reservation and is involved in the management of fish and wildlife and other natural resources in its aboriginal territory. The tribe's goal is restore salmon and other native species to their historic habitats in the watersheds of north central Washington. The Colville Natural Resources Department operates more than 10 programs, including Fish and Wildlife, Forestry and Parks and Recreation.

Federal

United States Forest Service and Bureau of Land Management

The Northwest Forest Plan was approved on April 14, 1994 and provides for coordinated land management for lands administered by the USFS and BLM within the range of the northern spotted owl. Over 76% of the Wenatchee sub-basin is under the jurisdiction of the Forest Service and subject to the Northwest Forest Plan. This region-wide management direction will provide overall coordination across administrative units, provinces, and watersheds in USFS and BLM lands, for the areas and resources covered by the final Supplemental Environmental Impact Assessment (SEIS) issued in February 1994.

Environmental Protection Agency

The Environmental Protection Agency (EPA) and the Washington Department of Ecology are responsible for carrying out the Clear Water Act, including overseeing the development and implementation of Total Maximum Daily Load (TMDL) plans.

United States Fish and Wildlife Service

The United States Fish and Wildlife Service (USFWS) is one of the principal federal agencies involved in the conservation, protection and enhancement of fish, wildlife, plants and their habitats. The agency's activities include management of migratory bird species, habitat restoration, fish passage and production, and management of national wildlife refuges. USFWS holds primary federal management responsibility for non-anadromous fish, and share federal responsibility for anadromous fish resources. The USFWS Endangered Species program is responsible for plant, wildlife and non-anadromous fish Endangered Species Act listings.

The Mid-Columbia River Fishery Resource Office (MCRFRO), located in Leavenworth, Washington, classifies its activities as addressing two primary actions:

1. Determining the survival, contribution and impact of spring chinook salmon (*O.tshawtytscha*) and steelhead trout (*O. mykiss*) released from USFWS mitigation hatcheries in north-central Washington, including the Leavenworth National Fish Hatchery located in Leavenworth, Washington; and more broadly,
2. Providing technical fisheries assistance and cooperating with agencies, tribes and other entities using and managing aquatic species and their habitats in the Columbia River and its tributaries above its confluence with the Snake River.

Natural Resources Conservation Service

The Natural Resources Conservation Service (NRCS), a federal agency within the U.S. Department of Agriculture (USDA), works in cooperation with the Washington Conservation Commission to aid the Chelan County Conservation District. NRCS manages a variety of programs that provide financial and technical assistance to implement conservation practices on privately owned land. Using this help, farmers and ranchers apply practices that reduce soil erosion and improve water quality; enhance forest and grazing land and wildlife habitat; and maintain riparian areas along streams containing salmonid fish.

National Marine Fisheries Service

The National Marine Fisheries Service (NMFS) administers the Endangered Species Act (ESA) for anadromous fish. NMFS reviews and comments on activities that affect fishery resources and develop recovery plans for listed species in the Subbasin. Under the ESA's 4(d) rule, "take" of listed species is prohibited and permits are required for handling.

Biological Opinions, recovery plans, and habitat conservation plans for federally listed fish and aquatic species help target and identify appropriate watershed protection and restoration measures. NMFS took a lead role in developing the following documents in 2000:

- Federal Caucus All-H Paper (2000). This document provides a framework for basin-wide salmon recovery and identifies strategies for harvest management, hatchery reform, habitat restoration, and hydropower system operations.

- FCRPS BiOp (2000). This is a biological opinion written by NMFS and the Fish and Wildlife Service regarding the operation of the federal hydropower system on the Columbia River, and fulfills consultation requirements with the US Army Corps of Engineers, the Bureau of Reclamation, and the Bonneville Power Administration under Section 7 of the ESA. This recent BiOp also concluded that off-site mitigation in tributaries is necessary to continue to operate the hydropower system.

State

State of Washington

The *Statewide Strategy to Recover Salmon* was released in September 1999, following the Salmon Recovery Planning Act passed by the legislature in 1998. The Strategy was designed as the state's long-term vision or guide "to restore salmon, steelhead and trout populations to healthy and harvestable levels and improve the habitats on which fish rely".

Washington Conservation Commission

The Washington Conservation Commission (WCC) assists and guides local conservation districts. Washington Sate Conservation Commission has several salmon recovery initiatives including the Salmon Habitat Limiting Factors Program and the Conservation Reserve Enhancement Program. The Salmon Habitat Limiting Factors Program involves the identification of habitat conditions that limit the ability of the habitat to fully sustain salmon populations as the first step in restoring healthy salmon runs. The draft limiting factors report for the Wenatchee subbasin was completed in August 2001 (Andonaegui 2001). The final report will be available in October 2001.

Administered by the WCC, the USDA's Conservation Reserve Enhancement Program provides technical and financial assistance to qualifying landowners to install and maintain streamside buffers along waters that are spawning areas for salmon and steelhead stocks. The Conservation Reserve Enhancement Program fits into the Governor's Salmon Recovery Plan by helping protect habitat on agricultural land. The WCC makes a variety of water quality grants to conservation districts.

Washington Department of Natural Resources

The Washington Department of Natural Resources administers the Natural Areas Program (NAP), which includes the Camas Meadows Natural Area Preserve in the Wenatchee subbasin. The WDNR has other lands in the drainage that are managed for economic return to the school lands trust. The WDNR also has regulatory authority on other private lands in the subbasin to ensure that they are in compliance with the Sate Forest Practices Act.

Washington Department of Fish and Wildlife

The mission of the WDFW is to provide sound stewardship of fish and wildlife resources. The WDFW and treaty Indian tribes co-manage the state's salmon populations and are joining with NMFS and USFWS to define recovery goals for listed species. In addition to the protection and enhancement of these resources, WDFW is charged with providing fishing, hunting and other opportunities for public recreation.

Through its Priority Habitats and Species Program, WDFW also provides important fish, wildlife and habitat information to local governments, state and federal agencies, private landowners and consultants, and tribal biologists for land use planning purposes. PHS information indicates which species and habitat types are priority for management and conservation; where these habitats and species are located; and what should be done to protect these resources. In the Wenatchee Subbasin, there are 10 habitats and 30 species that have received PHS classification.

Washington Department of Ecology

The mission of the Department of Ecology (WDOE) is to protect, preserve and enhance Washington's environment, and promote the wise management of our air, land and water for the benefit of current and future generations. It goals are to prevent pollution, clean up pollution and support sustainable communities and natural resources. WDOE is responsible for implementing the federal Clean Water Act and enforcing the water quality standards. In accordance with Section 303(d) of the act, every two years the state must identify its polluted water bodies and what type of pollution they suffer from and submit this list to EPA. In 2000 section of the Wenatchee River and major subbasin tributaries were listed as impaired under 303(d).

Local

Chelan County

Chelan County is designated a "lead entity" under the Washington Salmon Recovery Act (HB 2496) and assembles salmon habitat projects and project lists for submittal to the Washington Salmon Recovery Funding Board. The lead entity process facilitates the development and attainment of salmon habitat project proposals within the County. The central component of the lead entity process is a citizen committee that establishes local project priorities for the SRFB and develops a habitat work schedule for future salmon habitat protection and restoration efforts.

Chelan County is also the lead administrative agency for the Wenatchee Watershed Planning Unit described under regional organizations.

Chelan Country Conservation District

The Chelan County Conservation District and the NRCS work together to support Wenatchee River watershed landowners with natural resource research and management activities. The CCCD has been actively supporting ongoing water quality improvement projects since the early 1980s.

The CCCD supports the Chelan County Watershed Program as the "Lead Agency" for the Wenatchee watershed planning effort under Washington State's Watershed Planning Act Chapter 90.82 Revised Code of Washington). The CCCD serves as coordinator, technical assistance, and facilitator of the Water Quality component of the Wenatchee River watershed planning effort. Through the WWPU process, the CCCD is

working with WDOE to implement water pollution cleanup plans known as Total Maximum Daily Load (TMDL) allocations. The CCCD is coordinating the research and development of management recommendations for water quality issues through out the Wenatchee River watershed.

The NRCS and CCCD also work with the Planning Unit and landowners to monitor water and salmonid habitat resources, and implement projects to address water and habitat issues. The CCCD and NRCS work with landowners to implement water resource, water quality, and habitat conservation projects often characterized as Best Management Practices (BPS), through development of on-farm conservation plans.

The CCCD and NRCS will continue to work through the WWPU throughout the duration of the watershed planning process. The Watershed Plan is anticipated to be completed in September of 2005. Implementation of recommendations is ongoing, but will begin in earnest with the completion of the watershed plan in 2005.

Regional

Upper Columbia Salmon Recovery Board

The Upper Columbia Salmon Recovery Board (CSRB) is a partnership among Chelan, Douglas, and Okanogan counties, the Yakama Nation, and Colville Confederated Tribes in cooperation with local, state, and federal partners. The mission of the UCSRB is to restore viable and sustainable populations of salmon, steelhead, and other at-risk species through the collaborative efforts, combined resources, and wise resource management of the Upper Columbia Region.

Wenatchee Watershed Planning Unit

The Wenatchee Watershed Planning Unite (WWPU) is a representative body of government and non-government organizations and individuals who will determine how best to manage the water resource for the Wenatchee River Watershed [Water Resource Inventory Area (WRIA) 45] as defined by rule in Washington Administration Code Chapter 173-500. The WWPU is funded by WDOE and administered by Chelan County. Membership in the WWPU includes federal, tribal, state and local agencies, irrigation districts, local watershed councils, environmental organizations, local landowners and other interested stakeholders.

The purpose of the Planning Unit is to develop collectively a watershed plan that will assess watershed conditions and, specifically, address water quantity, water quality, in-stream flow, and habitat issues. Governmental members (federal, tribal, state and local) make up a Steering Committee, which is responsible for evaluating policy and action items and making policy and process recommendations to the full Planning Unit. The work of the WWPU is also supported by Technical Sub-Committees assigned to address technical or policy issues and develop alternative approaches for the WWPU as needed. Current technical sub-committees include the Water Quantity/Instream Flow, the Water Quality, the Habitat, and the Regulatory Compliance sub-committees.

Other

Local Watershed Councils

Various informal watershed councils exist within the Wenatchee sub-basin, including the following: Icicle Creek Watershed Council, Peshastin Creek Watershed Council,

Chumstick Creek Community Watershed Alliance and the Mission-Brender-Yaksum Creeks Watershed Council. In the state of Washington, the term "watershed council" holds no statutory or official meaning, unlike in Oregon where watershed councils are recognized by state laws. The watershed councils in the Wenatchee subbasin are informal organizations, presently without tax-exempt status, that have organized over the past ten years to address specific issues within their area. Each council acts much like a community forum where ideas can be exchanged and advocated, though the representation of the community in each council may not be broad but determined by specific issues. The councils have not implemented any projects of their own because of their inability to receive funds but have supported and discussed projects implemented by others. The on-going WWPU, funded by the WDOE and administered by Chelan County, has developed a strategy to engage the existing watershed councils and created new ones in other parts of the subbasin in an effort to facilitate project implementation at the grass-roots level. The WWPU recognizes the overall importance of these watershed councils in the effective implementation of future sub-basin plans.

Existing Goals, Objectives, and Strategies [

The following section summarizes the contributing management entities' existing fish and wildlife goals, objectives and strategies for the Wenatchee subbasin. Not all entities agree with each of the objectives and strategies. This is an inclusive list showing where there are differences of purpose and emphasis. Many agency goals, objectives and strategies are not available as quantifiable objectives at this time.

The overall goal is to protect, restore and enhance fish and wildlife and their habitats in the Wenatchee subbasin to provide ecological, cultural, economic, and recreational benefits.

Goal 1. Maintain and protect existing high quality habitat and the native populations inhabiting those areas, as described in "Habitat Areas and Quality" and "Fish and Wildlife Status."

Objective 1 **Maintain the distribution, diversity, and complexity of watershed and landscape scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.**

- Strategy 1: Maintain late-successional and old growth species habitat and ecosystems on federal land
- Strategy 2: Restrict or mitigate management activities that would prevent maintenance or enhancement of existing good habitat. These could include road building, timber harvest, fire prevention, etc. Allow natural processes such as fire, riparian vegetation growth, and woody debris input to continue.
- Strategy 3: Protect riparian areas where large woody debris (LWD) is currently good.

Objective 2 **Maintain biological diversity associated with native species and ecosystems.**

- Strategy 1: No further reduction of genetic variability and viability of remaining fish stocks from present levels through improvement of habitats for

holding, rearing, and spawning, and through provision of adequate water (quantity and quality) for migration through the system

Strategy 2 Manage critical wildlife habitat to improve the status of threatened and endangered species to a point where they no longer need protection under the Endangered Species Act.

Objective 3 Maintain the spatial and temporal connectivity within and between watersheds. Included are the drainage network connections, floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia.

Strategy 1 Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands

Strategy 2 Maintain live and dead connectivity along stream courses, ridge tops, and large forest blocks.

Objective 4 Maintain favorable streamflows and riparian conditions.

Strategy 1 Maintain the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distribution of coarse woody debris sufficient to sustain physical complexity and stability.

Strategy 2 Maintain the physical integrity of the aquatic system include shorelines, banks and bottom configurations

Strategy 3 Maintain instream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing.

Strategy 4 Protect areas where stream shading is good. Dedicate streamside areas for riparian management.

Strategy 5 Ensure that non-infested disturbed and undisturbed sites are protected from invasion by weeds through implementation of the Leavenworth Ranger District prevention strategy.

