INTRODUCTION

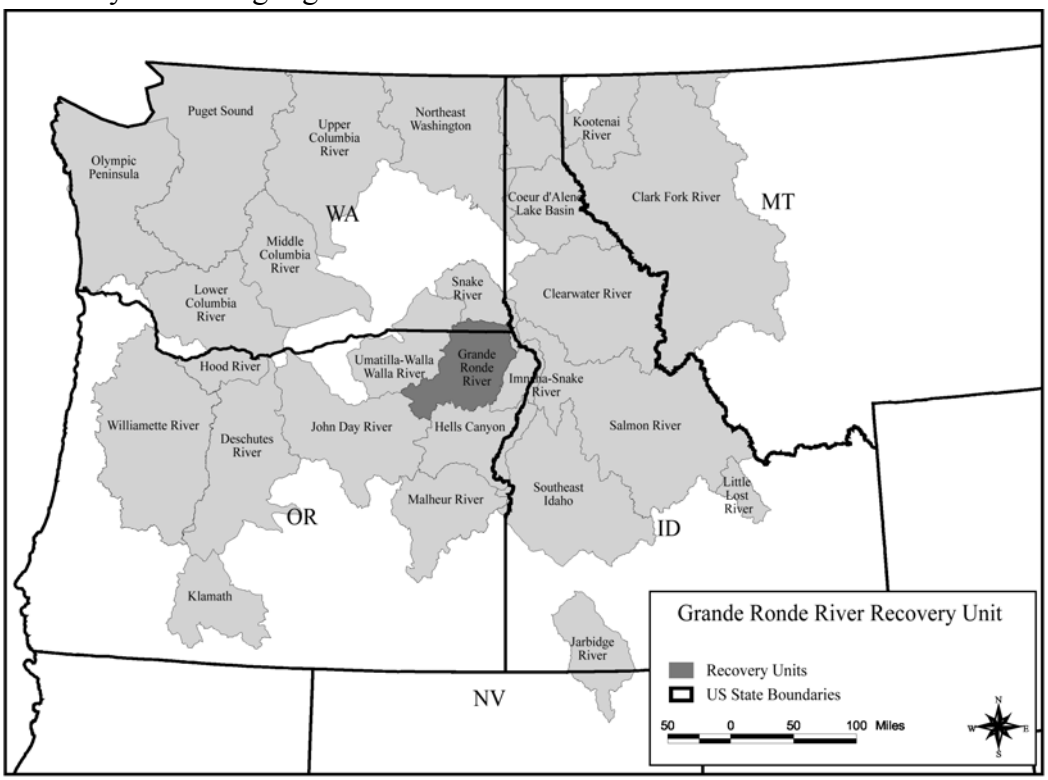
Recovery Unit Designation

The U.S. Fish and Wildlife Service issued a final rule listing the Columbia River and Klamath River populations of bull trout (*Salvelinus confluentus*) as a threatened species under the Endangered Species Act on June 10, 1998 (63 FR 31647). An emergency rule listing the Jarbidge River population as endangered due to road construction activities was published on August 11, 1998 (63 FR 42757), and the population was subsequently listed as threatened on April 8, 1999 (64 FR 17110), when the emergency rule expired. The Coastal-Puget Sound and St. Mary-Belly River populations were listed as threatened on November 1, 1999 (64 FR 58910), which resulted in all bull trout in the coterminous United States being listed as threatened (Figure 1). The five populations discussed above are listed as distinct population segments, *i.e.*, the U.S. Fish and Wildlife Service has concluded that they meet the requirements of the joint policy with the National Marine Fisheries Service regarding the recognition of distinct vertebrate populations (61 FR 4722).

As required by the Endangered Species Act, the U.S. Fish and Wildlife Service has developed a plan which, when implemented, will lead to the recovery and ultimate delisting of the Columbia River Distinct Population Segment of bull trout. An overall recovery unit team with membership from the states of Washington, Oregon, Idaho, and Montana as well as Tribes was established to develop a framework for the recovery plan, provide guidance on technical issues, and insure consistency through the recovery planning process. Within the Columbia River distinct population segment, the recovery unit team has identified 22 recovery units. Recovery unit teams were established to identify specific reasons for decline and develop actions necessary to recover bull trout.

Recovery units were identified based on three factors: (1) recognition of jurisdictional boundaries, (2) biological and genetic factors common to bull trout within a specific geographic area, and (3) logistical concerns for coordination,

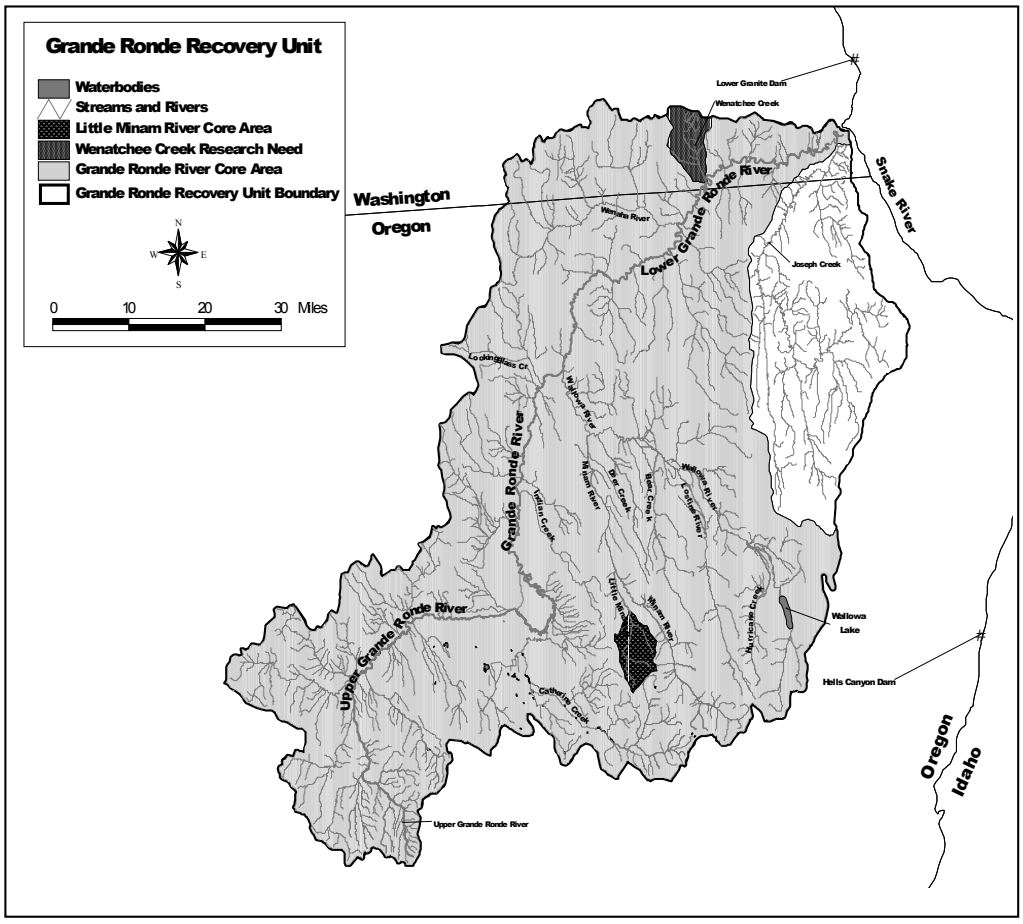
Figure 1. Bull trout recovery units in the United States. The Grande Ronde River Recovery Unit is highlighted.



development, and implementation of the recovery plan. To facilitate the recovery planning process and avoid duplication of effort, the recovery unit team considered the frameworks put forth in Kostow (1995) and Buchanan *et al.* (1997) to develop recovery units in Oregon. The Grande Ronde River subbasin was identified as one of the 22 recovery units for bull trout within the Columbia River Distinct Population Segment.

The Grande Ronde River Recovery Unit includes bull trout from one watershed, the Grande Ronde River (Figure 2). The majority of this watershed is in the State of Oregon. The lower portion of the Grande Ronde River, tributaries to this portion of the river, as well as tributaries to the mainstem of the Wenaha River (a major tributary to the Grande Ronde River) are located in the State of Washington.

Figure 2. Grande Ronde River Recovery Unit (Grande Ronde and Little Minam Core Areas) for bull trout in Oregon and Washington.



After considering information that is currently available, including that in Ratliff and Howell (1992), Kostow (1995), Buchanan *et al.* (1997), and Washington Department of Fish and Wildlife (1998), the recovery unit team identified nine extant, local populations (or stocks) of bull trout within the Grande Ronde River subbasin. A local population is considered to be fish of a given species which spawn in a particular lake or stream(s) at a particular season, and which to a substantial degree do not interbreed with any group spawning in a different place, or in the same place at a different season (see Chapter 1).

The risk of any given local population going extinct varies within the recovery unit. The risk of the Little Minam River and Wenaha River local populations going extinct is low (Ratliff and Howell 1992; Washington Department of Fish and Wildlife 1998). Relative to extinction, the Minam River/Deer Creek complex is composed of a low risk component (Minam River) (Ratliff and Howell 1992) and a component of special concern (Deer Creek) (see Buchanan *et al.* 1997). The risk of the Upper Hurricane Creek local population going extinct is of special concern (Ratliff and Howell 1992). Relative to extinction, the Lostine River/Bear Creek complex is composed of a moderate risk component (Lostine River) and a component of special concern (Bear Creek) (Ratliff and Howell 1992). The risk of the local populations in the Upper Grande Ronde River complex and Indian Creek (Ratliff and Howell 1992) as well as Catherine Creek and Lookingglass Creek (Buchanan *et al.* 1997) going extinct is moderate. A local population of bull trout previously from Wallowa Lake/River is now considered to be extinct (Ratliff and Howell 1992). From the Washington portion of the Grande Ronde River subbasin, anecdotal reports also exist of bull trout in Wenatchee Creek. However, Washington Department of Fish and Wildlife (1998) did not describe or distinguish bull trout from Wenatchee Creek as a distinct local population. Additional research needs to be conducted on whether such a local population exists and its relative risk of extinction.