Objective 5 Maintain the water quality necessary to support healthy riparian, aquatic, and wetland ecosystems.

Strategy 1 Annual maximum 24-hour water temperatures should not exceed 61 degrees Fahrenheit

Strategy 2 Sediment yields within the sub-basin should not cause measured sediment loads to exceed 20 percent fines as defined in the Wenatchee Forest Plan.

Strategy 3 Woody debris within the stream system should average 100 per mile as defined within the Wenatchee Forest Plan.

Goal 2. Restore degraded areas, and return natural ecosystem functions to the subbasin as described in “Habitat Areas and Quality.”

Objective 1	**Restore the distribution, diversity, and complexity of watershed and landscape scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.**
Strategy 1	Provide large woody debris (LWD) for long-term soil productivity and potential and instream.
Strategy 2	Increase infiltration and decrease compaction of soils. Watershed hill-slopes should be vegetated to handle water at the potential infiltration and percolation rates. Off-site erosion should be within a pre-disturbance range of landform development processes.
Strategy 3	Maximize infiltration of precipitation and melt in order to minimize surface runoff. Maintain the integrity of near-surface groundwater movement.
Strategy 4	Promote percolation of moisture though the profile - decrease compaction. Minimize interception, concentration, and rapid delivery of sub-surface flows along the way to the channel area as a result of road/trail cut slopes.
Strategy 5	Promote a frequent, low intensity fire regime that is naturally occurring (<45 years), in order to maintain healthy grassland plant communities. Soils in these areas evolved with grassland under story communities with open park-like forest canopies.
Strategy 6	Restore canopy to provide effective evapo-transpiration and interception to buffer storm events.
Strategy 7	Promote water movement and infiltration as near surface groundwater, reduce road cut interception and reduce compaction.
Strategy 8	Avoid actions or events (e.g. fire, roads) that could trigger landslides and accelerate sedimentation.
Strategy 9	Avoid long, linear overstory alterations up and down hill slopes that can concentrate and rapidly deliver surface runoff to stream channels. Limit ground based, mechanical treatments in identified landform types because of high soil compaction hazards.
Strategy 10	Limit ground based, mechanical treatments in identified landform types because of high soil compaction hazards.
Strategy 11	Maintain closed canopies in moist forest communities so that near surface groundwater would not be concentrated and trigger landslides and the potential for surface runoff during connective storms and rapid melt events would be reduced. Avoid large open patch sizes in dense dry forest stands that have little understory vegetation where surface runoff would be accelerated.
Strategy 12	Minimize surface runoff and erosion from roads within the entire watershed. Any new ground-disturbing activities (e.g., road construction) must incorporate appropriate surface water control.
Strategy 13	Restore the ecological effects of 'natural' disturbance (i.e., fire) by managing fuels similar to levels in pre-settlement landscapes.
Strategy 14	Strive towards a land ownership pattern that will provide for better management and protection.
Strategy 15	Make improvements to existing and new roads.

Strategy 16	Provide protection for unstable slopes.
Strategy 17	The use of prescribed fire could be used to return the distribution of structural stages within each forest group back to historic conditions. Design timber harvest plans to maintain a distribution of different seral stages within drainage basins, in particular MLSA/LSR's.
Strategy 18	Manage for open pine forest in lower elevations, within dry forest vegetation groups.
Strategy 19	Distribution of successional stages in subalpine fir and lodgepole pine are outside the Natural Range of Variability. Restore and maintain the distribution, abundance, and composition of successional stages back to within the natural range of variability. This would be 15-20% in an early-successional condition, 45-60% in a mid-successional condition, and 20-40% in a late-successional condition.
Strategy 20	Promote grassland understory plant communities. Promote plant communities that produce organic matter high in basses and base actions.

Objective 2 **Restore biological diversity associated with native species and ecosystems.**

Strategy 1	Allow for and promote a more diverse riparian forest type with respect to species and age classes. This will also provide for fish habitat over time and help to maintain diversity within the aquatic system.

Objective 3 **Restore the spatial and temporal connectivity within and between watersheds. Included are the drainage network connections, floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia.**

Strategy 1	Improve fish screens within the river system.
Strategy 2	Improve and replace stream crossings (culverts) where fish passage barriers exist.
Strategy 3	Correct existing barriers and screen diversions and prevent new passage problems.
Strategy 4	Maintain connectivity of habitats throughout watershed by maintaining adequate low flows
Strategy 5	Restore access to habitat for salmon by removing existing barriers, preventing creation of new barriers, and screening all diversions.
Strategy 6	Restore live and dead connectivity along stream courses, ridge tops, and large forest blocks.

Objective 4: **Restore habitat to support well-distributed populations of native plant, and riparian-dependent species, including habitat necessary for sustaining salmonids at critical life history stages of spawning, rearing and migration.**

Strategy 1	Protect, maintain and restore adult holding cover and ensure adequate water quantity for upstream migration.
Strategy 2	Reduce fine sediment delivery to stream system.

Strategy 3	Moderate the frequency and occurrences of peak flows to near natural conditions.
Strategy 4	Improve fish screens within the river system.
Strategy 5	Improve holding, resting and juvenile rearing habitat.
Strategy 6	Reverse degradation of holding, spawning, and rearing habitat in through habitat improvements either instream or riparian management to improve bank stability and shading of the water surface.
Strategy 7	Promote the growth of large woody debris wherever possible adjacent to streams.
Strategy 8	Rehabilitate the fire-line crossings where appropriate by pulling back the banks and reestablishing riparian vegetation.
Strategy 9	Restrict riparian harvest to promote diversity. However, if harvest can promote growth of large conifers to provide shade and woody debris then allow with mitigation measures. Reforest those areas that are currently low in shade.
Strategy 10	Improve riparian areas through planting trees and allowing growth (e.g. brush removal) where LWD is in poor condition. Dedicate streamside areas for growth of healthy multi-layered stand to provide shade and large woody debris.
Strategy 11	Improve shading where it is currently poor by planting trees and tail brush. Dedicate streamside areas for riparian management.
Strategy 12	Refer to vegetation management strategies to manage vegetation to reduce catastrophic fire risk and resultant increased sediment and flows that would contribute to channel degradation.
Strategy 13	Restore the availability and effectiveness of the riparian habitats to within historic conditions. Rehabilitate areas at dispersed campsites that have access to riparian areas.
Strategy 14	Eradicate newly established and outlying populations of weeds.
Strategy 15	Emphasis should be given to new species in the watershed and disjunct populations of existing weeds.
Strategy 16	Control domestic livestock within Riparian Reserves to prevent streambank erosion and provide sufficient deciduous plant cover.
Strategy 17	Manage Riparian Reserves to improve or maintain quality where needed.
Strategy 18	Enhance habitat to prevent the need for listing species on the Regional Forester's sensitive species list.

Objective 5: Increase amounts of water to protect and restore fish habitat.

Strategy 1	Establish instream flows for watersheds that support important fish stocks.
Strategy 2	Protect and/or restore instream flows by keeping existing flows and putting water back into streams where flows are diminished by existing uses — especially illegal or wasteful uses or by poor land use practices.
Strategy 3	Moderate the frequency and occurrences of peak flows to near that found naturally.

Strategy 4	In areas where low stream flow conditions have been identified, install pressurized water systems to provide water on an as needed/used basis. Works with other agencies/tribes/irrigation districts/cities to better manage water use.
Strategy 5	Improve farm and sector-based practices to provide the water quality, water quantity, and functional riparian habitat needed for salmon recovery in the agricultural sector.

Objective 6 Restore the water quality necessary to support healthy riparian, aquatic, and wetland ecosystems.

Strategy 1	Reduce fine sediment delivery to the stream system.
Strategy 2	Revise and implement water quality standards to respond to aquatic ecosystem needs.
Strategy 3	Implement water cleanup plans for water bodies in ESA listed areas first.
Strategy 4	Implement nonpoint source "best management practices," and nonpoint action plans.
Strategy 5	Reduce the impact of agricultural practices on water quality in the Wenatchee River Watershed while maintaining the viability of the agricultural industry.
Strategy 6	Protect natural ecosystems such as wetlands, stream corridors and uplands from adverse effects of agricultural practices.
Strategy 7	Minimize runoff from construction sites and development areas to reduce impacts to downstream land and water.
Strategy 8	Eliminate impacts to surface and ground waters by reducing contamination of stormwater.
Strategy 9	Minimize sediment input from roads, timber harvest activities, existing slides in the watershed and recreational site developments along the riparian area
Strategy 10	Provide for stream fertilization, where identified as appropriate with salmon carcasses or other species.
Strategy 11	Meet or exceed federal and Washington state water quality standards.
Strategy 12	Enhance -or restore habitat that may include fuels treatments to reduce fire risk and potential loss of late-successional habitat.
Strategy 13	Increase connectivity of late-successional and riparian habitats in areas where extensive human development is not likely to occur.

Goal 3. Restore, maintain, and enhance fish and wildlife populations, as described in "Fish and Wildlife Status," to sustainable levels and also, when applicable, to harvestable levels, while protecting biological integrity and the genetic diversity of the watershed.

Objective 1. Increase or establish salmonid stocks and runs to a level where they can maintain themselves through natural spawning and rearing.

Strategy 1	Protect and restore spawning, rearing and migration habitat as described under Goals 1 and 2
Strategy 2	Establish spawning escapement goals for the subbasin.

The Yakama Nation production and escapement goals are as follows:

- Spring chinook: 21,000 adults — 12,000 are natural fish and 9,000 hatchery
- Summer chinook: 10,000 adult natural fish
- Sockeye: 35,000 adult natural fish
- Summer steelhead: 12,218 adults —4,718 are natural fish and 7,500 hatchery
- Fall chinook: not yet established
- Coho: not yet established

Strategy 3	Reestablish naturally reproducing coho salmon populations in mid-Columbia River basins with numbers at or near carrying capacity that provide opportunities for significant harvest for tribal and non-tribal fishers.
Strategy 4	Continue coho feasibility studies. See Goal 4, Objective
Strategy 5	Initiate coho natural reproduction in areas of low risk to sensitive species.
Strategy 6	Determine whether hatchery adults from lower Columbia River brood stock return in increasing numbers to the Wenatchee basins so that their progeny may be expected to reach replacement, thus significantly limiting the infusion of the Lower (Columbia) River hatchery stock, with the long-term goal of eliminating use of the Lower River stock altogether.
Strategy 7	Begin to develop a locally adapted brood stock, starting with adult returns to Winthrop NFH and Wells Dam.
Strategy 8	Begin coho releases in areas of low risk to listed species that will be allowed to return as adults to spawn naturally. These areas currently are located in the Wenatchee basin at sites at Chumstick and Brender creeks.
Strategy 9	Minimize potential negative interactions among coho and listed and sensitive species.
Strategy 10	Maintain an adequate number of all life stages of trout (especially bull trout) that are well distributed throughout the watershed and are sustained through high quality habitat.
Strategy 11	Maintain active stewardship of cutthroat, rainbow, steelhead, chinook salmonids along with non-game fish, to promote and restore species and habitats
Strategy 12	Allow no further reduction of genetic variability and viability of remaining fish stocks from present levels through improvement of habitats for holding, rearing, and spawning, and through provision of adequate water (quantity and quality) for migration through the system
Strategy 13	Maintain only native aquatic species in the watershed. Remove eastern brook trout from the upper watershed. This will maintain the first two actions above and allow for less competition for native species.

Objective 2 **Maintain and rebuild viable and appropriately distributed native wildlife populations.**

Strategy 1	Use road closures and/or move roads and trails in important riparian areas to protect gray wolf, wolverine, grizzly bear, fisher, lynx, mule deer and elk populations.
Strategy 2	Reduce disturbances that occur on the winter range for mule deer and elk.
Strategy 3	Coordinate with WDFW to manage deer use of winter range; emphasize mule deer habitat needs in the watershed, rather than for elk.
Strategy 4	Manage big game habitat to sustain optimum numbers of deer at carrying capacity.
Strategy 5	Restore and manage native grasses, forbs, and browse species in areas that would be considered suitable bighorn habitat.
Strategy 6	Buffer geomorphic habitats (caves, cliffs, talus, rock outcrops) 300 feet to provide habitat. Design new bridges and other man-made structures to be "bat friendly" where possible.
Strategy 7	Improve habitat in spotted owl sites and other late-successional dependant species, including by decreasing fragmentation from past harvest activities in bottom lands; helping to accelerate late-successional habitat in the monoculture type plantations; and maintaining important connectivity within the watershed.
Strategy 8	Eliminate and control encroaching weeds and coniferous shrubs and trees in meadow habitats and wetlands associated with grizzly bears.
Strategy 9	Use signage, restrictions on firewood harvest and other methods to protect primary and secondary bald eagle nest sites in the draft Lake Wenatchee Bald Eagle Nest Site Management Plan and to protect bald eagle perch trees (snags and green recruitment trees) along the shorelines of Lake Wenatchee, Fish Lake, lower Little Wenatchee, and White River
Strategy 10	Protect harlequin duck populations by restoring streambanks and stream channels, maintaining riparian vegetation and large wood components of stream systems, and obliterating roads within riparian reserves
Strategy 11	To protect mountain goat populations, restrict livestock grazing in mountain goat habitat and human and vehicle traffic near in winter range areas; retain natural habitat on cliffs and in travel corridors between cliffs used by mountain goats; in forage areas, use burning seeding and fertilization to increase food supply.
Strategy 12	Increase/maintain raptor nest habitat for great gray owl in Mill Creek, great horned owl, osprey nests and goshawks throughout the watershed.
Strategy 13	Maintain forested micro-climate for lichens, fungi, amphibians, mollusk, bats, spotted owls, fisher and deer.
Strategy 14	Restore a proper mix of habitat components to sustain lynx population. (Generally, lynx prey habitat has increased while travel and denning habitat has decreased, especially ridge tops and valleys.)