All local populations identified in the recovery unit are believed to be native fish. There have been no known releases of hatchery-origin bull trout anywhere in the recovery unit. In the 1990's, one transfer of bull trout from Little Sheep Creek (Imnaha River subbasin) did occur into Wallowa Lake. There is no evidence, however, that these fish established a self-sustaining population or still exist (B. Smith, Oregon Department of Fish and Wildlife, pers. comm., 2002). In the 1970's bull trout/Dolly Varden from Alaska were also released into Wallowa Lake. Again, there is no evidence that these fish still exist or established a self-sustaining population (Buchanan *et al.* 1997).

This recovery unit geographically overlaps ceded lands of both the Confederated Tribes of the Umatilla Indian Reservation and the Nez Perce Tribe. These Tribes have guaranteed treaty fishing rights for both anadromous and

resident fish species. When the Grande Ronde River Recovery Unit has achieved its recovery goal, the Oregon and Washington departments of fish and wildlife as well as the Tribal Nations will determine the location and level of bull trout harvest which can be sustained while maintaining healthy populations.

Geographic Description

The Grande Ronde River subbasin is located in the southwest portion of the Blue Mountains ecological province, encompassing an area of about 10,240 square kilometers (4,000 square miles) in northeastern Oregon and southeastern Washington (see Northwest Power Planning Council 2001). The subbasin is characterized by rugged mountains and two major river valleys, and is defined by the Blue Mountains to the west and northwest, and the Wallowa Mountains to the southeast. It is in these mountain ranges, with peaks as high as 7,700 feet (2,347 meters) in the Blue Mountains and nearly 10,000 feet (3,048 meters) in the Wallowa Mountains, where the headwater streams of the Grande Ronde River begin. The Grande Ronde River flows generally northeast 212 miles (339 kilometers) from its origin to join the Snake River at River Mile 169 (River kilometer 270), about 20 miles (32 kilometers) upstream of Asotin, Washington and 493 miles (789 kilometers) from the mouth of the Columbia River. The Grande Ronde River begins in the Blue Mountains near the Anthony Lakes recreation area, flows north, then northeast and through the cities of La Grande and Island City (River Mile 157, River kilometer 251). In the valley, the river slows and meanders the valley floor before continuing north-northeast through the towns of Imbler, and Elgin. A State ditch, which eliminated approximately 20 River Miles (32 River kilometers), was developed to channelize the river through the Grande Ronde valley. Downstream of Elgin the river enters into a canyon, passes through Troy, Oregon (River Mile 46, River kilometer 74), then it crosses into Washington at River Mile 38.7 (River kilometer 62) before joining the Snake River. There are eight dams on the Columbia and Snake rivers between the Grande Ronde River and the Pacific Ocean. Major streams flowing into the Grande Ronde are Catherine and Joseph creeks and the Wallowa and Wenaha rivers.

Geology

The Grande Ronde subbasin has a complex geologic history (see Northwest Power Planning Council 2001). Rocks of the Columbia River Basalt Group dominate the surface geology of the area. Rocks older than the Columbia River Basalts occur only in the headwaters areas of the Grande Ronde River, the Wallowa River and Catherine Creek. These rocks consist of granitic intrusives and older volcanics with associated sedimentary deposits. Some of these older rocks are visible in the Wallowa Mountains where the andesitic core was exposed during uplift of the mountain range (Baldwin 1964). Some older rocks may be visible near the mouth of the Grande Ronde River where the channel cuts into rock below the basalt layers. The structural geology of the area is also complex. Regional deformation has included easterly and southeasterly tilting and uplift and northwesterly compression. Because of these forces, many faults cut the bedrock formations. These faults follow a general northwest-southeast trend. Some structural deformation continues in the area as evidenced by offsets in modern alluvial and colluvial deposits. The southern portion of the subbasin is subsiding faster than the northern portion as demonstrated by the large bend in the Grande Ronde River to the south. The presence of hot springs and regional, deep groundwater flow systems also indicate ongoing tectonic activity.

Climate

The relief of the Blue and Wallowa mountains creates several localized climatic effects (see Northwest Power Planning Council 2001). The diversity of landscapes between mountain ranges, rolling topography and deep, dissected canyons influences local climatic patterns. However, the major influence to the regional climate comes from the Cascade Mountains lying nearly 200 miles (320 kilometers) to the west. These mountains form a barrier against the modifying effects of moist winds from the Pacific Ocean, resulting in a modified Continental climate in the Grande Ronde River subbasin. Winters are cold and moist. January is the coldest month, with an average daily minimum temperature of 24 degrees Fahrenheit (-4 degrees Celsius). Summers in the subbasin are warm and dry. July is the warmest month with an average daily maximum of 84 degrees Fahrenheit (29 degrees Celsius). Temperature and precipitation vary considerably with elevation. In winter, valleys tend to be colder than lower slopes of adjacent

mountains due to cold air drainage. Average annual precipitation increases from 14 inches (36 centimeters) on the valley floor to more than 60 inches (152 centimeters) in some mountain areas. On average, precipitation increases approximately 5 inches (13 centimeters) with each 1,000-foot (305 meter) rise in elevation. Precipitation occurs in the mountains throughout the year but falls primarily as winter snow. The average annual frost-free period in the Grande Ronde River is 160 days. The cooler Wallowa River valley may experience frost at any time of the year but the average frost-free period is 130 days.

Hydrology

Due to the varying physiography in the Grande Ronde River subbasin, the timing of spring runoff and peak discharge is also variable (see Northwest Power Planning Council 2001). The upper Grande Ronde River, flowing out of the relatively low elevation Blue Mountains, generally experiences seasonal peak flows in March or April while peak flows in Catherine Creek, originating in the Wallowa Mountains, usually occur in May or June. Flows in the Wallowa River, which also originates from mostly north-facing slopes of the higher elevation Wallowa Mountains, generally do not peak until late May or June.

Gauging stations operated by the U.S. Geological Survey, the Oregon Water Resources Department, Oregon Watershed Enhancement Board and the Wallowa Soil and Water Conservation District, measure and record stream flows throughout the subbasin (see Northwest Power Planning Council 2001). Average annual discharge of the Grande Ronde River at Troy, Oregon, the lowest gauging station presently in use, is approximately 2.25 million acre feet (3101 cubic feet per second or 88 cubic meters per second). The only major tributary adding to the Grande Ronde River below this station is Joseph Creek, which is ungauged. Daily flows at gauging stations throughout the basin can vary 100-fold in as little as one month and differences between the annual minimum and maximum flows can be even greater. The gaging station on Catherine Creek near Union, Oregon, recorded a minimum flow in 1998 of 1.4 cubic feet per second (0.04 cubic meters per second) and a maximum the same year of 2,160 cubic feet per second (61.13

cubic meters per second). The average annual discharge of Catherine Creek at this gaging station is approximately 85,500-acre feet (3.34 cubic meters per second).

Most surface- and ground-water use is for irrigation (see Northwest Power Planning Council 2001). Information regarding the number of water diversions for irrigation is unavailable, as is the number of water rights holders in the subbasin. Sales and subdivision of water rights over the years has created a situation where there are many small water rights holders and few accurate records. Despite the lack of information regarding water rights and diversions, it is known that the water in the Grande Ronde River subbasin is fully appropriated; during the summer, there is no remaining unappropriated water.

Water Quality

The Oregon Department of Environmental Quality has identified many stream segments within the Grande Ronde subbasin as water quality limited (see Northwest Power Planning Council 2001). Many of these streams include habitat areas important for chinook salmon, summer steelhead and bull trout. Water quality limited means instream water quality fails to meet established standards for certain parameters for a portion of the year. Oregon's 1998, 303(d) List of Water Quality Limited Waterbodies identifies nine parameters of concern in the upper Grande Ronde River subbasin: algae, bacteria, dissolved oxygen, flow modification, habitat modification, nutrients, pH, sedimentation and temperature. All of these concerns exist within the Grande Ronde River valley portion of the subbasin. Three of these nine concerns – temperature, sediment and habitat modification – are widespread throughout the rest of the subbasin outside the Grande Ronde River valley.

Land Uses

Until the mid-1800's, the Grande Ronde subbasin was utilized solely by the Cayuse, Umatilla, Walla Walla and Nez Perce Tribes (James 1984). The Confederated Tribes of the Umatilla Indian Reservation ceded all of their lands in northeast Oregon and southeast Washington to the Federal government under the Treaty of 1855 (Confederated Tribes of the Umatilla Indian Reservation 1996).

The Nez Perce Tribe retained claim to its lands in the subbasin until the Treaty of 1863, when all of the Oregon territory was removed from the Nez Perce Reservation. The tribes maintain reserved rights for these lands that include harvesting salmon, wildlife and vegetative resources (USACE 1997). As European settlers moved into the area, significant timber harvest, livestock grazing and agricultural production began (McIntosh 1992).

The U.S. Forest Service and the Bureau of Land Management manage about 46 percent (1,901 square miles or 4,867 square kilometers) of the land in the Grande Ronde River subbasin, with a small amount of additional public land managed by the states of Oregon and Washington (see Northwest Power Planning Council 2001). The percentage of public land is higher in Wallowa County than in Union County with 65 percent of the county in public ownership (U.S. Forest Service, Bureau of Land Management, State of Oregon). The Grande Ronde River, Catherine Creek, Wallowa River and its tributaries, and Joseph Creek originate in the Wallowa-Whitman National Forest. The Wenaha River originates in the Umatilla National Forest. With the exception of those areas that lie within the Eagle Cap and Wenaha-Tucannon Wilderness Areas, the National Forests are managed for multiple use including, primarily, timber production, livestock grazing, and recreation. Seasonal recreation use of the forest, including big game hunting and mushroom harvest is economically significant to communities in the subbasin.

Privately owned land is generally at lower elevations along streams and on the valley floors (see Northwest Power Planning Council 2001). Nearly all of the agricultural lands of the Grande Ronde and Wallowa valleys are privately owned, as are portions of the Joseph Creek headwaters and high elevation meadows of the Upper Grande Ronde River. Primary uses of private land are forest, range and cropland.

DISTRIBUTION AND ABUNDANCE

Status of Bull Trout at the Time of Listing

In the final listing rule (63 FR 31647) the U.S. Fish and Wildlife Service identified one bull trout subpopulation in the Grande Ronde River subbasin. This subpopulation included both resident and migratory fish as well as fish that spawn and rear in (for example) the Upper Grande Ronde River, Catherine Creek, Lookingglass Creek, Wallowa River, Minam River, and Wenaha River. Although believed to be extirpated, bull trout used to spawn and rear in the Wallowa Lake/River complex in Oregon and Wenatchee Creek in Washington. At the time of listing (June 1998), the status of and trend in the Grande Ronde River subpopulation was unknown. The subpopulation was not considered to be at risk of extirpation due to natural events.

The U.S. Fish and Wildlife Service determined there were four major threats to the Grande Ronde River subpopulation of bull trout: agricultural practices, grazing, quality issues, and nonnative brook trout. Although subpopulations were an appropriate unit upon which to base the 1998 listing decision, the recovery plan has revised the biological terminology to better reflect the current understanding of bull trout life history and conservation biology theory. Therefore, subpopulation terms will not be used in this chapter.

Current Distribution and Abundance

In the past, wild bull trout occurred throughout the Grande Ronde River subbasin. Although bull trout were probably never as abundant as other salmonids in the subbasin, they were certainly more abundant and more widely distributed than they are today. Currently, the U.S. Fish and Wildlife Service considers there to be two core areas in the Grande Ronde River subbasin: the upper Grande Ronde River, and the Little Minam River. Although Wenatchee Creek has the potential to be a core area, it is currently considered a research need.

The Oregon Department of Fish and Wildlife recognizes nine local populations of bull trout within the Oregon portion of the basin (Buchanan *et al.* 1997). Distinct local populations are present in the Upper Grande Ronde River, Catherine Creek, Indian Creek, Minam River/Deer Creek complex, Lostine River/Bear Creek complex, upper Hurricane Creek, Wenaha River, Lookingglass Creek, and the Little Minam River. While Washington Department of Fish and Wildlife also recognizes the Wehana River local population of bull trout, they are uncertain about the existence of bull trout in Wenatchee Creek (Washington Department of Fish and Wildlife 1998). Finally, although the original local population of bull trout in the Wallowa River/Lake complex is believed to have been extirpated (Buchanan *et al.* 1997), bull trout from the Imnaha River subbasin were recently introduced into this complex (B. Smith, Oregon Department of Fish and Wildlife, pers. comm., 2002). The current status of bull trout that were introduced into the Wallowa River/Lake comples is unknown. All extant local populations of bull trout in the Grande Ronde River subbasin are native fish sustained by wild production. There is very little information to indicate whether these local populations are genetically distinct. The Oregon Department of Fish and Wildlife separated local populations based on geographical, physical and thermal isolation of the spawning populations.

For purposes of the recovery plan local populations of bull trout within the Grande Ronde River subbasin have been aggregated based on the potential to reestablish connectivity and reduce threats (see Strategy for Recovery). The Oregon Department of Fish and Wildlife in cooperation with the U.S. Fish and Wildlife Service, U.S. Forest Service, the Confederated Tribes of the Umatilla Indian Reservation and the Nez Perce Tribe conduct annual bull trout spawning ground surveys in selected locations within the basin (Table 1). This information represents the best census information available for bull trout distribution and abundance within the Grande Ronde River subbasin.

Upper Grande Ronde River

In the upper portion of the Grande Ronde River subbasin, small groups of bull trout appear to be present all year in the mainstem, in Limber Jim, Indiana and Clear creeks (Buchanan *et al.* 1997), as well as Hoodoo Creek (a tributary to

Beaver Creek) and Lookout Creek (a tributary to Fly Creek) (J. Zakel, Oregon Department of Fish and Wildlife, pers. comm., 2002). An isolated sighting has also been reported from Five Points Creek (Zakel, *in litt.* 1995). On an intermittent basis, bull trout can also be found distributed throughout the mainstem, perhaps migrating to and from various tributaries or following sources of food. Limited information is available on the abundance of bull trout in the upper Grande Ronde River. Standard redd counts or creel surveys are not conducted on a regular basis. Buchanan *et al.* (1997) reported that these fish were at moderate risk of extinction. Spawning and rearing appears to occur in relatively small, headwater areas including the upper Grande Ronde River, Limber Jim, Indiana and Clear creeks. Essentially no information is available on the size of these fish at spawning, age at maturation, sex ratio, fecundity, time of emergence, and survival rates. It seems likely that bull trout in this population exhibit a resident life history form. Although little information is available on the prevalence of fluvial bull trout in the Upper Grande Ronde River, the Confederated Tribes of the Umatilla Indian Reservation have trapped fluvial fish at a weir during the late summer and early fall (P. Lofy, Bonneville Power Administration, pers. comm., 2002).

Table 1. Bull trout spawning ground survey schedule in the Grande Ronde River Recovery Unit during 2001.

Core Area	Stream	Survey Area	Survey Time
Little Minam	Little Minam River	Complete	Every other week, mid-September through the end of October.
Grande Ronde	Lostine River	Complete	Once in September and October.
	Lookingglass Creek	Complete (National Forest only)	Once in September and October.
	Wenaha River	Partial	Once in October.

Catherine Creek

Bull trout in Catherine Creek have been observed throughout the mainstem as well as in the North Fork Catherine Creek, South Fork Catherine Creek, Middle Fork Catherine Creek, Sand Pass Creek, Collins Creek and Pole Creek (Buchanan *et al.* 1997). Although presence/absence surveys suggest that numbers are low (West and Zakel, *in litt.* 1993), no specific population estimates have been conducted in Catherine Creek. Buchanan *et al.* (1997) considered bull trout in Catherine Creek at moderate risk of extinction. Although bull trout are occasionally observed during the summer as low in the watershed as the town of Union, the majority of summer rearing appears to occur above river kilometer 50 (River Mile 31) in the mainstem or in the headwater tributaries (Zakel, *in litt.* 1995). Presumably spawning also occurs in these headwater tributaries. Bull trout migrating downstream have been captured near the town of Union (M. Keefe., Montgomery-Watson-Harza, pers. comm., 2002). These fish ranged from 121 to 255 mm (4.76 to 10 inches) in fork length and were captured during the months of September and October. Otherwise, very little information is available on the size of these fish at spawning, age at maturation, sex ratio, fecundity, time of emergence, and survival rates. It seems likely that bull trout in this population exhibit a resident life history form. Although little information is available on the prevalence of fluvial bull trout in Catherine Creek, the Confederated Tribes of the Umatilla Indian Reservation have also trapped fluvial fish at an upstream weir during the late summer and early fall (P. Lofy, Bonneville Power Administration, pers. comm., 2002).

Indian Creek

Bull trout have been observed in the mainstem of Indian Creek as well as the East Fork of Indian Creek and Camp Creek (Buchanan *et al.* 1997). All known holding and rearing areas are on National Forest lands in the headwaters of the drainage. Presumably spawning also occurs in these headwater tributaries. Historically, fish were probably distributed throughout the mainstem of Indian Creek and connected to the Grande Ronde River. However, habitat in the lower reaches of Indian Creek is severely degraded and there are no recent reports of bull trout in these reaches. No information is available on the abundance of bull trout in Indian Creek. Standard redd counts or creel surveys are not conducted on

a regular basis. No information is available on the size of these fish at spawning, age at maturation, sex ratio, fecundity, time of emergence, and survival rates. It seems likely that bull trout in this population exhibit a resident life history form.

Minam River/Deer Creek complex

The Minam River and Deer Creek are both tributaries to the Wallowa River. The mouths of the Minam River and Deer Creek are separated by less than 3 River kilometers (1.86 River Miles). Given the potential for fluvial fish in these streams as well as their relative proximity, the U.S. Fish and Wildlife Service has grouped bull trout from the Minam River and Deer Creek as one local population complex (bull trout from more than one tributary that presumably function, both demographically and genetically, as one unit).