Strategy 15	Need to manage long-term snag recruitment for viability of snag user species. Restore the availability, distribution, and species composition of snag habitats.
Strategy 16	Rebuild viable and well-distributed populations of riparian dependent species such as ruffed grouse, beaver, harlequin duck, and amphibians by the restoring availability of riparian habitat to the natural range of variability.
Strategy 17	Restore extirpated beaver and big horn sheep populations back to historic levels.
Strategy 18	Restore biodiversity back to historical levels. Desired conditions would maintain or restore genetic variability and/or wildlife populations to provide a high probability of viable populations. In addition, the distribution and structure of wildlife habitats would be within the natural range of variability that could be sustainable over the long term.
Strategy 19	Maintain connectivity between corridors (i.e. riparian, late-seral stands) to provide access to the variety of habitats needed by wildlife species.
Strategy 20	Maintain the structural components (snag tree, down wood, vertical structure, canopy closure, etc.) at historic conditions, wherever possible, by plant series groups.
Strategy 21	Throughout many of the Wenatchee watersheds, natural fire regimes have not occurred resulting in changed wildlife habitats. Restore grassland, dry series, and patch sizes back to within the natural range of variability.
Strategy 22	In many areas throughout the Wenatchee subbasin there is reduced availability of snag habitat in some areas in the dry series habitats. Restore this habitat back to within the natural range of variability.
Strategy 23	Enhance habitat to prevent the need for listing species on the Regional Forester's sensitive species list.
Strategy 24	Strive towards a land ownership pattern that will provide for better management, protection and access to the forest.

Objective 3 **Use the strategies and accomplish the objectives described in Goals 1 and 2 to maintain and restore the habitat upon which Wenatchee subbasin fish and wildlife depend.**

Goal 4. Increase the information and knowledge needed to protect, restore and manage fish, wildlife and their habitats.

Objective 1 **Provide scientific basis for protecting aquatic ecosystems and enable planning for sustainable resource management**

Strategy 1	Study interactions among coho and listed and sensitive species, particularly spring chinook and sockeye salmon, steelhead, and bull trout.
Strategy 2	Annually evaluate project performance and expand or adapt studies as data indicate is necessary or appropriate.

Strategy 3	Develop better understanding of fish passage needs, especially juvenile salmon migration habits and needs.
Strategy 4	Create a permit file for all on-site sewage systems in Chelan County. Using Global Positioning System, place all sites on a GIS database.
Strategy 5	Conduct inventories within the drainage to determine amphibian and mollusk species and distribution in wetlands and streams in the watershed.
Strategy 6	Identify roads for closure, decommission, or obliteration. Identify roads directly contributing sediment to streams, and mitigation measures to reduce sediment introduction. Identify where roads have interrupted near surface ground water.
Strategy 7	Identify unstable slopes and contributing factors, as well as potential mitigation measures.
Strategy 8	Identify sites experiencing accelerated erosion (not road related) and potential mitigation measures.
Strategy 9	Identify management practices that cause or enhance the spread of weeds, and modify those practices (e.g. grazing).
Strategy 10	Identify priority areas for initiating noxious weed control projects. Areas to consider include rock and borrow pits, riparian areas, trailheads, and dispersed campgrounds.
Strategy 11	Complete watershed-based inventories and prioritization of fish passage problems.

Objective 2 **Accurately assess the responses in fish and wildlife populations and their habitats to specific strategies undertaken.**

Strategy 1	Develop and promote the use of appropriate analysis and assessment tools, monitoring plans and guidance to support the strategy and related watershed and regional responses.
Strategy 2	Develop and promote complementary, integrated and flexible approaches for the collection, analysis and sharing of monitoring information within and across sites, watersheds and regions.
Strategy 3	Review the ecological role of the brook trout within this subbasin and consider possible removal, if warranted, to maintain existing species of native salmonids.
Strategy 4	Conduct fish surveys to establish presence/absence and relative abundance of salmonids during appropriate times of the year to catch migrating fish.
Strategy 5	Continue existing studies and initiate new ones (adapting to changing needs, new information, and concerns of project participants) to determine whether a brood stock can be developed from Lower Columbia River coho stocks, whose progeny can survive in increasing numbers to return as adults to the mid-Columbia region.
Strategy 5	Provide information needed to prepare the biennial “State of the Salmon” report.

Objective 3 **Assess water supply and use in the Wenatchee subbasin**

Strategy 1	Prepare a list of studies, plans, and assessments already completed in the watershed
Strategy 2	Examine surface and ground water present in management area (commonly referred to as the "water balance")
Strategy 3	Investigate water represented by claims in the water rights registry, use permits, certificated rights, existing minimum instream flow rules, federally reserved rights, and any other rights to water
Strategy 4	Estimate amount of surface and ground water currently in use
Strategy 5	Evaluate climate pattern studies
Strategy 6	Estimate amount of water needed for future use
Strategy 7	Identify locations where aquifers are known to recharge surface bodies of water and locations that provide aquifer recharge
Strategy 8	Estimate amount of surface and ground water available for instream and future out-of-stream uses (commonly referred to as the "water budget")

Objective 4 **Determine adequacy of existing instream flows within Wenatchee subbasin for fish and community needs.**

Strategy 1	Identify the existing, legally-established instream flows and examine the relationship between out-of-stream and instream uses
Strategy 2	Prepare a list of studies, plans, and assessments already completed in the watershed
Strategy 3	Evaluate methods used to establish existing instream flows
Strategy 4	Prepare a list of needed assessments
Strategy 5	Prepare a streamflow data summary and hydrograph synthesis
Strategy 6	Evaluate the relationship between instream flow and land use
Strategy 7	Evaluate the relationship between instream flow and habitat
Strategy 8	Investigate optimal instream flow conditions for competing watershed interests throughout the year.

Objective 5 **Inform and educate landowners, recreationists and the general public about the need to protect, restore and manage natural resources.**

Strategy 1	Raise the awareness and understanding in the agricultural community of salmon recovery and watershed health, and build support for the agricultural strategy and its implementation.
Strategy 2	Inform the public about the condition of steelhead and salmon, and how the public can be involved in their recovery.
Strategy 3	Inform the public about the ramifications of having Endangered Species Act (ESA) listed salmon, steelhead and trout in their watersheds.
Strategy 4	Inform the public about sewage issues.
Strategy 5	Promote an environmental stewardship ethic among the agricultural community through information and education.
Strategy 6	Provide technical and financial assistance to encourage the use of Best Management Practices.

Strategy 7 Educate forest landowners of Forest Practice Rules and Regulations.
Strategy 8 Educate landowners of incentives to keep their land in forest production.
Strategy 9 Develop an information and education program for forestry Best Management Practices.
Strategy 10 Identify priority or critical septic/water quality problems areas and inform the public of these problems.

Goal 5. Improve management, regulation and enforcement, public involvement and government incentives and funding to maintain and restore natural ecosystem and the species they support.

Objective 1. Make decision-making about and management of fish, wildlife populations and their habitats more effective.

Strategy 1 Tribal, federal, state, and other land and resource managers are encouraged to resolve inter-jurisdictional impediments to salmon recovery.
Strategy 2 Make stewardship of salmonid populations the first priority in managing fishery resources.
Strategy 3 Fishery approaches will be implemented and evaluated to protect depleted populations while providing more stable and sustainable access to healthy species and stocks.
Strategy 4 Integrate fish passage and screening activities into implementation of watershed planning and other planning and restoration efforts.
Strategy 5 State and federal agencies will integrate the Endangered Species Act (ESA) and Clean Water Act (CWA) to offer agencies and landowners a predictable, practical and coordinated process to meet the needs of both laws.
Strategy 6 Use scientific principles and information consistent with recovery of healthy salmon populations as the basis to identify and establish geographic priorities for habitat protection and restoration.
Strategy 7 Revise the Field Office Technical Guide (FOTG) to provide the tools needed to enhance, restore and protect habitat for fish and to address state water quality standards.
Strategy 8 Fully implement the Conservation Reserve Enhancement Program (CREP) and expand its scope to include tree fruit, berries and grapes.
Strategy 9 Establish a scientific foundation for the Statewide Strategy to Recover Salmon and the monitoring component.
Strategy 10 Provide leadership, coordination and technical assistance to agencies and other Statewide Strategy to Recover Salmon partners.
Strategy 11 Status and productivity of wild salmonid populations and their habitats will be regularly monitored to evaluate the performance of protection and recovery actions.

Objective 2 Strengthen plans and regulations to restore and maintain habitat to support healthy, harvestable quantities of fish.

Strategy 1	Strengthen regulations and other measures necessary to meet fish conservation requirements of the Endangered Species Act and water quality requirements of the Clean Water Act.
Strategy 2	Counties and cities in the Wenatchee will revise their Growth Management Act (GMA) plans and regulations by September 1, 2002, to include the best available science and give special consideration to the protection of salmon.
Strategy 3	Ensure implementation of land use practices that protect habitat and/or have no detrimental impacts on salmon habitat.
Strategy 4	Focus state and local land use and salmon recovery efforts first in areas with Endangered Species Act (ESA) listings and areas with potential for high quality habitat.
Strategy 5	Be more rigorous and thorough in reviewing new subdivisions and individual sites for suitability of on-site sewage systems.
Strategy 6	Mandate improvements for existing and new roads
Strategy 7	Commercial and recreational fisheries will continue to be restructured to improve their stability, management and profitability.

Objective 3	**Use incentives and government funding to support the protection and restoration of fish, wildlife and their habitats.**
Strategy 1	Promote the use of local incentives and non-regulatory programs to protect and restore wetlands, estuaries and streamside riparian habitat.
Strategy 2	Identify and provide financial assistance programs to help homeowners repair or replace failing in-site septic systems.
Strategy 3	Establish a consistent funding base for the Chelan-Douglas Health District, which treats and regulates sewage waste.
Strategy 4	Allocate a greater portion of new state and federal funds to habitat protection than to restoration.
Strategy 5	Create a comprehensive long-term funding strategy that uses federal, state, local and private dedicated funds and project mitigation funds to expand correction programs and monitor effectiveness of those programs.
Strategy 6	Create a comprehensive long-term funding strategy that uses federal, state, local and private dedicated funds and project mitigation funds to expand correction programs and monitor effectiveness of those programs.
Strategy 7	Allocate most new state and federal funds for salmon habitat protection and restoration to higher priority geographic areas.
Strategy 8	Provide continuing technical and financial support to ensure that decisions within high priority areas are scientifically sound.

Objective 4.	**Build support, involve and mobilize citizens to assist in restoration, conservation and enhancement of fish and wildlife habitat.**
Strategy 1	Use volunteer-based organizations where appropriate to gain the best use of limited funds.

Strategy 2	Ensure that there is thorough stakeholder participation in the process of revising the Field Office Technical Guides under the Natural Resource Conservation Service's Memorandum of Understanding (MOU) with state and federal resource agencies.
Strategy 3	Support agricultural organizations' and associations' efforts to implement the agricultural strategy and to help communities and general public understand and support this effort.
Strategy 4	Organize a statewide coalition of individuals, groups, associations and governments that will work together to educate the public about salmon recovery.
Strategy 5	Promote and enhance volunteer resources needed to implement recovery efforts.

Research, Monitoring, and Evaluation Activities (CRITFC 1995)

Fish

The limiting factors analysis (Andonaegui, 2001) has identified the following inventory and assessment research needs at the subbasin level:

- A study is needed to define current floodplains and riparian habitat in the Wenatchee River corridor in terms of channel form and process. This would contribute to the development of a habitat protection and restoration strategy that would address issues of maintaining habitat connectivity and habitat-forming processes. Chelan County has initiated a Channel Migration Zone Study of the Wenatchee River from the bottom of Tumwater Canyon downstream to the Columbia River confluence, including the lower 4.0 miles of Nason Creek (see Existing and Past Efforts).
- A hydrologic assessment to evaluate groundwater and surface water interactions, identifying critical ground water recharge areas, and locations where groundwater contributes to surface water in the Wenatchee River corridor, including the alluvial fans is needed. A measure of the affect this interaction has on moderating high summertime stream temperatures and low summer/fall instream flows should be included.
- More information is needed on bull trout distribution and habitat use for all life history forms found in the Wenatchee subbasin (fluvial, adfluvial and resident). The extent of habitat fragmentation (i.e., water crossing structures, thermal barriers, dewatering/low flows) on bull trout, both its causes and affects, is needed.

The Regional Technical Team identified the following research and monitoring needs for watersheds within the subbasin

- In all watersheds, monitor stream channel sinuosity, width/depth ratio, and riparian coverage from fixed station on a periodic schedule (i.e., every 3 years). Continue ariel reconnaissance.
- Survey Nason Creek watershed and upper mainstem Wenatchee River side channels and oxbows for the presence of juvenile salmonids
- For the Chiwawa watershed, investigate effects of hatchery weir operations on spring chinook spawning distribution

- For Icicle Creek watershed, monitor adult passage and spawning throughout the watershed
- For Icicle Creek watershed, investigate the role of surface and well water withdrawals on instream flows and habitat use
- For Chumstick and Mission watersheds and the upper mainstem Wenatchee River, monitor selected water quality parameters at fixed stations and set periodicity

The Yakama Tribal Recovery Plan identifies the following research, monitoring and evaluation needs:

- Further delineate fish distribution and habitat conditions in the basin.
- Complete Watershed Analysis/Assessments on a priority basis where it is not completed.
- Further determine limiting factors to salmonid stocks and lamprey in the Wenatchee Sub-basin.
- Evaluate the effectiveness of supplementation projects, habitat and riparian restoration, and improvements to land management activities.