Bull trout have been observed throughout the mainstem of the Minam River, the North Fork Minam River and Elk Creek (Buchanan *et al.* 1997). All known summer rearing and holding areas in the Minam River are on National Forest lands (designated wilderness) above River kilometer 35 (River Mile 21.7). Spawning presumably occurs in these headwater areas as well as in headwater tributaries. Based on radiotelemetry data on bull trout from drainages adjacent to the Minam River (*i.e.* Lookingglass Creek and the Lostine River), fish found in the Minam River below River kilometer 35 (River Mile 21.7) are probably moving between summer or spawning habitat and overwinter habitat in the Wallowa, Grande Ronde or Snake Rivers. Although the La Grande District of Oregon Department of Fish and Wildlife conducted some surveys in the mid-1990's, limited information is available on the abundance of bull trout in the Minam River. Standard redd counts or creel surveys are not conducted on a regular basis. Buchanan *et al.* (1997) considered fish from the Minam River at low risk of extinction. No information is available on the size of these fish at spawning, age at maturation, sex ratio, fecundity, time of emergence, or survival rates. It seems likely that bull trout in this population complex exhibit both resident and fluvial life history forms.

Bull trout have been observed throughout the mainstem of Deer Creek and in the mouth of Sage Creek. All known summer rearing and holding areas in the

Deer Creek watershed are on National Forest lands (designated wilderness) between River kilometer 15 and River kilometer 25 (River Miles 9.3 and 15.5). Spawning presumably occurs in these headwater areas as well as in headwater tributaries. Between fall and spring, bull trout have also been observed between River kilometer 0 and River kilometer 15 (River Miles 0 and 9.3) of Deer Creek. Based on radiotelemetry data on bull trout from drainages adjacent to the Deer Creek (*i.e.* Lookingglass Creek and the Lostine River), fish found in Deer Creek below River kilometer 15 (River Mile 9.3) are probably moving between summer or spawning habitat and overwinter habitat in the Wallowa, Grande Ronde or Snake Rivers.

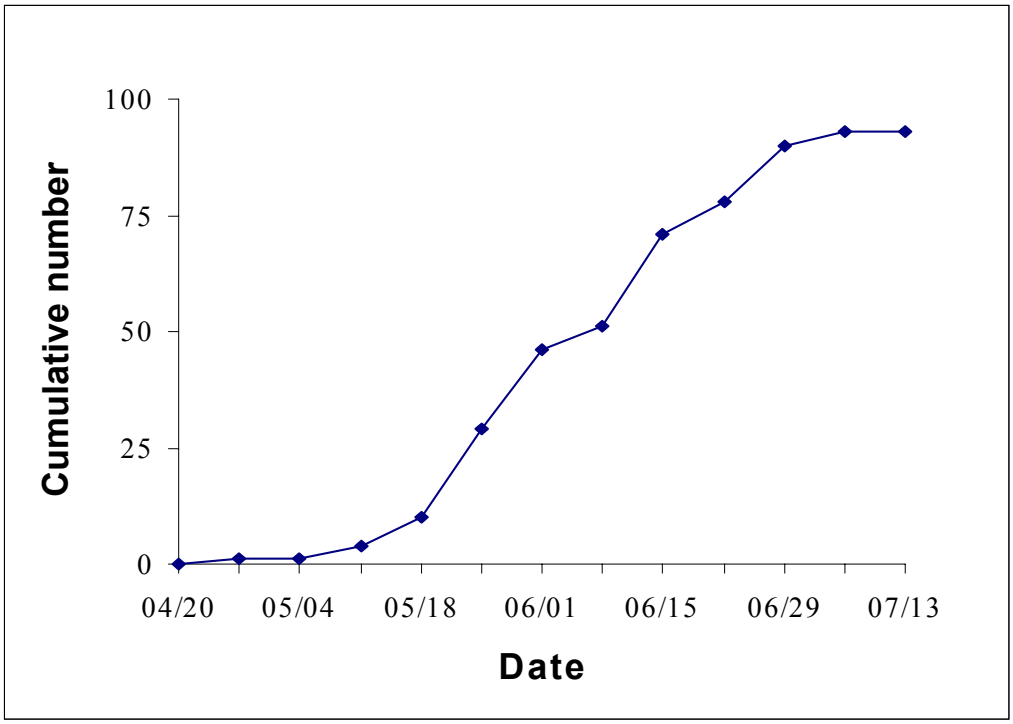
Limited information is available on the abundance of bull trout in Deer Creek. One recent sampling effort observed 18 fish/100 square meters as well as 6.5 kilometers (4 miles) of habitat supporting that density (Oregon Department of Fish and Wildlife, *in litt.* 1993). Approximately 50 percent of these fish were longer than 160 millimeters (6.3 inches) in fork length, which is the approximate size when resident fish in the Grande Ronde River subbasin become mature (Hemmingsen *et al.* 2001c). Given this and other habitat data, it has been estimated that the summer rearing population of bull trout in Deer Creek is approximately 3,000 yearling or older fish. Standard redd counts or creel surveys are not conducted on a regular basis. Buchanan *et al.* (1997) listed the status of fish from Deer Creek as special concern. No information is available on age at maturation, sex ratio, fecundity, time of emergence, or survival rates. It seems possible that bull trout in Deer Creek exhibit both resident and fluvial life history forms.

Lostine River/Bear Creek complex

The Lostine River and Bear Creek are both tributaries to the Wallowa River. The mouths of the Lostine River and Bear Creek are separated by less than 11 River kilometers (6.8 River Miles). Given that fluvial fish exist in the Lostine River and may exist in Bear Creek as well as the relative proximity of the streams, the U.S. Fish and Wildlife Service has grouped bull trout from the Lostine River and Bear Creek as one local population complex.

Bull trout have been observed throughout the mainstem of the Lostine River, as well as the mouths of Silver and Lake creeks (Buchanan *et al.* 1997). All known summer rearing and holding areas in the Lostine River are on National Forest lands (that are bounded by designated wilderness) above River kilometer 20 (River Mile 12.4). Spawning presumably occurs in these headwater areas as well as in some headwater tributaries. Based on recent radiotelemetry data (P. Sankovich, Oregon Department of Fish and Wildlife, pers. comm., 2002), fish found in the Lostine River below River kilometer 20 (River Mile 12.4) are probably moving between summer or spawning habitat and overwinter habitat in the Wallowa, Grande Ronde or Snake rivers. Fluvial adults appear to move into the Lostine River in the months of June, July, and August. Fluvial adults appear to move out of the Lostine in the months of September, October, and November. Limited information is available on the abundance of bull trout in the Lostine River. Standard redd counts as well as counts of migratory adults captured at

Figure 3. Fluvial bull trout captured moving upstream in the Lostine River during 2001. Fish were captured in a weir operated near the river's mouth by the Nez Perce Tribe (J. Harbeck, Nez Perce Tribe, pers. comm., 2002).



salmon weirs (Figure 3); data provided by have been conducted only recently. Standard creel surveys are not conducted on a regular basis. Ratliff and Howell (1992) considered fish from the Lostine River at moderate risk of extinction. Little information is available on the size of these fish at spawning, age at maturation, sex ratio, fecundity, time of emergence, or survival rates. It seems likely that bull trout in this population complex exhibit both resident and fluvial life history forms. River at moderate risk of extinction.

Bull trout have been observed throughout the mainstem of Bear Creek as well as throughout Little Bear Creek and the mouth of Goat Creek (below a waterfall). All known summer rearing and holding areas in the Bear Creek drainage are on National Forest lands (much of which is designated wilderness). This distribution occurs primarily above River kilometer 19 (River Mile 11.8) in Bear Creek and above River kilometer 5 (River Mile 3.1) in Little Bear Creek. Summer distribution is currently (and presumably historically) disrupted by a loss of surface flow between Goat and Granite creeks. Spawning presumably occurs in the headwaters of Bear and Little Bear creeks. Between fall and spring, bull trout have also been observed between River kilometers 0 and 19 (River Miles 0 and 11.8) of Bear Creek and between River kilometers 0 and 5 (River Miles 0 and 3.1) of Little Bear Creek. Given radiotelemetry data on bull trout from drainages adjacent to the Bear Creek (*i.e.* the Lostine River), fish found in these downstream reaches are probably moving between summer or spawning habitat and overwinter habitat in the Wallowa, Grande Ronde or Snake Rivers. Limited information is available on the abundance of bull trout in Bear Creek. Standard redd counts or creel surveys are not conducted on a regular basis. Ratliff and Howell (1992) listed the status of fish from Bear Creek as special concern. No information is available on age at maturation, sex ratio, fecundity, time of emergence, or survival rates. It seems probable that bull trout in Bear Creek exhibit both resident and fluvial life history forms.

Upper Hurricane Creek

Bull trout have been observed in the mainstem of Hurricane Creek (Buchanan *et al.* 1997). All known holding and rearing areas are above River kilometer 16 (River Mile 9.9) and about half of this distribution is on National

Forest lands that are designated wilderness. Spawning presumably occurs in the headwaters of Hurricane Creek. Between fall and spring, bull trout have also been observed between River kilometers 0 and 16 (River Miles 0 and 9.9) of Hurricane Creek. Given radiotelemetry data on bull trout from drainages adjacent to the Hurricane Creek (*i.e.* the Lostine River), fish found in these downstream reaches are probably moving between summer or spawning habitat and overwinter habitat in the Wallowa, Grande Ronde or Snake Rivers. No information is available on the abundance of bull trout in Hurricane Creek. Standard redd counts or creel surveys are not conducted on a regular basis. No information is available on the size of these fish at spawning, age at maturation, sex ratio, fecundity, time of emergence, and survival rates. It seems likely that bull trout in this population exhibit both resident and fluvial life history forms.

Wenaha River

The Wenaha River drainage may have the most abundant and well distributed population of bull trout in the Grande Ronde River subbasin (Buchanan *et al.* 1997). Bull trout have been observed throughout the mainstem of the Wenaha River, South Fork Wenaha River, North Fork Wenaha River, Butte Creek, and Crooked Creek, as well as Milk Creek (tributary to South Fork Wenaha River), First Creek and Third Creek (tributaries to Crooked Creek) (Buchanan *et al.* 1997). All known summer rearing and holding areas in the Wenaha River or its tributaries are on National Forest lands (designated wilderness) above River kilometer 9 (River Mile 5.6) of the Wenaha River. Spawning occurs in the headwater areas of the Wenaha River and many of its tributaries. Radiotelemetry data on bull trout from the Wenaha River (for example see Hemmingsen *et al.* 2001b) suggests that fish found below River kilometer 9 (River Mile 5.6) appear to be moving between summer or spawning habitat and overwinter habitat in the Grande Ronde and Snake rivers. In at least one case, a bull trout tagged in the Wenaha River also moved up the Grande Ronde River and entered Lookingglass Creek (Hemmingsen *et al.* 2001a). Limited information is available on the abundance of bull trout in the Wenaha River. Standard redd counts or creel surveys are not conducted on a regular basis. Buchanan *et al.* (1997) considered fish from the Wenaha River at low risk of extinction. Little information is available on the size of these fish at spawning,

age at maturation, sex ratio, fecundity, time of emergence, or survival rates. It seems likely that bull trout in this population exhibit both resident and fluvial life history forms.

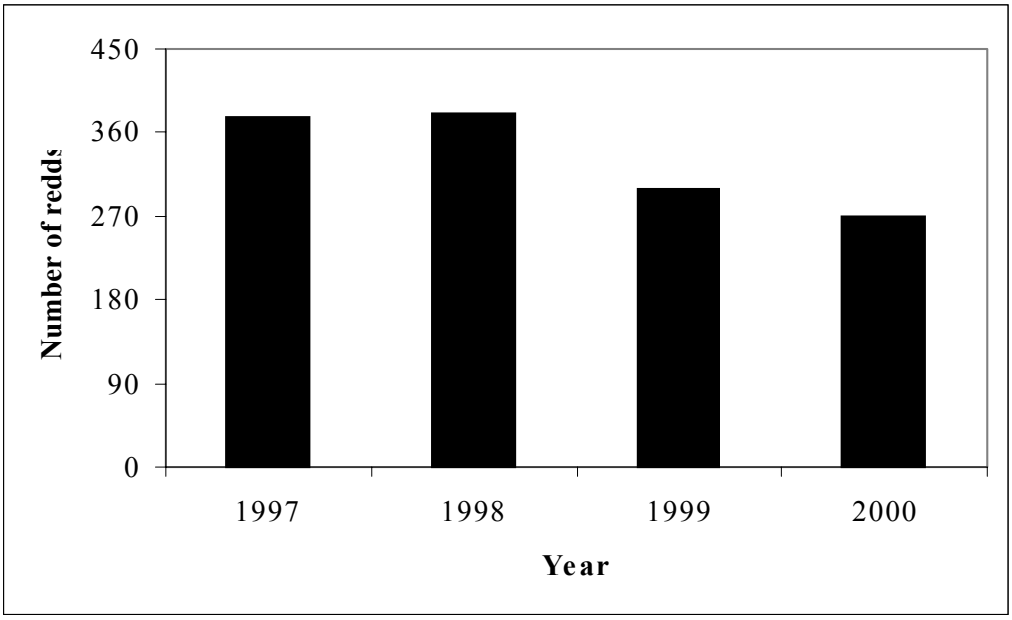
Lookingglass Creek

Bull trout have been observed throughout the mainstem of Lookingglass Creek as well as in the lower half of Little Lookingglass Creek (Buchanan *et al.* 1997). Lookingglass Creek is primarily spring-fed with relatively moderate water temperatures. Bull trout are known to rear and hold during the summer in all areas of Lookingglass Creek. The upper half of this distribution is on National Forest lands. Spawning occurs in the headwater areas of Lookingglass and Little Lookingglass creeks and may also occur in other tributaries. Radiotelemetry data on bull trout from the Lookingglass Creek (for example see Hemmingsen *et al.* 2001a) suggests that fluvial bull trout may overwinter in the Grande Ronde or Snake rivers. In at least one case, a bull trout tagged in the Wenaha River also moved up the Grande Ronde River and entered Lookingglass Creek (Hemmingsen *et al.* 2001a). Limited information is available on the abundance of bull trout in the Lookingglass Creek. Spawning ground surveys of index areas have been conducted recently. In 2001, 54 redds were observed during bull trout spawning ground surveys on National Forest land (P. Sankovich, Oregon Department of Fish and Wildlife, pers. comm., 2002). In general, spawning ground and presence/absence surveys have suggested that bull trout abundance is low in the Lookingglass Creek drainage (West and Zakel, *in litt.* 1993). Standard creel surveys are not conducted on a regular basis. Buchanan *et al.* (1997) considered fish from Lookingglass Creek at moderate risk of extinction. Little information is available on the size of these fish at spawning, age at maturation, sex ratio, fecundity, time of emergence, or survival rates. It seems likely that bull trout in this population exhibit both resident and fluvial life history forms.

Little Minam River

Bull trout have been observed in the Little Minam River as well as in the lower portion of Boulder Creek and throughout Dobbin Creek, both tributaries to the Little Minam River (Buchanan *et al.* 1997). A waterfall exists at approximately River kilometer 9 (River Mile 5.6) of the Little Minam River

Figure 4. Number of redds observed in the Little Minam River watershed from 1997-2000. This includes counts in the Little Minam River and Dobbin Creek.



which is believed to prevent the upstream movement of most fish, including bull trout. Thus, a resident population of bull trout, which does not experience immigration of bull trout from other areas in the Grande Ronde River, exists above River kilometer 9 (River Mile 5.6). Bull trout are believed to rear and hold during the summer in all these areas of the Little Minam River drainage. The entire distribution of bull trout in the Little Minam River is on National Forest lands (designated wilderness). Spawning occurs in the headwater areas of the Little Minam River and throughout Dobbin Creek. Limited information is available on the abundance of bull trout in the Little Minam River. Spawning ground surveys have been conducted over the last several years (Figure 4) (Bellerud *et al.* 1997; Hemmingsen *et al.* 2001a, 2001b, 2001c, 2001d). Spawning ground surveys included all areas where bull trout could spawn in the Little Minam River and Dobbin Creek. In general, surveys were conducted once every two weeks during September and October. In 2001, 434 redds were counted in the Little Minam River and Dobbin Creek (P. Sankovich, Oregon Department of Fish and Wildlife, pers. comm., 2002). Standard creel surveys are not conducted on a regular basis. Ratliff and Howell (1992) considered fish from the Little Minam River at low risk of extinction. Fish spawning in the Little

Minam River and Dobbin Creek are generally between 150 and 250 millimeters (5.9 to 9.8 inches) in fork length (Bellerud *et al.* 1997). Little additional information is available on the size of these fish by age, age at maturation, sex ratio, fecundity, time of emergence, or survival rates. Given that fluvial fish are unlikely to immigrate to the Little Minam River (above River kilometer 9 or River Mile 5.6) for spawning it seems likely that this population of bull trout functions as a resident life history form. However, bull trout produced in the Little Minam River may emigrate to other areas (i.e. the Minam, Wallowa, and Grande Ronde rivers) in the Grande Ronde River subbasin.

Wallowa Lake/River

Historically, bull trout were present in the Wallowa River above Wallowa Lake, however, this population is believed to have been extirpated by the 1950's (Buchanan *et al.* 1997). Although a reintroduction program using bull trout and Dolly Varden (from Alaska) was initiated in 1968, this program was unsuccessful and terminated in 1978 (Buchanan *et al.* 1997). No bull trout or Dolly Varden were captured in the Wallowa Lake fishery between 1980 and 1996 (B. Smith, Oregon Department of Fish and Wildlife, pers. comm., 2002). In 1997, 600 bull trout from Big Sheep Creek, a tributary to the Imnaha River, were introduced into Wallowa River above Wallowa Lake (B. Smith, Oregon Department of Fish and Wildlife, pers. comm., 2002). The current status of these fish is unknown.

Wenatchee Creek

Historically, fluvial-sized bull trout (longer than 46 centimeters or 18 inches) were be found far up into Wenatchee Creek (D. Groat, U.S. Forest Service, pers. comm., 2002). However, in the 1960's a barrier waterfall formed near River kilometer 4 (River Mile 2.5) of Wenatchee Creek and currently, it is unlikely that fluvial bull trout would be able to get above this waterfall (D. Groat, U.S. Forest Service, pers. comm., 2002). In the mid-1980's, one account of resident bull trout existing above the barrier waterfall in Wenatchee Creek was published in the Lewiston Tribune (G. Mendel, Washington Department of Fish and Wildlife, pers. comm., 2002). However, recent surveys have not been able to confirm the presence of resident bull trout in Wenatchee Creek.

REASONS FOR DECLINE

Dams

Dams can affect bull trout by altering habitats; flow, sediment, and temperature regimes; migration corridors; and interspecific interactions, especially between bull trout and introduced species (Rode 1990; Washington Department of Wildlife 1992; Craig and Wissmar 1993; Oregon Department of Fish and Wildlife, *in litt.* 1993; Rieman and McIntyre 1993; Wissmar *et al.* 1994). In addition, hydroelectric facilities can directly impact bull trout via entrainment, and by direct injury or mortality by passing through turbines. Impassable dams and other barriers have caused declines of bull trout primarily by preventing access of migratory fish to spawning and rearing areas in headwaters and precluding recolonization of areas where bull trout have been extirpated (Rieman and McIntyre 1993; Montana Bull Trout Scientific Group 1998).