Conduct a thorough survey of road crossings (culverts) in the drainages to determine sites that block or impede fish passage

The Wenatchee River Watershed Action Plan (1998) identifies the following monitoring and research needs:

- Surface water quality monitoring in Mission and Chumstick Creek watersheds
- Increase ambient monitoring sites in subbasin to include stations in Mission and Chumstick Creek watersheds
- Intensive survey of streams flowing through orchards to assess the impacts of high concentrations of multiple insecticides on stream biota and associated wildlife
- Groundwater monitoring and hydrogeologic characterization of subbasin
- Install staff gauges on all the major tributaries and monitor stream flow in order to develop rating tables
- Develop and implement a water quality monitoring program to sample storm drains in towns of Leavenworth and Cashmere

The USFS watershed assessments list the following monitoring needs:

Fish and Habitat:

- Continue to monitor fish population trends as outlined in the Wenatchee Land and Resource Management Plan.
- Continue to conduct stream surveys of the basin as needed to monitor changes in fish habitat. On fish habitat improvement projects use a Level III monitoring protocol to determine changes in habitat and fish populations as a result of project.
- Develop a monitoring plan for stream channels that includes sediment monitoring, as currently being conducted on the Forest, to determine amount and source of fines within the system. To be done on a yearly basis and before and after projects. In addition, continue to monitor cross sections of the channel to determine changes to channel geomorphology.

Soils and Hydrology:

Specific monitoring protocols should be developed for each watershed and for these resource needs:

- Groundwater levels through time.
- Stream Temperatures.
- Flow measurements on tributaries.
- Debris flow occurrence and distribution as related to both managed and unmanaged areas.
- Compaction and sedimentation due to grazing, both long term and current.
- Surface and subsurface water interception by roads.
- Grazing, harvest, and fire suppression effects to debris flow disturbance regime.
- Identify road and alluvial fan interactions and potential problems.
- Fine sediment levels in stream systems.
- Determine natural fine sediment loads from upland areas.

Transportation Systems:

- Inventory roads and enter into GIS with a linked database showing road status.
- Monitor the road density within the Late Successional Reserves (LSR) to see if moving towards 1 mile/square mile.
- Monitor progress on the obliteration of identified roads or road segments.
- Locate where roads are restricting stream channels.
- Evaluate the effectiveness of the road closures.

Riparian Areas:

- Develop a monitoring plan for riparian vegetation to determine, especially in those areas where riparian vegetation is below standards, how riparian vegetation should be managed to maintain shade and large woody debris.

Ongoing monitoring and research and evaluation activities that have been described more fully under Past and Existing Efforts include:

- USFS hatchery performance monitoring of spring chinook salmon escapement and survival.
- The Mid-Columbia Coho re-introduction feasibility program
- WDFW Wenatchee River juvenile salmon and steelhead monitoring program
- Annual bull trout surveys conducted by USFS, USFWS and WDFW
- USFW bull trout telemetry studies
- USFS stream habitat surveys and channel cross section monitoring
- USFS sediment monitoring

Wildlife

The USFS watershed assessments listed the following wildlife-related monitoring, research and evaluation needs, including some related to vegetation.

Vegetation:

Major vegetation types should be monitored where management activities have taken place. It is important to determine through monitoring if we are meeting landscape objectives**.** Where the objective is to manage stands within their 'natural' range of

variability, monitor to see if stand structure and species composition are becoming more representative of historic conditions. In areas where stands are purposely being managed outside of the natural range of variability for other resource objectives, monitoring should be carried out to determine of such vegetative conditions are being sustained. Specific and detailed methods for monitoring will need to be developed.

Specific monitoring protocols should be developed for each watershed and for these resource needs:

- Inventory of noxious weed locations.
- Analysis to determine need for acceleration of structure in riparian areas.
- Inventory of similar habitat for vegetation species of concern.
- Analysis of grazing allotment to determine utility and continuance or modification.

Wildlife

- Monitor raptor, including spotted owl, responses to habitat disturbance from dry site conversion practices
- Investigate and inventory habitat associations and effects of management activities on species such as raptors, small carnivores, mollusks, and amphibians.
- Develop deer and elk cover/forage models in relation to the sustainability of dry forest and current management strategies for dry forest conversion. Inventory winter and summer range for quality and quantity of deer/elk forage.
- Conduct surveys for species of concern to determine habitat preference and distribution
- Inventory wetland/seeps and springs with particularly emphasis on connectivity issues related to wildlife dispersal and migration.
- Survey lynx populations in subbasin.
- Evaluate multi-resource projects for impact to lynx and lynx habitat.
- Conduct an elk telemetry study to determine the extent of elk use, distribution, migration routes, and calving areas within the watershed.
- Conduct population surveys to determine estimate and trends in mountain goat population.
- Investigate how disturbance dynamics of habitats influence suitability for bats and other species and implications for ecosystem management.
- Gain understanding of bat diets and strategies, as well has roosting and hibernaculum site needs to determine and refine ecological roles of bats in forested environments
- Inventory/survey waterfowl habitat and populations.
- Conduct studies of bald eagle food habitat, feeding area and perch tree use.
- Survey/inventory potential suitable peregrine falcon nesting habitat.
- Inventory/survey potential harlequin habitat to establish presence and baseline populations.

The NW Forest Plan outlines the wildlife species that will be monitored and the monitoring protocol that will be followed. Established protocol exists for some species such as the spotted owl, goshawk, amphibians, and woodpeckers. For many others, protocol has not been established but is being developed by interagency teams of scientists.

The President's Forest Plan outlines specifically the timeline in which these protocols will be completed.

Specific monitoring protocols should be developed for each watershed and for these resource needs:

- Monitor of unique habitats for frequency, stability, and species composition.
- Inventory of similar habitats for species of concern (mollusks, amphibians, others).
- Monitor of current populations of species of concern.

Statement of Fish and Wildlife Needs

Fish

- Protection and restoration of native fish populations
- Protection, restoration and reconnection of properly functioning floodplain and riparian habitat throughout the basin. Emphasis is on protection in White, Little Wenatchee, Chiwawa River and Nason Creek watersheds and on restoration/reconnection in Icicle, Mission, Peshastin and lower mainstem Wenatchee River.
  Areas of particular concern for protection include
    - Lower White River from Panther Creek confluence downstream to the mouth (UCSRB RTT 2001; MCMCP, 1998);
    - Little Wenatchee River from mouth upstream to falls; and lower Chiwawa River (UCSRB RTT 2001; MCMCP, 1998),
    - Near Chikamin Creek confluence (UCSRB RTT 2001; MCMCP, 1998);
    - Selected sites along the mainstem Wenatchee River form mouth of Lake Wenatchee downstream to Deadhorse Canyon (MCMCP 1998).

  Restoration and reconnection needs identified by referenced reports include:
    - Developing riparian habitats in the right of ways along State Highway 2 in lower Wenatchee River, Nason Creek and Peshastin Creek areas (MCMCP 1998);
    - Restoring wetland complexes throughout White/Little Wenatchee watersheds that connect to stream channel (USCRB RTT 2001),
    - Restoring riparian buffers along Little Wenatchee and Rainy Creek (USFS, 1998),
    - Protecting and restoring habitat within the channel migration zone of the Lower Wenatchee River and Nason Creek (UCSRB RTT 2001)
    - Identifying, protecting and restoring high-flow habitat (side channels) in the Wenatchee River corridor (Andonaegui 2001)
    - Restoring habitat of lower Chiwawa River, from moth to Deep creek confluence, RM 4.0 (MCMCP 1998)
- Restoration of fish passage.
  Specific fish passage restoration needs identified in referenced reports include
    - Provide year-round passage to and from wetlands that were cut off from the lower Wenatchee River because of Highway 2 placement from RM 7.2 to RM 3.5 (MCMCP 1998)

        - Restore full fish passage at the North Road culvert on Chumstick Creek (RM0.3) to allow unimpeded upstream passage for salmonids (MCMCP 1998)
        - Remove human-caused barriers, particularly spillway at Leavenworth NFH (Andonaegui 2001)
        - Provide fish passage from wetlands and oxbows to Nason Creek that were cutoff because of Highway 2 placement, RM 14.6 to RM 5.1 (UCSRB RTT 2001, MCMCP 1998)
- Improved instream flows particularly late summer flows in lower Wenatchee River, Chumstick Creek, Mission Creek, Bender Creek, Peshastin Creek, Icicle Creek and lower Chiwawa River
- Develop alternative flow recommendations using Instream Flow Incremental Methodology (Wenatchee Watershed Planning Unit)
- Development and implementation of water conservation practices and explore development of water banks/trusts
  Specific areas identified in referenced documents include
        - Lower Peshastin Creek during low flow period from Ingall Creek (RM 9.4.) to mouth (UCSRB RTT 2001)

- Minimize sediment delivery from roads, timber harvest activities, and other human activities
- Manage recreational areas to reduce or avoid impacts to riparian habitats (UCSRB RRT 2001)
- Reduce road densities in Mission Creek, Little Wenatchee River corridor and Rainy Creek drainage (USFS 1998)
- Initiate public information efforts to discourage harassment of spawning spring chinook salmon and bull trout (UCSRB RRT 2001)
- Reduce impacts on shallow water habitat and protect Lake Wenatchee shorelines, particularly near the mouth of the White and Little Wenatchee rivers
- Develop and implement a brook trout removal program for Schaefer Lake (UCSRB RTT 2001)
- Expand broodstock collection for the Leavenworth NFH to include upriver and tributary stocks, if stock identification data indicates significant genotypic or phenotypic differences among various populations (Yakama Nation 2000)
- Utilization by release programs of final rearing and/or acclimation facilities in national production areas including Nason Creek, White River and the Little Wenatchee River (Yakama Nation 2000)
- Restoration of coho to the Wenatchee subbasin after completion of feasibility/risk evaluation phase of restoration project (Yakama Nation 2000).
- After restoration of natural runs, provide for increased harvest opportunities (Yakama Nation, 2001)
- Restore lamprey to the subbasin (Yakama 2001)

Wildlife

These needs have been primarily identified by the USFWS

- Reestablish vegetative communities on harvested upland habitat
- Maintain/restore important connectivity within the subbasin, for spotted owls and other late-successional dependant species.
- Protect, maintain and manage for spotted owl habitat to meet threshold and optimal conditions
- Reduction of road and trail densities in important grizzly bear, gray wolf, mule deer, elk, wolverine and mountain goat habitat.
- For gray wolves, protect from human-caused mortality and maintain a good ungulate prey base
- Improve meadow and wetland habitat by removing encroached weeds and coniferous shrubs and trees.
- Maintain and enhance security habitat with Forest Planning Units for lynx, gray work, wolverine, grizzly bear and other species of concern.
- Protect and restore primary and secondary bald eagle nest sites and perch trees.
- Maintain/enhance riparian habitat, stream bank vegetation and large wood component of stream systems for harlequin ducks and other waterfowl.
- Maintain important travel corridors and forage for mountain goats.
- Control noxious weed spread.
- Implement use of fire in whitebark pine, aspen, subalpine fir/parkland and upland meadows.
- Increase/maintain raptor nest habitat
- Maintain forested micro-climate for lichens, fungi, amphibians, mollusk, bats, spotted owls, fisher and deer
- Maintain live and dead connectivity along stream courses, ridge tops and large forest blocks.
- Manage long-term snag recruitment for viability of snag user species.
- Maintain a proper mix of lynx prey, travel and denning habitat to sustain lynx population within the subbasin.

Information Needs

Fish Information needs identified by the UCSRB Regional Technical Team:

- Fluvial processes in many Upper Columbia streams are not fully understood, particularly in the lower Wenatchee River. Stream channels in these reaches are constrained by railroads, highways, dikes, and development, causing reduced channel sinuosity, flood attenuation, gravel recruitment, large woody debris recruitment, and connection to side channels. Information needs include historical and current channel migration rates, factors affecting migration rates, means to restore floodplain function, and the appropriate types and locations of restoration.
- More information is needed on the water balance and the relation of surface and groundwater in Upper Columbia streams. A hydrologic assessment should identify critical ground water recharge areas and determine locations where groundwater contributes to surface water. This assessment should include measuring interactions

between groundwater management and surface water flows during critical periods. The role of upslope forest and range management on water balance and hyporheic flows needs to be further understood.

- Many watersheds in the region require fish passage barrier and screen inventories and assessments. A comprehensive inventory would include identification and prioritization of both artificial and natural barriers (culverts, diversions, diversion dams, gradients, etc.), and the locations of water diversions (both gravity and pump). Inventories are now being conducted in the Wenatchee, yet full assessments of these structures may be required to correct the barriers in a systematic and strategic order.
- An understanding of habitat/productivity relations in Upper Columbia streams would help guide land and water management decisions contributing to recovery of salmonids in the region. Upstream/downstream salmonid migrant trapping, parr production surveys, and spawning ground surveys in selected index streams would greatly contribute to our knowledge base, and lead to more appropriate resource allocation decisions. Indicator streams should be established.
- The extent of salmonid rearing in small-order tributaries to the Upper Columbia River is not known. Many streams may be rearing or overwinter refuges, which could be important to the population structure and dispersal patterns of salmonids in the region. The presence of redband trout in these streams should be determined.
- The cumulative effects of current gold mining activities in the Peshastin watershed on sediment delivery, water quality and channel conditions need to be examined.

Additional watershed-specific needs identified in the Limiting Factors Analysis

- Compilation and analysis of Mission Creek water quality data needs to be undertaken.
- The cumulative effects of past timber harvest and road development in tributaries on sediment delivery, stream channel function, LWD recruitment and water quality area not fully understood, but should be evaluated. (Nason Creek, Peshastin Creek, White River and Little Wenatchee River watersheds).

Wildlife information needs identified in USFW Watershed Assessments:

- Population assessments and information on ecological interactions are needed for wildlife species in the subbasin.
- Information on the extent and affect of exotic plant invasions.
- Further study and inventory to determine habitat associations and effects of management activities on species such as raptors, small carnivores, mollusks and amphibians.

Wenatchee Subbasin Recommendations

Projects and Budgets

The following subbasin proposals were reviewed by the Columbia Cascade Province Budget Work Group and are recommended for Bonneville Power Administration project funding for the next three years.

Table 1 provides a summary of how each project relates to resource needs, management goals, objectives, and strategies, and other activities in the subbasin.

Continuation of Ongoing Projects

Project: –199604000 – Evaluate the Feasibility and Risks of Coho Re-introduction in Mid-Columbia

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Sponsor: Yakama Nation

Short description

Determine the feasibility of re-establishing a naturally spawning coho population within the mid-Columbia tributaries, while keeping adverse ecological impacts on other salmonid species of concern within acceptable limits.

Abbreviated abstract

The Mid-Columbia Coho Reintroduction Feasibility Study encompasses a vision of an optimistic future that may take many years to achieve, as well as short-term goals that will provide information to enable decision-makers to assess whether the vision is achievable. The long-term vision for this program is to reestablish naturally reproducing coho salmon populations in mid-Columbia river basins with numbers at or near carrying capacity that provide opportunities for significant harvest for tribal and non-tribal fishers. Mid-Columbia coho reintroduction is identified as a priority in the Wy-Kan-Ush-Mi-Wa-Kish-Wit document (Tribal Restoration Plan; CRITFC 1995). The feasibility phase has two primary goals:

1) To determine whether a localized broodstock can be developed from Lower Columbia River coho stocks, whose progeny can survive in increasing numbers to return as adults to the mid-Columbia region; and
2) to initiate natural production in areas of low risk to listed species.

The Mid-Columbia Coho Reintroduction Feasibility Study is centered on the development of a localized broodstock while minimizing potential negative interactions among coho and listed and sensitive species. From its inception, monitoring and evaluation has been a critical element of the study. We will monitor the project in terms of performance indices relating to:

• Hatchery and natural coho smolt production

• Relative survival differences between lower Columbia River transfers, localized broodstock, and naturally produced coho.
• Ecological interactions with listed and sensitive species
• Divergence between lower Columbia River hatchery stocks and program stocks in regard to genetic and life history characteristics

Project success will be defined in terms of the development of a localized broodstock, and increasing natural production with limited adverse impacts on listed and sensitive species. Development of a localized broodstock will be monitored in terms of smolt-to-smolt survival, smolt-to-adult survival, and life history and genetic divergence from the parent stocks. Natural production will be monitored in terms of natural origin recruits and its components (adult reproductive performance and survival from egg to fry, fry to smolt and smolt-to-adult). Ecological impacts on listed and sensitive species will be assessed with indices of predation and competition.

Relationship to other projects

Project ID	Title	Nature of relationship
199506325	YKFP Monitoring and Evaluation	Transfer of meaningful results, techniques and strategies between projects.
88122001	YKFP Project Management	Transfer of meaningful management strategies between projects.
199701725	YKFP Operation and Maintenance for the Yakima River Subbasin	Transfer of meaningful results, techniques and strategies between projects.
198811525	YKFP Design and Construction for the Yakima River Subbasin	Transfer of meaningful results, techniques and strategies between projects.

Relationship to existing goals, objectives and strategies

Wy-Kan-Ush-Mi-Wa-Kish-Wit

Since the early 1900s, the native stock of coho has been decimated in the tributaries of the middle reach of the Columbia River (the Wenatchee and Methow rivers) (Mullan 1983). The four Columbia River Treaty Tribes (Nez Perce, Umatilla, Warm Springs, and Yakama) identified coho restoration in the mid-Columbia as a priority in the *Wy-Kan-Ush-Mi-Wa-Kish-Wit* document, commonly referred to as the Tribal Restoration Plan (TRP) (CRITFC 1995). It is a comprehensive plan put forward by the Tribes to restore the Columbia River fisheries. In 1996, the Northwest Power Planning Council recommended the mid-Columbia restoration project for funding by BPA. It was identified as one of fifteen high-priority supplementation projects for the Columbia River basin, and was incorporated into the NWPPC's Fish and Wildlife Program (program measures 7.1H, 7.4A, 7.4F, and 7.4O).

Methow and Wenatchee Subbasin Summaries (Draft 2001)

These subbasin summaries identify the need to continue studies to determine the feasibility of re-establishing coho in the Methow and Wenatchee subbasins as part of the specific goal to restore, maintain, and enhance fish and wildlife populations to sustainable levels and also, when applicable, to harvestable levels, while protecting biological integrity and the genetic diversity of the watershed. Specific strategies in the subbasin summaries outline the need to minimize potential negative ecological interactions with other species and develop a local broodstock to assess the feasibility of re-introduction. Furthermore, the

subbasin summaries strongly promote increased biological diversity within both subbasins. Re-establishment of a native anadromous species would help accomplish that goal.

Biological Assessment and Management Plan, Mid-Columbia River Hatchery Program
The *Biological Assessment and Management Plan*, Mid-Columbia River Hatchery Program (NMFS et al. 1998) also recognizes the potential for coho reintroduction in mid-Columbia basins, although coho plans and analyses were recognized as being outside the scope of that document. Plans for the initial feasibility research phase of this project were outlined, revised, and analyzed in several documents, primarily *Mid-Columbia Coho Salmon Study Plan* 11/25/98 (YIN 1998); *Mid-Columbia Coho Reintroduction Feasibility Project Final Environmental Assessment and FONSI* (USDOE BPA 1999(b)); and *Biological Opinion: 1999 Coho Salmon Releases in the Wenatchee River Basin by the Yakama Indian Nation and the Bonneville Power Administration* (NMFS 1999). The release of coho from lower Columbia hatcheries into mid-Columbia tributaries is also recognized in the Columbia River Fish Management Plan, a court-mandated joint plan under the jurisdiction of *U.S. v. Oregon*, involving Federal, state and tribal fish managers in the Columbia basin (CTWSR et al. 1988).

Review Comments

The project sponsor (YN) has reduced their budget to FY 2002 funding level plus 3.4% for FY 2003. The budget will increase by 3.4% each year. Specific reductions will be identified during contracting with BPA.

Budget

FY03	FY04	FY05
Rec: $2,195,191 Category: High Priority	Rec: $2,269,828 Category: High Priority	Rec: $2,347,002 Category: High Priority

Project: – 200000200 – Final Phase of the Chumstick Culvert Replacement and Habitat Restoration Enhancement

Sponsor: Chelan County Conservation District

Short Description:

Restore salmon and steelhead passage in Chumstick Creek.

Abbreviated Abstract

Chumstick Creek is a 3rd order stream, which drains a 78 square mile subbasin of the Wenatchee River watershed. In 1994, Chumstick Creek was ranked second to Mission Creek as contributing to current and future potential water quality degradation in the Wenatchee River watershed (Hinds, 1994). The stream once supported healthy populations of chinook (Oncorhynchus tshawytscha), steelhead (Oncorhynchus mykiss) and bull trout (Salvelinus confluentus), however access to Chumstick Creek is now limited due to 23 culverts that are migrational barriers particularly at low flows (Bugert and Bambrick, 1996). The 1995-1996 floods and the high water runoff of 1997 affected several of these sites. The overall goal of this project is to enhance and improve salmonid migration

throughout the Chumstick drainage. In addition to replacing the 12 identified culverts, 7 to 10 sites will be enhanced by improving in-stream habitat and riparian vegetation. All in-stream work will be completed by spring 2004. Riparian vegetation will be replanted at each culvert site immediately following construction. Two other projects are presently being implemented within the watershed. They are a point source pollution project, funded by Washington Department of Ecology and the replacement of eight culverts, funded (in part) by the Bonneville Power Administration. A third project is still in the planning phase and would replace a partial barrier culvert on Highway 209/North Road. With the completion of all three projects, the health of the watershed will be improved dramatically. These projects will provide access to 78 square miles of habitat for anadromous and resident fish. In addition to the habitat for fish, the migrational corridor for waterfowl, bald eagles, spotted owls, and grey wolves will be improved. Monitoring sites will be set up throughout the watershed. The monitoring parameters will include water quality; cross section; sediment; habitat; and photo points.

Relationship to Other Projects

Project ID	Title	Nature of relationship
200000200	Remove Migrational Barriers and Restore Instream and Riparian Habitat on Chumstick Creek	Removes barriers downstream of this proposed project
199902300	Chumstick Creek North Road Culvert Replacement	Plans to replace partial barrier downstream of this project

Relationship to Existing Goals, Objectives and Strategies

Wenatchee Subbasin Summary (Draft 2001) The objective of this project is to restore habitat and reestablish salmon and trout passage within Chumstick Creek. This objective is identified in several goals, objectives and strategies in the Wenatchee Subbasin Summary.

This project is consistent with Goal 2, "Restore degraded areas, and return natural ecosystem functions to the subbasin…." The project is the final phase of a continuing project that will remove the final 12 barriers. Its overall purpose is to provide and improve fish passage to 78 square miles of habitat for steelhead, spring chinook and bull trout; allow for favorable streamflows at between the projects; prevent streambank and roadbed erosion; facilitate natural sediment and wood movement; and eliminate or reduce excess sediment loading. Also, the project is intended to eliminate or reduce dynamic changes in stream flow patterns through culverts that cause streambank erosion, undermining of roadbeds, and the washout of culverts.

Fish habitat conditions in the Chumstick watershed are summarized below in an excerpt from *Wenatchee Limiting Factors Analysis*:

> Chumstick Creek Drainage: All habitat attributes, except pool frequency, are highly degraded in Chumstick Creek primarily as a result of private land development and road densities on forest service lands (USFS 1999a). Some of these attributes affect channel morphology (e.g., loss of floodplain connectivity, alteration of disturbance regimes, loss of refugia and loss of off-channel habitat). In addition, Chumstick Creek experiences very low instream flows (2 cfs in August/September) which are exacerbated to an undetermined extent by private diversions and wells affecting surface flows. Presently, fish passage into the drainage is partially blocked at RM 0.3 for all fish species except steelhead trout; some adult individuals can navigate the culvert barrier at some flows. However, there are about 20 additional fish

passage barrier culverts upstream of the barrier at RM 0.3, water quality is degraded and high fine sediments may limit spawning success and food production. Given removal of fish passage barriers in the drainage, degraded habitat quality and low flow conditions will continue to limit salmonid production (Andonaegui 2001).

- Goal 2, Objective 1 is "Restore the distribution, diversity, and complexity of watershed and landscape scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted." By providing access and habitat restoration, this project improves distribution, diversity and complexity in Chumstick Creek.

- Goal 2, Objective 3 is "Maintain the spatial and temporal connectivity within and between watersheds. Included are the drainage network connections, floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia." This project will provide spatial and temporal connectivity between the headwaters of Chumstick Creek and the Wenatchee River (as well as other watersheds within the Wenatchee River system).

- Goal 2, Objective 3, Strategy 2 is "Improve and replace stream crossings (culverts) where fish passage barriers exist." This project specifically focuses on replacing culverts that are fish passage barriers. Strategy 3 is "Correct existing barriers and screen diversions and prevent new passage problems." This project corrects known existing fish passage barriers in Chumstick Creek. Strategy 5 is "Restore access to habitat for salmon by removing existing barriers, preventing creation of new barriers, and screening all diversions." As previously indicated, this project is designed to restore passage to 78 square miles of spawning, rearing and overwintering habitat for steelhead, spring chinook and bull trout. The project will improve fish passage and water quality in the private lands portion of the Chumstick Watershed.

- Goal 2, Objective 4 is "Restore habitat to support well-distributed populations of native plants and riparian-dependent species, including habitat necessary for sustaining salmonids at critical life history stages of spawning, rearing and migration." This project will improve the quality and quantity of mature riparian habitat available in Chumstick Creek thus allowing greater juvenile and adult survival at each freshwater stage and may result in more offspring surviving to begin migration to the ocean. This project will improve and restore the species composition at the project sites.

- Goal 2, Objective 4, Strategy 1 is "Protect, maintain and restore adult holding cover and ensure adequate water quantity for upstream migration." This project will improve the quality and quantity of habitat available in Chumstick Creek thus allowing greater juvenile and adult survival at each freshwater stage and may result in more offspring surviving to begin migration to the ocean.

- Goal 2, Objective 4, Strategy 5 is "Improve holding, resting and juvenile rearing habitat." This project will improve the quality and quantity of habitat available in

Chumstick Creek thus allowing greater juvenile and adult survival at each freshwater stage and may result in more offspring surviving to begin migration to the ocean.