The construction and operation of dams, both within and outside the Grande Ronde River Recovery Unit, has contributed to the decline of bull trout populations. Within the Grande Ronde River subbasin, dams exist in the Wallowa River and in Beaver Creek. The dam in the Wallowa River was built at approximately River kilometer 97 (River Mile 60.3), completed in 1931, currently maintains Wallowa Lake and provides multiple stream diversions into the Wallowa River valley. The dam in Beaver Creek was built at River kilometer 20 (River Mile 12.4), completed in 1915, and currently maintains a reservoir that supplies water to the city of La Grande, Oregon. Both of these dams were constructed without fish passage facilities and prevent bull trout from access to historic spawning habitat within the Grande Ronde River subbasin. In addition, the Grande Ronde River flows into the Snake River between Lower Granite and Hells Canyon dams. Bull trout from the Grande Ronde River that express a fluvial life history form may migrate to and overwinter in the mainstem of the Snake River (for example see Baxter 2002). Dams in the Snake River have impaired the connectivity between bull trout from the Grande Ronde River and those from below Lower Granite Dam or above Hells Canyon Dam. Lower Granite Dam has also changed the habitat where bull trout potentially overwinter from a free-flowing river to a reservoir. The specific impacts of these dams to bull trout from the Grande Ronde River Recovery Unit are unclear.

Forest Management Practices

Past and present forest management practices on Federal, private and State lands have and continue to adversely affect riparian and stream habitat as well as bull trout. Past practices such as thinning of riparian vegetation, the construction of splash dams utilizing the stream to transport logs, the construction of log flumes and diversion of streamflow from the creek, the destruction of riparian vegetation through the building of timber railroads and forest roads, the use of smaller side drainages as skid trails and harvest-related wildfire have decreased the function of the existing riparian vegetation in many areas. Bull trout in tributaries, for example Bear Creek, have been impacted through significant habitat degradation from road development and logging. Bull trout in mainstem areas, for example the upper Grande Ronde River (Oregon Department of Fish and Wildlife, *in litt.* 1993), have been impacted through increased water temperatures resulting in thermal barriers, siltation of spawning gravel, and loss of instream structure (*i.e.* large wood).

The riparian functions that have been historically compromised include the ability of the vegetation to act as a sediment filter and provide streambank stability, overhead shade, detritus and a source of instream wood. Riparian species size and composition have decreased from historic conditions and buffer widths between roads and streams are too narrow in many drainages to filter out all soil movement before reaching the stream. The abundance of large instream wood is low in many drainages due to the lack of recruitment sources in riparian areas logged in the past or burned in historic wildfires. Bank erosion has occurred where timber harvest and/or wildfire has removed vegetation with roots integral to the bank stability.

Streambank conditions, in certain areas, are poor with low vegetative coverage and high erosiveness due to past timber harvest and/or the imprint of a road located within the riparian vegetation. Soil movement from harvest sites and road systems add to the existing high embeddedness level of the streambed substrate where riparian vegetation is insufficiently wide to intercept this material. This high embeddedness decreases the amount of suitable spawning and

rearing habitat through the filling of interstitial spaces and filling of pool habitat. The combination of eroding streambanks, high sediment loading and lack of large woody debris have caused sections of stream channel to have higher bankfull width/depth ratios than would be expected of the channel type. These degraded stream segments are wider and shallower than normal. Furthermore, diverse benthic fauna is beneficial to native trout species at all life stages and embedded substrates can have detrimental effects on density and species diversity.

Livestock Grazing

Livestock grazing has contributed to the decline of bull trout through impacts to both upland and riparian areas of many tributaries in the recovery unit. For examples, significant livestock grazing (as well as some feedlot development) exists in the upper Grande Ronde River, the upper Wallowa River and the lower portion of Bear Creek. The result of poor livestock management is the overgrazing of the riparian vegetation and excessive nutrient inputs to waterways. This overutilization leads to the reduced effectiveness of species that cover and stabilize streambanks. The compacting and cutting action of the hooves of livestock on moist soils causes the sloughing of banks where localized use for feeding, watering and crossing occurs. The indirect effect is to increase bank erosion and embeddedness of the streambed substrate, widening of the stream channel and an increase in water temperature due to lack of overhanging vegetation. Livestock may also cause direct mortality of eggs or alevin if the redd (spawning bed) is trampled during watering or crossing.

Agricultural Practices

Bull trout within the Grande Ronde River Recovery Unit have been and continue to be adversely affected by irrigation diversions and water withdrawals. Unscreened or inadequately screened irrigation diversions strand bull trout (and other fish) in irrigation canals, sometimes resulting in high mortality. In addition, water withdrawals from streams for irrigation, particularly in late summer, exacerbate natural low-flow conditions in some streams. Low flows in late summer can prevent bull trout, which are preparing to spawn from reaching

spawning grounds and can also strand them. Low stream flows can also strand rearing juvenile fish in dry channel beds and result in elevated water temperatures which can delay spawning. When irrigation water is returned to streams and rivers, it carries sediment and nonpoint pollution from agricultural chemicals which degrade water quality.

Specific concerns include many of the watersheds in the Grande Ronde River subbasin. Much of the Bear Creek watershed has little or no flow during the summer due to irrigation diversions. In the Lostine River the lower reaches of suspected historic summer distribution are substantially impacted by irrigation withdrawal, erosion control activities and irrigation return flow. Between River kilometer 0 and 10 (River Mile 0 to 5.6) of the Lostine River, low summer flows resulting (in part) from water diversions appear to impair the upstream movement of bull trout from July through September. This impact is especially significant during low flow years. The U.S. Forest Service and Oregon Department of Fish and Wildlife have begun a radiotelemetry investigation to examine this relationship further (see Oregon Department of Fish and Wildlife 2001a). Below the Upper Alder Slope Irrigation Ditch, Hurricane Creek is currently separated from the remainder of the habitat, substantially simplified due to channelization, impacted by warm water and sediment, and a 5 kilometer (2.6 mile) reach is dewatered by the irrigation withdrawal. Historically, the Lookingglass Creek, Catherine Creek, and Indian Creek watersheds experienced significant riparian loss and channel alterations which resulted in increased water temperatures, siltation, and loss of instream structure (Oregon Department of Fish and Wildlife, *in litt.* 1993). Since the 1970's, however, riparian loss and channel alteration in the Lookingglass Creek watershed has been minimized and water temperature has remained unchanged (M. McLean, Confederated Tribes of the Umatilla Indian Reservation, pers. comm., 2002). In addition, grazing has been limited to a 3 kilometer (1.6 mile) section of Lookingglass Creek and the Boise Cascade Corporation has eliminated grazing by the creek (M. McLean., Confederated Tribes of the Umatilla Indian Reservation, pers. comm., 2002).

Culverts and diversions have contributed to the decline of bull trout populations within the Grande Ronde River Recovery Unit. Numerous diversions

and culverts exist throughout the recovery unit and may act as barriers to bull trout movement. For example, the Upper Alder Slope/Moonshine Ditch diversion in Hurricane Creek and the culvert at the Indian Creek hydropower facility (Oregon Department of Fish and Wildlife, *in litt.* 1993) are likely barriers to the upstream movement of bull trout. Low flows during the summer and fall may exacerbate the impact of these culverts and diversions as barriers by contributing to elevated water temperatures that result in a thermal barrier. In any event, these barriers have reduced both the connectivity between local populations as well as the habitat available to bull trout.

Transportation Network

Road densities are high in many watersheds in the Grande Ronde River Recovery Unit. Federal, State and county road construction, reconstruction and maintenance had and continue to have impacts on water quality and aquatic habitat as well as contribute to the decline of bull trout. Depending upon their location, roads have contributed to the reduction of riparian vegetation and disconnected the habitat at stream crossings. In addition, culverts, depending upon condition and position, may be blockages to upstream fish passage. Poorly located and designed roads, through maintenance and use, are constant sources of soil movement into adjacent stream systems. Soil that enters a stream may increase the level of turbidity and embeddedness of the streambed substrate, fill pool habitat and widen channels within low gradient areas.

Fragmentation of habitat by culvert installation and sediment input are the major problems caused by road maintenance and construction. As with other watersheds with a history of timber harvest, many of the roads are within the riparian zone are causing sedimentation in streams. These problems are apparent in many watersheds of the recovery unit. For example, roads parallel most of the streams in the Deer Creek watershed and the Bear Creek watershed (excepting the upper-most reaches). The presence and maintenance of these roads contribute to increased stream temperatures during the summer, increased sediment and lack of channel diversity, particularly in the lower portions of the creeks. In addition, there are culverts (for examples: on Sage Creek, a tributary to Deer Creek, and

Sand Pass Creek (Road 650), a tributary to Catherine Creek) which may be passage barriers at certain times of the year (Oregon Department of Fish and Wildlife, *in litt.* 1993).

Mining

Past mining activities likely contributed to the decline of bull trout. Mining in the Lostine River, Hurricane Creek and Upper Grande Ronde River watersheds has resulted in decreased channel stability which may result in disrupted or lost habitat for bull trout. Little mining currently occurs in the Grande Ronde River Recovery Unit.

Residential Development

Residential development has contributed to the decline of bull trout. Areas within the Grande Ronde River Recovery Unit have grown in popularity as preferred areas for home sites and recreation areas. For example, a State park and popular tourist site have been developed around Wallowa Lake and the river above the lake. In part as a result of this development, the river above the lake has been channelized. Additional stream channelization has occurred as residential developments have encroached the lower reaches of the Lostine River and Hurricane Creek (below the National Forest boundary). As the human population in the recovery unit increases more development and subsequent impacts to riparian areas, water quality and bull trout are likely. Impacts to bull trout from previous and future development may include loss of riparian habitat, increases in nutrient loading from septic systems and chemical applications.