- Goal 2, Objective 4, Strategy 6 is "Reverse degradation of holding, spawning, and rearing habitat in through habitat improvements either instream or riparian management to improve bank stability and shading of the water surface." This project will improve fish habitat by instream work of removal of passage barriers and the restoration of riparian areas at and adjacent to the individual project sites. Riparian restoration will improve streambank stability by the establishment of native riparian vegetation, which will in turn provide stream surface shading.

- Goal 2, Objective 4, Strategy 10 is "Improve riparian areas through planting trees and allowing growth (e.g. brush removal) where large woody debris is in poor condition. Dedicate streamside areas for growth of healthy multi-layered stand to provide shade and large woody debris." This project improves and establishes native riparian vegetation in Chumstick Creek at the project sites and allows for woody debris to become established from the restoration work to be completed. All disturbed areas will be completely revegetated with native riparian plant species beneficial to fish and wildlife, such as ponderosa pine, black cottonwood, water birch, alder, hawthorn, red-osier dogwood, and several willow species. These plants will provide shade, in-stream large organic diversity recruitment, overhanging cover, leaf litter and other detritus for aquatic food chain development in the project area.

- Goal 2, Objective 4, Strategy 11 is "Improve shading where it is currently poor by planting trees and tall brush. Dedicate streamside areas for riparian management." The landowner agreement that all landowners will sign (4 of the 12 have been signed already) to participate in this program indicates that they must maintain riparian vegetation that is reestablished at the project sites. Currently, many of these sites have less than desirable amounts of vegetation creating shade and streambank stabilization. The establishment and maintenance of riparian vegetation will improve upon these parameters.

- Goal 3 is "Restore, maintain, and enhance fish and wildlife populations, as described in 'Fish and Wildlife Status,' to sustainable levels and also, when applicable, to harvestable levels, while protecting biological integrity and the genetic diversity of the watershed." This project will restore and enhance fish and wildlife populations in the Wenatchee subbasin by accessing 78 square miles of additional habitat in Chumstick Creek. This will help to provide fish and wildlife populations the opportunity to reach sustainable levels and will assist with providing genetic diversity by allowing local adaptations within the restored habitat.

- Goal 3, Objective 1 is "Increase or establish salmonid stocks and runs to a level where they can maintain themselves through natural spawning and rearing." This project is designed to increase access to78 square miles of spawning, rearing and overwintering habitat for steelhead, spring chinook and bull trout. The project will help to allow these

species (and potentially coho if they are re-introduced in to the watershed) maintain themselves by having more quality habitat available to them.

- Goal 3, Objective 1, Strategy 1 Protect and restore spawning, rearing and migration habitat…" This project will restore historic spawning, rearing, migrational and overwintering habitat in Chumstick Creek by eliminating fish passage barriers.

- Goal 3, Objective 1, Strategy 8 is "Begin coho releases in areas of low risk to listed species that will be allowed to return as adults to spawn naturally." These areas currently are located in the Wenatchee basin at sites at Chumstick and Brender creeks. This project will provide 78 square miles of additional habitat in the Chumstick Creek watershed for chinook, steelhead and coho (once coho are introduced, as planned by the Yakama Nation).

- Goal 3, Objective 5 is "Inform and educate landowners, recreationists and the general public about the need to protect, restore and manage natural resources." Results from this project will be presented at workshops throughout eastern Washington. The focus audience of these workshops will be the private landowners. This project will be used as a demonstration site to teach landowners about the benefits of habitat restoration and working with the Endangered Species Act and natural resource related issues. In addition to the workshops, local schools will use this project as an outdoor classroom to teach students about watershed management. This will include aquatic, riparian, and upland habitats.

- Goal 3, Objective 5, Strategy 2 is "Inform the public about the condition of steelhead and salmon, and how the public can be involved in their recovery." Results from this project will be presented at workshops throughout eastern Washington. The focus audience of these workshops will be the private landowners. This project will be used as a demonstration site to teach landowners about the benefits of habitat restoration and working with the Endangered Species Act and how they can be involved with similar types of activities on their own land to help with the recovery of Chinook and steelhead.

- Goal 3, Objective 5, Strategy 3 is "Inform the public about the ramifications of having Endangered Species Act (ESA) listed salmon, steelhead and trout in their watersheds." Results from this project will be presented at workshops throughout eastern Washington. The workshops will be used to educate the private landowner about the various ramifications of having ESA listed species in their watershed.

- Goal 5 is "Improve management, regulation and enforcement, public involvement and government incentives and funding to maintain and restore natural ecosystem and the species they support." Through workshops explaining the results of this project, we hope to improve public involvement and knowledge, and enlist their participation in decisions regarding the management, regulation and enforcement, government incentives and funding that will assist with maintaining and restoring natural ecosystems and the species they support.

- Goal 5, Objective 4 is "Build support, involve and mobilize citizens to assist in restoration, conservation and enhancement of fish and wildlife habitat." This project will be used as an example of how public support and involvement of interested citizens can lead to the restoration, conservation and enhancement of fish and wildlife habitat. If it can be accomplished in Chumstick Creek (a relatively conservative area of Chelan County), it can be accomplished in other areas of Chelan County.

- Goal 5, Objective 4, Strategy 1 is "Use volunteer-based organizations where appropriate to gain the best use of limited funds." This project is a cooperative effort between the U.S. Fish and Wildlife Service, Natural Resource Conservation Service, Chelan County Conservation District, the Chumstick Watershed Community Alliance and the landowners of the lower Chumstick watershed. It was initiated and is broadly supported by the landowners of the area and is a perfect example of a volunteer based organization being used to gain the best use of limited funds.

FCRPS Biological Opinion, Action 150: "In subbasins with listed salmon and steelhead, BPA shall fund protection of currently productive non-Federal habitat, especially if at risk of being degraded, in accordance with criteria and priorities BPA and NMFS will develop by June 1, 2001; …[t]he Action Agencies shall coordinate their efforts and support offsite habitat enhancement measures undertaken by other federal, states, Tribes, and local governments; and….measures implemented by the Action Agencies to improve habitat can complement efforts by...local entities" (NMFS 2000). The Final Phase of the Chumstick Creek Restoration Project is a cooperative and coordinated effort between U.S. Fish and Wildlife Service, the Natural Resources Conservation Service, Washington Department of Fish and Wildlife, Trout Unlimited, Chumstick Community Watershed Alliance, Chelan County Conservation District, and local landowners.

Northwest Power Planning Council Columbia River Basin Fish and Wildlife Program (FWP). In the Habitat Strategies of the 2000 FWP, there is considerable emphasis on projects that will "build from strength" to "expand adjacent habitats that have been historically productive or have a likelihood of sustaining healthy populations by reconnecting or improving habitat" (NWPPC 2000).

Through the restoration of in-stream habitat, riparian vegetation and the reduction of migrational barriers on Chumstick Creek, a migrational corridor will be re-established for chinook, steelhead, and possible introduction of coho. This project will make available 78 miles of spawning and rearing habitat, which is currently virtually inaccessible.

This project will further the goals of the Fish and Wildlife Program by limiting habitat degradation and removing migrational barriers within the Wenatchee River watershed. It will improve the quality and quantity of habitat available in Chumstick Creek, thus allowing greater juvenile and adult survival at each freshwater stage and may result in more offspring surviving to begin migration to the ocean.

In addition to the habitat benefits to Chumstick Creek, this project will be used as a demonstration site to promote a watershed approach to bioengineering and habitat restoration. Results of this project will be presented at a number of workshops to educate local landowners on the benefits of restoration and how to work within the Endangered

Species Act. The project area will also serve as an outdoor classroom for high school students in the Leavenworth area. This project will provide an opportunity for students to get hands on experience in natural resources and stream restoration.

By replacing the 12 identified culverts and restoring the adjacent habitat, the Chumstick Watershed will have the following benefits:

- Improved migrational passage for salmonids and other aquatic species.
- Reduced sediment loads.
- Increased water quality through the use of riparian buffers.
- Increased riparian habitat, which will improve the travel and migrational corridor for neotropical migratory birds, waterfowl, Canada lynx, deer and other species. This will also improve the prey base for eagles.
- Access to 78 miles of spawning and rearing habitat for aquatic species and restoration of approximately 50 acres of riparian area along the creek.

Review Comments

Critical to realize upstream benefits. Should not be further delayed. The Chumstick Creek will potentially become a valuable coho stream. WA SRFB has approved funding of $273,100 for 2002 contingent on the completion of the North Road culvert project. Designs are currently being finalized for that project. The budget has been modified to reflect the project sponsors additional needs from BPA to complete two additional culvert replacements. NMFS has identified this project as a BiOp project.

Budget

FY2003	FY2004	FY2005
$0 Category: High Priority	$53,850 Category: High Priority	$2,700 Category: High Priority

New Projects

Project: – 29027 – Comprehensive Inventory and Prioritization of Fish Passage and Screening Problems in the Wenatchee and Entiat Subbasins

Sponsor: Washington Department of Fish and Wildlife, Yakima Screen Shop (WDFW-YSS)

Short Description:

Locate and evaluate all culverts, dams, fishways, water diversions, and other human-made features in the Wenatchee and Entiat subbasins, conduct habitat assessments, and prioritize all barriers and unscreened or inadequately screened water diversions.

Abbreviated Abstract

The Washington Department of Fish and Wildlife/Yakima Screen Shop proposes to conduct a watershed-based inventory of all fish passage barriers and unscreened or inadequately screened water diversion in the Entiat and Wenatchee sub basins. All fish

bearing streams will be walked and each human-made feature (culverts, dams, fishways, water diversions, and other) encountered will be assessed and prioritized following the protocols outlined in the *Fish Passage Barrier and Surface Water Diversion Screening Assessment and Prioritization Manual* (WDFW 2000). Habitat assessments will be conducted beginning with the first barrier encountered and continue upstream until the stream is no longer fish bearing. The data collected in this inventory will be stored in SSHEARbase, the statewide fish passage and screening database developed and maintained by Salmonid Screening, Habitat Enhancement and Restoration Section (SSHEAR) staff in Olympia.

Relationship to Other Projects

Project ID	Title	Nature of relationship
	Columbia Cascade Province Pump Screening	This project will provide current information to the existing pump screen inventory.

Relationship to Existing Goals, Objectives and Strategies

The NWPPC and BPA have made substantial investments in the Columbia River basin anadromous fish recovery effort. These investments are considered off-site mitigation for losses related to hydroelectric operations in the Columbia River, and are predicated on the fact that substantial wild salmon production potential still exists because of large expanses of accessible, high quality spawning and rearing habitat still exists in parts of the basin. This project will identify where high priority fish passage projects could be undertaken to increase fish distribution and production in the watersheds, and identify high priority screening projects to improve juvenile fish survival, which is believed to be important in improving overall egg-to-smolt survival of critically depressed stocks of naturally produced chinook, steelhead, and bull trout.

These surveys tie directly to other efforts being conducted within these watersheds by providing prioritization of corrections, and assessment of habitat conditions. The Fish Passage Task Force and the Salmon Recovery Funding Board have sanctioned this protocol. This protocol is also listed as a source of information in the Joint Natural Resources Cabinet's *Guidance on Watershed Assessment for Salmon,* an October 15, 2001 publication. The information from this protocol is a key element in WDFW's Salmon and Steelhead Habitat Inventory & Assessment Program and in the Ecosystem Diagnostic & Treatment (EDT) model being used in the Columbia Basin Salmon Recovery efforts at the watershed level.

NMFS 2000 Biological Opinion & Reasonable and Prudent Alternatives (RPA) The Biological Opinion (BiOp) encourages the Action Agencies to support a basin-wide recovery strategy (NMFS 2000). The following information is included to demonstrate that this proposal will support the BiOp.

The BiOp lists measures to avoid jeopardy and gives specific tributary habitat objectives, which include providing passage and diversion improvements and supporting overall watershed health of riparian and upland habitat.

RPA Action 149 addresses passage and screening problems. While initially specifying 3 priority areas (Lemhi, Methow, Upper John Day), it indicates that the program should be expanded, in coordination with NWPPC. The BOR is designated the

lead. At the end of 5 years, work will be underway in at least 15 subbasins (including the Entiat beginning in 2003, and the Wenatchee beginning in 2004), with a 10-year window to achieve results.

Entiat Limiting Factors Analysis (Andonaegui 2001) In an assessment of causes of fish blockages, the Limiting Factors Analysis calls for an "inventory of these dams or dikes that act as fish blockages…to be conducted in the Entiat watershed" and for "a culvert barrier survey…to be completed in this watershed." It also notes that no prioritization of barrier removals exists and that a "list needs to be developed."

Entiat Subbasin Summary (Draft 2001) supports this project. As called for in Section 2, Goal 1, Objective 1, Strategies 3 and 4, this project would "[i]nventory and assess the extent to which dams and dikes in the Entiat watershed act as fish passage barriers (Strategy3) and identify culvert barriers and map and the incorporate the information into a database (Strategy 4).

Wenatchee Subbasin Summary (Draft 2001) supports this project. As called for in Section 2, Goal 4, this project would "increase the information and knowledge needed to protect, restore, and manage fish, wildlife and their habitats." By completing an inventory of fish barriers and prioritizing fish passage problems, this project addresses Goal 4, Objective 1, Strategy 11, (which states "complete watershed-based inventories and prioritization of fish passage problems").

Upper Columbia Salmon Recovery Board, A Strategy to Protect and Restore Salmonid Habitat in the Upper Columbia Region, A Discussion Draft Report (Upper Columbia Regional Technical Team [RTT] 2001), identifies the following restoration measures in 3.2 Habitat Restoration:

> The highest priority for increasing biological productivity is to restore the complexity of the stream channel and floodplain. The RTT recommends a range of strategies for habitat restoration in the Upper Columbia Region. Examples of restoration measures would include, but not be limited to screening water intakes to prevent impingement or stranding of juvenile fish…and removing passage barriers.

Review Comments

Assure work is coordinated with Chelan County. The reviewers recommend reducing the staff proposed by 1 FTE and find other sources for the 2 4x4 pickup trucks in 2003. The budget has been reduced to reflect these changes. NMFS has identified this project as a BiOp project.

Budget

FY2003	FY2004	FY2005
$277,436 Category: High Priority	$277,436 Category: High Priority	$277,436 Category: High Priority

Project: – 29028 – Fabricate and Install Three New Fish Screens on Wenatchee River Diversions

Sponsor: Washington Department of Fish and Wildlife, Yakima Screen Shop (WDFW-YSS)

Short Description:

WDFW, YSS proposes to fabricate and install 2 new fish screening facilities, and rehabilitate one existing screening facility, on 3 irrigation diversions on the Wenatchee River and tributaries. The facilities will be in compliance with current criteria.

Abbreviated Abstract

The Washington Department of Fish and Wildlife/Yakima Screen Shop proposes to fabricate and install three fish screening facilities located on the Wenatchee River, and several tributaries to the Wenatchee River. Obsolete Wenatchee River basin fish screens constructed in the 1930's, 40's, 50's and 60's must be replaced or updated to comply with current, regional fish screen biological protection criteria adopted by Columbia Basin Fish and Wildlife Authority Fish Screening Oversight Committee in 1995. The project objective is to provide 100 percent protection from mortality and/or injury for all species and life stages of anadromous and resident salmonids, including bull trout, spring chinook, and steelhead that are listed as "threatened" and "endangered" under ESA (6/98, 3/99, and 3/99, respectively). Old screens in the Wenatchee basin, and in other Columbia River sub basins, may provide fair protection for large (4-6 inch long) yearling smolts, but poor protection for fry and fingerling life stages. Mortality of fry and fingerlings by irrigation diversions may reduce subsequent smolt production and hampers efforts to restore depressed salmon and steelhead populations through natural production or hatchery supplementation. Biological evaluations of completed Phase II fish screen facilities in the Yakima River basin by Battelle, Pacific Northwest National Laboratory under Project # 198506200 has quantified survival and guidance rates approaching 100% (ranging from 90 to 99%).

Relationship to Other Projects

Project ID	Title	Nature of relationship
26015	Fish Screen Construction	Regional efforts to improve anadromous juvenile fish survival at water diversions may contribute to higher Columbia Basin natural smolt survival and outmigration

Relationship to Existing Goals, Objectives and Strategies

The NWPPC and BPA have made substantial investments in the Columbia River basin anadromous fish recovery effort. These investments are considered off-site mitigation for losses related to hydroelectric operations in the Columbia River, and are predicated on the fact that substantial wild salmon production potential still exists because of large expanses of accessible, high quality spawning and rearing habitat still exists in parts of the basin. Improved juvenile fish survival at Wenatchee basin gravity water diversions is widely believed to be important in improving overall egg-to-smolt survival of critically depressed stocks of naturally-produced chinook, steelhead, and bull trout.

NMFS 2000 Biological Opinion & Reasonable and Prudent Alternatives (RPA) The Biological Opinion encourages the Action Agencies to support a basin-wide recovery strategy. The following information is included to demonstrate that this proposal will support the BiOp (NMFS 2000).

The BiOp lists measures to avoid jeopardy, and gives specific tributary habitat objectives, which include providing passage and diversion improvements, and supporting overall watershed health of riparian and upland habitat.

RPA Action 149 addresses passage and screening problems. While initially specifying 3 priority areas (Lemhi, Methow, Upper John Day), it indicates that the program should be expanded, in coordination with NWPPC. The BOR is designated the lead. At the end of 5 years, work will be underway in at least 15 sub basins (including the Wenatchee beginning in 2004), with a 10-year window to achieve results.

Northwest Power Planning Council Columbia River Basin Fish and Wildlife Program, This proposal is consistent with the Fish and Wildlife Program (NWPPC 2000), because it addresses imminent risk to listed species—name them—and has direct benefits, including these:

- Connect patches of high quality habitat or extend habitat
- Meets multiple priority objectives
- Collaborative effort with synergistic effects
- Recommended by an action plan
- Approved by state or tribal plan

Examples given in the Program include irrigation screens and passage (including culvert replacement) and supporting local ESA recovery efforts.

Upper Columbia Salmon Recovery Board, A Strategy to Protect and Restore Salmonid Habitat in the Upper Columbia Region, A Discussion Draft Report (Upper Columbia Regional Technical Team [RTT] 2001), identifies the following restoration measures in 3.2 Habitat Restoration:

> The highest priority for increasing biological productivity is to restore the complexity of the stream channel and floodplain. The RTT recommends a range of strategies for habitat restoration in the Upper Columbia Region. Examples of restoration measures would include, but not be limited to: screening water intakes to prevent impingement or stranding of juvenile fish (# 4)…and removing passage barriers (# 7).

Wenatchee Subbasin Summary (Draft 2001) This proposal supports specific key fish recovery elements described in the Wenatchee Subbasin Summary, specifically screening (fabrication and installation). This proposal also encourages fish recovery by providing access to habitat that is free of unscreened diversions. Goal 2 is "Restore degraded areas, and return natural ecosystem functions to the subbasin…," and its Objective 3 is "Restore the spatial and temporal connectivity within and between watersheds." This project helps accomplish this goal and objective by implementing Strategy 1, "Improve fish screens within the river system;" Strategy 3, "Correct existing barriers and screen diversions and prevent new passage problems; and Strategy 5, "Restore access to habitat for salmon by

removing existing barriers, preventing creation of new barriers, and screening all diversions."

- Goal 2, Objective 4, "Restore habitat to support well-distributed populations of native plant, and riparian-dependent species, including habitat necessary for sustaining salmonids at critical life history stages of spawning, rearing and migration." By providing access to additional habitat (including through fish screen improvements-Strategy 4), this project will contribute to greater juvenile and adult survival at freshwater life history stages.

Review Comments

These are important diversions that need to be screened. There is no cost share represented in the proposed budget. The budget should be reduced by 15% in order to encourage cost share by the landowners or other responsible parties. A contingency of $17,381 is identified in the proposal. These funds should be removed from the proposal. The budget has been modified to reflect these changes. NMFS has identified this project as a BiOp project.

Budget

FY2003	FY2004	FY2005
$184,976 Category: High Priority	$13,500 Category: High Priority	$13,845 Category: High Priority

Project: – 29039 – The Effects of Fine Sediment on the Hyporheic Zone: Monitoring and Evaluating the Influence of Hyporheic Exchange Flows on Stream Temperature

Sponsor: U.S. Forest Service – Pacific Northwest Research Station

Short Description:

Implement sediment and temperature monitoring; research to evaluate the influence of hyporheic exchange flows on stream temperature and thermal refugia; research to evaluate the influence of fine sediment on the hyporheic zone.

Abbreviated Abstract

Exchange flows of stream water through the hyporheic zone have the potential to significantly modify stream temperatures – both by dampening daily temperature fluctuations and by creating thermal refugia. However, the hyporheic zone is influenced by anthropogenic changes to streams. Hyporheic exchange is driven by head gradients created by channel morphologic features and the amount of exchange flow is a function of sediment texture. Simplification of stream channels caused by confinement, channelization, or reduced LWD and increased inputs of fine sediment caused by accelerated erosion can limit the role of the hyporheic zone in stream ecosystem processes. This project is designed to examine the effect of fine sediment on stream temperatures, through their effect on hyporheic exchange flows. Sediment and water temperature will be

monitored in spawning gravels of tributaries of the Wenatchee River. Sites with differing fine-sediment accumulations will be used to evaluate the effect of sediment on hyporheic exchange flows, and to estimate the importance of the hyporheic zone in either moderating stream temperatures or creating thermal refugia. The research results will be used to evaluate the potential to use hyporheic restoration as a tool for addressing problems of stream temperature, and thus helping restoring and maintaining habitat quality for salmonids in the Interior Columbia Basin.

Relationship to Other Projects

Project ID	Title	Nature of relationship
na		

Relationship to Existing Goals, Objectives and Strategies

Human alterations have been identified in watershed assessments throughout the Columbia River Basin because they limit connectivity between streams and their floodplains. Hyporheic exchange flows also contribute to the connectivity of streams with adjacent riparian ecosystems (Wondzell and Swanson 1996b); link mainstem streams with secondary and back channels (Wondzell and Swanson 1996a and 1999, Fernald et al. 2001); and in some cases, link streams to off-channel wetlands. Among other effects, the hyporheic zone influences both nutrient cycling and water temperature in streams. Despite the potential importance of the hyporheic zone in stream ecosystem processes, the hyporheic zone has not been specifically identified in many assessments of the Columbia River Basin [e.g. The All H's paper (Federal Caucus 2000)] nor specifically included in action items or restoration plans (NMFS 2001–BiOp, Chapter 9 & Appendix H; NWPPC 2000). The hyporheic zone is identified exactly once in the Information Needs section of the Wenatchee Subbasin Summary: "The role of upslope forest and range management on water balance and hyporheic flows needs to be further understood."

Wenatchee Subbasin Summary (Draft 2001) The research and monitoring program identified in this proposal supports the needs identified in the subbasin summaries for the Columbia Cascade Province, and for Sections 1 and 2 of the Wenatchee Subbasin in particular. The Wenatchee subbasin has been selected as one of 16 priority subbasins in which to address problems with tributary habitat on non-Federal land, and has also been selected by the BLM and Forest Service as one of seven subbasins in the Columbia River Basin ranked as highest priority for anadromous fish habitat restoration on Federal lands (Federal Caucus 2000). The subbasin summary identifies problems with connectivity, sedimentation and water temperature for the mainstem Wenatchee River and several tributary streams, some of which currently provide critically important spawning and rearing habitat. The hyporheic zone and its function in stream ecosystem processes are intimately connected to the problems identified in the subbasin summary for these streams. For example, the subbasin summary identifies the lower Little Wenatchee River and Rainy Creek as having reduced large wood (LWD) input, increased sediment delivery and a disrupted sediment budget resulting from debris slides. The mainstem Little Wenatchee also has problems with high stream temperatures. In Nason Creek, road and residential development have degraded spawning habitat; roads, railroads and powerlines along the creek have confined the channel; roads and timber harvest are important sources of

accelerated stream sedimentation; and changes in flow timing and duration have accelerated bank erosion. Similar problems have been identified in lower Icicle Creek. Both Peshastin Creek and Chumstick Creek share the problems identified above, but in addition, they are influenced by agriculture, stream channelization, numerous barriers to fish passage and very low instream flows due to diversions and wells. These problems are described in detail in the Wenatchee Subbasin Summary, but in general are characterized by loss of access to spawning and rearing habitat, loss of floodplain function, increased amounts of fines in streambed sediment and increased inputs of fines from upslope erosion, degraded riparian conditions, and degraded water quality – all of which limit the ability of habitat to fully sustain salmonid populations within the Wenatchee River subbasin.

The research proposed here, is important, because it focuses on the hyporheic zone – a relatively poorly understood component of the aquatic/riparian system, but one that is sensitive to the watershed problems listed above, and in turn, influences stream ecosystem processes. Channel simplification through confinement, channelization and loss of large wood all lead to the loss of those morphologic features that drive hyporheic exchange flows (i.e., pool-riffle or pool-step sequences, channel sinuosity, the presence of secondary or back channels, and split channels and island bars). Hyporheic exchange flows can be further reduced, or even eliminated, by the intrusion of fines into streambed sediment. Reduction in hyporheic exchange flows can change stream temperature regimes. If hyporheic exchange is large, relative to stream discharge, temperature changes would be apparent at the reach scale. Alternatively, where hyporheic exchange is small relative to stream discharge, they would contribute to the development of small-scale spatial variations in temperature that could be utilized as thermal refugia – providing water colder than ambient stream temperatures in summer and providing water warmer than ambient stream temperatures in winter.

FCRPS Biological Opinion The research and monitoring program described in this proposal is consistent with the FCRPS Biological Opinion (NMFS 2001). For example, the FCRPS BiOp (NMFS 2001, section 9.6.2.1) identified actions related to tributary habitat and monitoring. These include improving water quality to comply with water quality standards in spawning and rearing areas, basin-wide monitoring programs and the establishment of common data management systems.

Specifically, Action 152 will be supported through this proposal by sharing water quality data for the development of 303(d) lists and TMDLs. Monitoring and evaluation data collected will be made available through existing data management structures. Portions of Misson Creek, the Little Wenatchee River, the Wenatchee River, Icicle Creek, Peshastin Creek, and Nason Creek are all listed on the State of Washington's 303(d) list for failure to meet temperature standards (EPA year unknown).

The research proposed here partially supports Action 180 "…to develop and implement a basin-wide hierarchical monitoring program." in that the data collected through this project will be available to other agencies for use in their monitoring efforts. Also the data collected will constitute baseline data useful in the investigation of long-term trends in fine sediment and water temperature. Lastly, the detailed data collected in this project will be useful in "…ground-truthing of regional databases."

The research proposed here partially supports Action 198 to "…develop a common data management system for … water quality, and habitat data." Again, the data collected will constitute baseline data useful in the investigation of long-term trends in fine sediment and water temperature.