Fisheries Management

Harvest

Bull trout tend to be aggressive and easily caught through angling. Historic harvest of bull trout may have eliminated populations in small tributaries and contributed to the overall decline. For example, before the 1990's bull trout angling was permitted in the State of Oregon. Angling in the Grande Ronde

River watershed was controlled by standard Statewide seasons and limits for trout. Over the course of the 1990's, fishing for bull trout in Oregon became severely restricted. By 1994, angling for bull trout in the Grande Ronde River watershed was prohibited. Currently, both the states of Oregon and Washington prohibit angling for bull trout in the Grande Ronde River watershed (see Oregon Department of Fish and Wildlife 2001b; Washington Department of Fish and Wildlife 2001).

Although regulations prohibit it, harvest of bull trout still occurs in the Grande Ronde River subbasin. Anglers have been known to harvest bull trout from the Wallowa, Lostine, Grande Ronde, and Wenaha Rivers as well as Hurricane, Bear, Lookingglass, Catherine, and Deer Creeks. Some of this unauthorized harvest results from the difficulty in distinguishing between bull trout and brook trout. As a result, anglers sometimes mistake a bull trout for a brook trout and accidentally harvest the fish.

Hatcheries

Barriers associated with hatchery operations may also be contributing to the decline of bull trout populations within the Grande Ronde River Recovery Unit. Weirs to capture adult chinook exist in the upper Grande Ronde River and Catherine Creek (operated by Confederated Tribes of the Umatilla Indian Reservation), Lookingglass Creek (operated by Oregon Department of Fish and Wildlife), and the Lostine River (operated by Nez Perce Tribe). These weirs are designed to operate at a time when fluvial bull trout would also be moving upstream and they do capture bull trout. By impeding the migration of fish, these weirs may alter when and where bull trout spawn. Weirs also exist in Deer Creek and Spring Creek (in the Wallowa River watershed). However, these weirs are designed to capture adult steelhead and do not typically operate when fluvial bull trout are moving upstream. The major hatcheries in the Grande Ronde River Recovery Unit are the Wallowa Fish Hatchery and Lookinglass Fish Hatchery. Intakes to these hatcheries, and screens associated with these intakes, may also impact the migration of juvenile bull trout.

Brook Trout

Brook trout (*Salvelinus fontinalis)* are an exotic species that was introduced into the Grande Ronde River subbasin before the turn of the century. Brook trout were stocked in streams, rivers and high mountain lakes. Recently, brook trout that were stocked illegally into Langdon Lake were discovered and eradicated by the Oregon Department of Fish and Wildlife (T. Walters, Oregon Department of Fish and Wildlife, pers. comm., 2002). Brook trout have done relatively well in these nonnative habitats and are now abundant in many of the tributaries in the Grande Ronde River subbasin. Brook trout can be found in the Wallowa, Minam, Lostine, and Grande Ronde Rivers as well as Hurricane, Bear, Lookingglass, and Beaver creeks. Brook trout can be found in both public and private areas. Brook trout have contributed to the decline of bull trout populations primarily through competition and hybridization (for description, see Gunckel 2001). Brook trout are difficult to eradicate from a watershed and will likely impact bull trout well into the future.

Anadromous Salmonids

Anadromous salmonids have declined throughout the Grande Ronde River subbasin and are either extinct (coho *Oncorhynchus kisutch*, sockeye *O. nerka*) or listed under the Endangered Species Act (chinook *O. tshawytscha*, steelhead *O. mykiss*) (see National Marine Fisheries Service 2000). Juvenile salmonids produced by anadromous parents are considered to have been a primary food source of bull trout. This reduction in prey base has contributed to the decline of bull trout in the Grande Ronde River Recovery Unit. A reduced prey base is of particular concern in the Upper Grande Ronde River, Catherine Creek and Indian Creek watersheds.

Disease

There are no significant fish disease issues known in the recovery unit at this time. Bull trout populations, although low in abundance, generally appear to be in good health. However, diseases which may impact bull trout are present in the recovery unit (*i.e.* whirling disease has been present since the 1980's) and monitoring and screening efforts currently underway should continue. Although

bull trout in the recovery unit have not exhibited symptoms, disease issues can be difficult to detect in the natural environment.

Bull trout may be inherently resistant to some diseases that are more devastating to other salmonids. In studies conducted by Oregon State University researchers, Metolius (Deschutes) bull trout exposed to high and low doses of the infectious stages of *Myxobolus cerebralis* (causative agent in whirling disease) showed no signs of infection as measured by presence of spores, clinical disease signs, or histopathology. Rainbow trout exposed simultaneously showed high infection prevalence and disease severity. Nor were infections detected in Metolius (Deschutes) bull trout exposed to infection by *Ceratamyosis shasta* (Bartholomew 2001). Disease studies conducted on bull trout from the Deschutes River subbasin, showed them to be relatively resistant to all strains of Infectious Hematopeietic Necrosis Virus tested. Bull trout had detectable levels of antigen to *Renibacter salmoninarum* (bacterial kidney disease) but no evidence of the disease.

Isolation and Habitat Fragmentation

Isolation through habitat fragmentation has resulted from a variety of events. Habitat fragmentation has primarily occurred due to road and dam construction. For example, resident populations of bull trout in Hurricane Creek have been isolated above irrigation diversions. Culvert placement preventing upstream migration has precluded bull trout from some tributaries in the watershed. Loss of riparian habitat, primarily, has also resulted in water temperatures during the summer that are warmer than they were historically. On a seasonal basis, this warm water can act as a thermal barrier to isolate bull trout.

For example, warm water temperatures in the Grande Ronde River (particularly between the towns of La Grande and Elgin) may inhibit the ability of fluvial bull trout to migrate from the lower Grande Ronde River to spawning habitat in the upper Grande Ronde River.

ONGOING RECOVERY UNIT CONSERVATION MEASURES

Efforts to recover salmonid species, including bull trout, are ongoing in the Grande Ronde River subbasin. There is good cooperation between fishery entities on various projects. For example, spawning surveys to assess and monitor status and abundance have been a cooperative effort for many years involving Oregon Department of Fish and Wildlife, Oregon State Police, U.S. Forest Service, Confederated Tribes of the Umatilla Indian Reservation, Nez Perce Tribe, and local volunteers. The Grande Ronde River subbasin also has an active local watershed group dedicated to finding workable solutions to restoring native fish runs. The following represents many of the ongoing efforts within the recovery unit.

Oregon Department of Fish and Wildlife

Oregon Department of Fish and Wildlife initiated a bull trout research project in 1994 in the Grande Ronde subbasin. This research involves the genetics, habitat needs, limiting factors, and life history of bull trout in the basin. The project has contributed to status assessments as well as recovery planning and is ongoing. Oregon Department of Fish and Wildlife hired a bull trout coordinator in 1995 to complete Statewide bull trout status assessment, map bull trout distribution, and develop conservation strategies for bull trout. When bull trout were listed the effort shifted to recovery planning.

The Oregon Department of Fish and Wildlife modified fishing regulations for bull trout in the Grande Ronde River subbasin. In 1994 it became illegal to angle for bull trout in this watershed. Oregon Department of Fish and Wildlife has also modified regulations on other fisheries to reduce incidental take, reduced or eliminated brook trout stocking programs, made changes to instream work periods to better address bull trout needs, and developed and distributed bull trout identification posters to provide information to anglers. Oregon Department of Fish and Wildlife has a section 6 cooperative agreement with the U.S. Fish and Wildlife Service. Funding through section 6 has, in part, enabled spawning ground surveys to be conducted.

The Oregon Department of Fish and Wildlife implemented a project to eradicate brook trout from Langdon Lake to prevent their establishment in Lookingglass Creek. The Oregon Department of Fish and Wildlife also modified hatchery operations at Lookingglass Creek to provide timely passage for bull trout migrating upstream.

Oregon Department of Environmental Quality

In 2000, the Oregon Department of Environmental Quality completed a water quality management plan for the Grande Ronde basin. High water temperatures have been identified as a threat to bull trout recovery. Water temperature is also one of the parameters identified in the total maximum daily load process and its improvement would benefit bull trout populations in the basin.

U.S. Forest Service

The U.S. Forest Service has ongoing riparian enhancement projects in the upper reaches of the Grande Ronde River. Improved riparian structure will be beneficial to all aquatic species, including bull trout.

Tribes

The Nez Perce Tribe is planning to initiate a gene conservation effort through application of cryogenic technology for bull trout in the Grande Ronde River subbasin. This technology seeks to preserve genetic diversity of listed bull trout subpopulations before further population decline and loss of genetic diversity occurs.

The Nez Perce Tribe and Confederated Tribes of the Umatilla Indian Reservation operate weirs on the Lostine River as well as Catherine Creek and the upper Grande Ronde River, respectively. Both tribes collect information on abundance and timing of fluvial bull trout migrating upstream to spawn.

Multi-agency Efforts

Oregon Department of Fish and Wildlife, Oregon State Police, Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation, and U.S. Forest

Service staff work cooperatively on spawning and habitat surveys, research, telemetry, and abundance projects.

Bonneville Power Administration, the State of Oregon, and other Federal agencies have provided funding for numerous anadromous and bull trout habitat and research projects by the Oregon Department of Fish and Wildlife, Nez Perce Tribe, and the Confederated Tribes of the Umatilla Indian Reservation in the recovery unit.