All H's Paper Objectives of the All H's Paper Habitat Program call for the protection of existing high quality habitat, restoration of currently degraded habitat, and prevention of further degradation of existing habitat (Federal Caucus 2000). The All H's Paper identifies spawning and incubation habitats as at risk from siltation of spawning gravels and temperature and other water quality problems. Similarly, juvenile rearing is at risk from loss of pools, loss of channel complexity, connectivity with floodplain and off channel habitats, overall habitat simplification, and both temperature and water quality problems (Federal Caucus 2000). Again, these issues are intimately connected with the hyporheic zone and its influence on stream ecosystem processes and will be examined in the research, monitoring and evaluation program proposed here.

Northwest Power Planning Council Columbia River Basin Fish and Wildlife Program Finally, the Columbia River Basin Fish and Wildlife Program – Basinwide Biological Objectives (NWPPC 2000) calls for both protecting and restoring freshwater habitat and for restoring more natural hydrologic conditions. Specifically, the Fish and Wildlife Program calls for protecting or restoring both ecological and hydrological connectivity between rivers and adjacent ecosystems; for protecting or restoring functions of key alluvial river reaches; and for restoring more natural seasonal fluctuations in discharge and water temperature, and for reducing accelerated rates of erosion to restore more natural stream sediment budgets. Again, hyporheic exchange flows are a key component in the connectivity between streams and adjacent ecosystems. This connectivity is especially important in wide alluvial river reaches that are characterized by extensive hyporheic zones (Stanford et al. 1994, Baxter and Hauer 2000, Kasahara 2000) with abundant exchange flows that connect rivers to their floodplains, side channels and riparian zones.

Review Comments

Objectives need to be clarified. NMFS has identified this project as a BiOp project.

Budget

FY2003	FY2004	FY2005
$102,039 Category: Recommended Action	$106,121 Category: Recommended Action	$110,365 Category: Recommended Action

Project: – 29053 – Icicle/Wenatchee Habitat Acquisition

Sponsor: Chelan-Douglas Land Trust (CDLT)

Short Description:

Acquire and protect a critical 50-acre area of salmonid spawning and rearing habitat at the confluence of the Icicle and Wenatchee rivers.

Abbreviated Abstract

The Chelan-Douglas Land Trust seeks to acquire and permanently protect the wetland, floodplain, and riparian complex at the mouth of the Icicle and Wenatchee rivers. This 50-acre site is the second largest area of undeveloped floodplain on the lower Icicle and is one of the most important salmonid spawning and rearing areas in the region. This area contributes to habitat used by endangered spring chinook, endangered steelhead, threatened bull trout, fall chinook, cutthroat trout, and the most important remaining run of Columbia Basin sockeye salmon. There is great potential to develop approximately one half mile of additional high quality off channel rearing habitat on this property. This area is subject to rapid and extensive habitat modification due to development pressure in the Leavenworth area. If this property is not acquired now it will be far more expensive or unavailable in the future. Protection of this site would also complement and enhance an adjacent 22-acre site owned by the WDFW. Additionally, because of the proximity of this site to Leavenworth, and the planned development of an Audubon Learning Center in Leavenworth, this property has the potential to become an important area for environmental learning and study. The Chelan-Douglas Land Trust will work closely with WDFW, USFWS, Trout Unlimited, Icicle Canyon Coalition, WDOE, the Yakama Nation, and the Chelan County Conservation District to monitor, steward, and improve this site.

Relationship to Other Projects

Project ID	Title	Nature of relationship
	Chelan County HCP	Protects key habitat
	Rock Island and Rocky Reach HCP	Protects key habitat
199604000	Mid-Columbia Coho Reintroduction Feasibility Study	Protects key habitat
	Icicle Creek Restoration Project	Protects key habitat

Relationship to Existing Goals, Objectives and Strategies

Wenatchee Limiting Factors Analysis

The rationale for this project is clear and well documented. High quality spawning habitat, and especially rearing habitat, is in short supply on the Icicle and Wenatchee rivers (Andonaegui 2001).

2000 FCRPS Biological Opinion specifically supports this project. That document states, "Over the long term, the habitat strategy has three overarching objectives: 1) protect existing high quality habitat, 2) restore degraded habitats on a priority basin and connect them to other functioning habitats, and 3) prevent further degradation of tributary and estuary habitats and water quality (http://www.cbfwa.org/reviewforms/LongRPA, page 9). Action 150 from this document states: "in subbasins with listed salmon and steelhead, BPA shall fund protection of currently productive non-Federal habitat, especially if at risk of being degraded, in accordance with criteria and priorities BPA and NMFS will develop by June 1, 2001." The document goes on to say, "This opinion puts high priority on protecting habitat that is currently productive, especially if it represents a habitat type that already limits an ESU's productivity (e.g., summer rearing or overwintering habitat). BPA

should protect these habitats through conservation easements, acquisitions, or other means, working with non-profit land conservation organizations and others." (http://www.cbfwa.org/reviewforms/LongRPA_1.pdf, page 10) This project fits these criteria perfectly.

Wenatchee Subbasin Summary (Draft 2001) Further support for this project can be found in the Wenatchee Subbasin Summary, which includes the following goals, objectives, and strategies that directly demonstrate the value of this project.

Acquiring the area near the mouth of Icicle Creek and the Wenatchee River for their fish and wildlife values will make it possible to accomplish Goal 1, which is to "maintain and protect existing high quality habitat and the native populations inhabiting those areas." This project will help achieve related Goal 1 objectives and strategies: Objective 1 is "Maintain the distribution, diversity, and complexity of watershed and landscape scale features [including large woody debris, Strategy 3] to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted." Objective 2, Strategies 2 and 3 call for "maintaining biological diversity associated with native fish and wildlife species and their habitat to a point where they no longer need protection under the Endangered Species Act.

- Goal 1, Objective 3, and related Strategies 1 and 2, involve "maintaining the spatial and temporal connectivity within and between watersheds." Objective 4 and Strategies 1,2,4 and 5 are related to "maintaining favorable streamflows and riparian conditions."

- Goal 2, "Restore degraded areas, and return natural ecosystem functions to the subbasin…also supports the property acquisition and improvement that is proposed by this project. Objective 2 and Strategy 1 call for "restoration of biological diversity associated with native species and ecosystems, including (Strategy 2) allowing for…a more diverse riparian forest type. Objective 3 supports "restoration of the spatial and temporal connectivity within and between watersheds. Objective 4 and Strategies 1, 2, 3, 5, 6, 7, 9, 10, 11, 14, 15 and 17 refer to a variety of relevant actions that will help "restore habitat to support well-distributed populations of native plant, and riparian-dependent species, including habitat necessary for sustaining salmonids at critical life history stages of spawning, rearing and migration." Objectives 5 and 6 and their strategies address the need to increase amounts of water and water quality to protect and restore fish habitat.

Upper Columbia Salmon Recovery Board, A Strategy to Protect and Restore Salmonid Habitat in the Upper Columbia Region, A Discussion Draft Report (Upper Columbia Regional Technical Team [RTT] 2001). The regional importance of this project is demonstrated by a draft version of *A Strategy to Protect and Restore Salmonid Habitat in the Upper Columbia Region* (Bugert 2001). This document is based on the policies set by the Joint Natural Resource Cabinet in the Statewide Salmon Recovery Strategy (SSRS 1999, page 36). A key recommendation from this document is that a greater portion of state and federal funds should be allocated to protection than to restoration. In the *Strategy* the RTT states that the highest priority for the Upper Columbia Region should be to allow unrestricted stream channel migration, complexity, and flood plain function and that

protection and restoration should focus on maintaining the best remaining examples of biological integrity, connectivity, and diversity.

This project protects land on both the lower Icicle River and along the mainstem of the Wenatchee River. Both these areas are designated as Category 2 (high priority) watersheds in the *Strategy*. The Icicle is also designated as a Key Watershed in the Northwest Forest Plan. The key recommendations for these watersheds are listed below.

- Protect remaining floodplain and riparian habitat with emphasis placed on habitat downstream of the Leavenworth Hatchery. (Icicle River)
- Protect existing riparian habitat and channel migration floodplain function. (Wenatchee River)
- Restore channel migration to normative function. (Wenatchee River)
- If restoration is not possible, improve fish access to oxbows and historical side channels. (Wenatchee River)

This project is based on and fulfills all those objectives. This property is up for sale. The sale and continued development of this property will lead to habitat degradation, loss of channel migration, and loss of floodplain function. It is important to acquire this property now, before the opportunity is lost forever.

Review Comments

Appraisal price will likely be less than budget amount. Encourage cost share. Potential lost opportunity. The review group would like to see alternative strategies for acquiring this property (cost share, riparian parcels only, conservation easements). This project received $1,337,800 from the WA SRFB for 2003. The budget has been adjusted by the project sponsor to reflect this. NMFS has identified this project as a BiOp project.

Budget

FY2003	FY2004	FY2005
$257,500 Category: High Priority	$79,000 Category: High Priority	$26,000 Category: High Priority

Table 9. Subbasin Summary FY 2003 - Funding Proposal Matrix

Project Proposal ID	199604000	200000200	29027	29028	29039	29053
Provincial Team Funding Recommendation	**High Priority**	**High Priority**	**High Priority**	**High Priority**	**Recommended Actin**	**High Priority**
Overall Wenatchee Subbasin Goals and Objectives						
The overall goal is to protect, restore and enhance fish and wildlife and their habitats in the Wenatchee subbasin to provide ecological, cultural, economic, and recreational benefits.	X	X	X	X	X	X
Goal 1. Maintain and protect existing high quality habitat and the native populations inhabiting those areas, as described in "Habitat Areas and Quality" and "Fish and Wildlife Status."						X
Objective 1. Maintain the distribution, diversity, and complexity of watershed and landscape scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.						X
Objective 2. Maintain biological diversity associated with native species and ecosystems.						X
Objective 3. Maintain the spatial and temporal connectivity within and between watersheds. Included are the drainage network connections, floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia.						X
Objective 4. Maintain favorable streamflows and riparian conditions.						X
Objective 5. Maintain the water quality necessary to support healthy riparian, aquatic, and wetland ecosystems.						
Goal 2. Restore degraded areas, and return natural ecosystem functions to the subbasin as described in "Habitat Areas and Quality."		X		X		X
Objective 1. Restore the distribution, diversity, and complexity of watershed and landscape scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.		X				
Objective 2. Restore biological diversity associated with native species and ecosystems.						X
Objective 3. Restore the spatial and temporal connectivity within and between watersheds. Included are the drainage network connections, floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia.				X		X
Objective 4. Restore habitat to support well-distributed populations of native plant, and riparian-dependent species, including habitat necessary for sustaining salmonids at critical life history stages of spawning, rearing and migration.		X		X		X
Objective 5. Increase amounts of water to protect and restore fish habitat.						X
Objective 6. Restore the water quality necessary to support healthy riparian, aquatic, and wetland ecosystems.						X
Goal 3. Restore, maintain, and enhance fish and wildlife populations, as described in "Fish and Wildlife Status," to sustainable levels and also, when applicable, to harvestable levels, while protecting biological integrity and the genetic diversity of the watershed.	X	X				
Objective 1. Increase or establish salmonid stocks and runs to a level where they can maintain themselves through natural spawning and rearing.	X	X				
Objective 2. Maintain and rebuild viable and appropriately distributed native wildlife populations.						
Objective 3. Use the strategies and accomplish the objectives described in Goals 1 and 2 to maintain and restore the habitat upon which Wenatchee subbasin fish and wildlife						

Project Proposal ID	199604000	200000200	29027	29028	29039	29053
depend.						
Goal 4. Increase the information and knowledge needed to protect, restore and manage fish, wildlife and their habitats.	X		X		X	
Objective 1. Provide scientific basis for protecting aquatic ecosystems and enable planning for sustainable resource management	X		X		X	
Objective 2. Accurately assess the responses in fish and wildlife populations and their habitats to specific strategies undertaken.	X					
Objective 3. Assess water supply and use in the Wenatchee subbasin						
Objective 4. Determine adequacy of existing instream flows within Wenatchee subbasin for fish and community needs.						
Objective 5. Inform and educate landowners, recreationists and the general public about the need to protect, restore and manage natural resources.		X				
Goal 5. Improve management, regulation and enforcement, public involvement and government incentives and funding to maintain and restore natural ecosystem and the species they support.						
Objective 1. Make decision-making about and management of fish, wildlife populations and their habitats more effective.						
Objective 2. Strengthen plans and regulations to restore and maintain habitat to support healthy, harvestable quantities of fish.	X					
Objective 3. Use incentives and government funding to support the protection and restoration of fish, wildlife and their habitats.						
Objective 4. Build support, involve and mobilize citizens to assist in restoration, conservation and enhancement of fish and wildlife habitat.		X				

These projects are referenced by ID above:
199604000 – Evaluate The Feasibility And Risks Of Coho Reintroduction In Mid-Columbia
200000200 – Final Phase of the Chumstick Culvert Replacement and Habitat Restoration Enhancement
29027 – Comprehensive Inventory and Prioritization of Fish Passage and Screening Problems in the Wenatchee and Entiat Subbasins
29028 – Fabricate and Install Three New Fish Screens on Wenatchee River Diversions
29039 – The effects of fine sediment on the hyporheic zone: monitoring and evaluating the influence of hyporheic exchange flows on stream temperature.
29053 – Icicle/Wenatchee Habitat Acquisition

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