RELATIONSHIP TO OTHER CONSERVATION EFFORTS

State of Oregon

On January 14, 1999, Governor Kitzhaber expanded the Oregon Plan for Salmon and Watersheds to include all at-risk wild salmonids throughout the State through Executive Order 99-01. The goal of the Oregon Plan is to "restore populations and fisheries to productive and sustainable levels that will provide substantial environmental, cultural, and economic benefits". Components of this plan include (1) coordination of efforts by all parties, (2) development of action plans with relevance and ownership at the local level, (3) monitoring progress, and (4) making appropriate corrective changes in the future. It is a cooperative effort of State, local, Federal, Tribal and private organizations, and individuals.

Oregon Department of Fish and Wildlife and Oregon Water Resources Department have established priorities for restoration of streamflow as part of the Oregon Plan for Salmon and Watersheds (Measure IV.A.8). Oregon Department of Fish and Wildlife has prioritized streamflow restoration needs by ranking biophysical factors, water use patterns, and the extent that water limits fish production in a particular area. Oregon Water Resources Department watermasters will incorporate the priorities into their field work activities as a means to implement flow restoration measures. The needs priorities will be used by the Oregon Watershed Enhancement Board as one criterion in determining funding priorities for enhancement and restoration projects. Watershed councils and other entities may also use the needs priorities as one piece of information to determine high priority restoration projects. Bull trout occupied streams in the recovery unit are included in the highest priority designation for streamflow restoration (Northwest Power Planning Council 2001).

Opportunities to convert existing out-of-stream flows to instream flows in Oregon are available through a variety of legislatively mandated programs administered by Oregon Water Resources Department, *e.g.*, transfers of type and place of use (ORS 536.050(4)), voluntary written agreement among water users to rotate their use of the supply to which they are collectively entitled (ORS 540.150

and OAR 690-250-0080), allocation of "conserved water" to instream use (ORS 537.455 to 537.500), lease all or a portion of consumptive water rights to instream purposes (ORS 537.348, OAR 690-77-070 to 690-77-077, exchange of a water right for an instream purpose to use water from a different source, being stored water, surface or ground water (ORS 540.533 to 540.543), and substitute a ground water right for a primary surface water right (ORS 540.524). Oregon Water Trust provides purchase of water rights from willing landowners for conversion to instream water rights.

Under an agreement with the Environmental Protection Agency, the State of Oregon's Department of Environmental Quality is conducting total maximum daily load surveys and developing Water Quality Management Plans. In the Grande Ronde River subbasin, total maximum daily load surveys have been completed throughout the subbasin (http://www.deq.state.or.us/wq/TMDLs/UprGR/UprGRTMDL.pdf). In April 2000, a water quality management plan was also developed for the Upper Grande Ronde River (http://www.deq.state.or.us/wq/TMDLs/UprGR/UprGRWQMP.pdf). This plan addresses forest, agricultural, urban and transportation sources of water quality impairment.

The Agricultural Water Quality Management Program, established through the State Senate Bill 1010 process (ORS 568.900 through 568.933), addresses water pollution associated with agricultural lands and activities.

The Oregon Department of Fish and Wildlife developed a management plan for native trout (Oregon Department of Fish and Wildlife 1988), which includes bull trout. Oregon's trout plan focuses on protecting native fish and the habitats in which they exist. The plan provides specific guidance to managers and is consistent with much of the recovery plan.

State of Washington

The Governor's office in Washington State has developed a Statewide strategy that describes how State agencies and local governments will work

together to address habitat, harvest, hatcheries, and hydroelectric power generation as they relate to recovery of listed species. The Salmon Recovery Act, passed in 1998, provides the structure for salmonid protection and recovery at the local level (counties, cities, and watershed groups).

The Washington Department of Fish and Wildlife has developed a bull trout management plan that addresses both bull trout and Dolly Varden (Washington Department of Fish and Wildlife 1992). The Washington Department of Fish and Wildlife no longer stocks brook trout in streams or lakes connected to bull trout waters. Fishing regulations prohibit harvest of bull trout, except for a few areas where populations are considered healthy, within the State. The Washington Department of Fish and Wildlife is also currently involved in a mapping effort to update bull trout distribution data within the State of Washington, including all known occurrences, spawning and rearing areas, and potential habitats. The salmon and steelhead inventory and assessment program is currently updating their database to include the entire State, which consists of an inventory of stream reaches and associated habitat parameters important for the recovery of salmonid species and bull trout.

In January 2000, the Washington Forest Practices Board (2000) adopted new emergency forest practice rules based on the Forest and Fish Report. These rules address riparian areas, roads, steep slopes, and other elements of forest practices on non-Federal lands. Although some provisions of forest practice rules represent improvements over previous regulations, the plan will have to rely on an adaptive management program for assurance that the new rules will meet the conservation needs of bull trout. Research and monitoring being conducted to address areas of uncertainty for bull trout include protocols for detection of bull trout, habitat suitability, forestry effects on groundwater, field methods or models to identify areas influenced by groundwater, and forest practices influencing cold water temperatures. The Forest and Fish Report development process relied on broad stakeholder involvement and included State agencies, counties, Tribes, forest industry and environmental groups. A similar process is also being used for agricultural communities in Washington and is known as Agriculture, Fish, and

Water. The U.S. Fish and Wildlife Service is considering the possible impacts and potential benefits from both of these State processes relative to bull trout recovery.

The Washington Department of Ecology is responsible for maintaining stream flows and does this by (1) supporting development of water restoration plans, (2) conducting technical studies and adopting instream flow rules, (3) buying water rights to restore flows, (4) using the hydro power relicensing program to restore flows, (5) obtaining trust water through the Trust Water Right Program (RCW 90.42) in Endangered Species Act areas, and (6) developing a State position to Federal management of the Columbia and Snake rivers (http://www.ecy.wa.gov/programs/wr/wrhome.html).

Columbia River Intertribal Fish Commission

The Columbia River Intertribal Fish Commission developed the Tribal Columbia River Fish Restoration Plan, or Wy-Kan-Ush-Mi Wa-Kish-Wit (http://ccrh.org/comm/river/docs/critfcp.htm). Recommendations set forth in this plan for salmon recovery address three types of actions: institutional, technical, and watershed, with the overriding goal of simply putting fish back in the river. Objectives and strategies specific to the Grande Ronde basin are included in this restoration plan and will ultimately benefit bull trout.

Confederated Tribes of the Umatilla Indian Reservation

The Confederated Tribes of the Umatilla Indian Reservation is responsible for protecting and enhancing treaty fish and wildlife resources and habitats. Members of the Confederated Tribes of the Umatilla Indian Reservation have Federal reserve fishing and hunting rights. Confederated Tribes of the Umatilla Indian Reservation comanages fishery resources with Oregon Department of Fish and Wildlife and implements restoration and mitigation activities throughout the areas of northeast Oregon and southeast Washington. Confederated Tribes of the Umatilla Indian Reservation holds aboriginal title and exercised usual and accustomed use to lands including but not limited to the Grande Ronde subbasin.

Nez Perce Tribe

The Nez Perce Tribe is responsible for managing, protecting, and enhancing treaty fish and wildlife resources and habitats in the Grande Ronde subbasin. The Tribe individually and/or jointly implements restoration and mitigation activities in the subbasin. The Tribe's Department of Fisheries Resources Management is responsible for managing fisheries resources to provide for healthy self sustaining populations of historically present species, and promote healthy ecosystem processes and rich species diversity.

Local Planning Efforts

The Grande Ronde Model Watershed Program (http://www.fs.fed.us/pnw/modelwatershed/) was selected in 1992 by the Northwest Power Planning Council as the model watershed project in Oregon. The Grande Ronde Model Watershed Program has a Board of Directors, composed of local representatives, Tribes and natural resource management agencies, to coordinate policy of the program. For the last nine years the Grande Ronde Model Watershed Program has served as an example of a watershed management partnership among local residents, agency staffs and public interest groups. The program coordinates the implementation, maintenance and monitoring of habitat restoration projects. To date the program has facilitated the implementation of nearly 300 restoration projects.

The Nature Conservancy protects the lands and waters, which plant and animal species need to survive. It is instrumental in purchasing lands for habitat protection, working with agencies with similar objectives, and has been involved in the Grande Ronde River subbasin.

Northwest Power Planning Council's Subbasin Planning

As part of the Pacific Northwest Electric Power Planning and Conservation Act of 1980, the Bonneville Power Administration has the responsibility to protect, mitigate and enhance fish and wildlife resources affected by operation of Federal hydroelectric projects in the Columbia River and tributaries. The Northwest Power Planning Council develops and coordinates the

Columbia River Basin Fish and Wildlife Program that is implemented by the Bonneville Power Administration, U.S. Army Corps of Engineers, U.S. Bureau of Reclamation, and Federal Energy Regulatory Commission. Coordination of Bonneville Power Administration's responsibilities for protection, enhancement, and mitigation and incorporation of recommendations by Northwest Power Planning Council is in part done through the development of subbasin summaries , which identify status of fish and wildlife resources, limiting factors, and recommended actions at the subbasin level.

A draft of the Grande Ronde subbasin summary was completed in June 2001 (http://www.cbfwa.org/files/province/blue/subsum/010601Grande.pdf). The summary encompasses the Grande Ronde River Recovery Unit, and is consistent with bull trout recovery planning efforts to identify limiting factors. The draft Grande Ronde subbasin summary identifies temperature, channel conditions, instream habitat diversity, flow, riparian, and passage as contributing to the decline of bull trout. The Grande Ronde River Recovery Unit Team will continue to utilize this planning process to identify and seek funding for projects to aid bull trout recovery.