INTRODUCTION

Recovery Unit Designation

The Umatilla-Walla Walla Recovery Unit is one of 22 recovery units designated for bull trout in the Columbia River Basin (Figure 1). Designation of the Umatilla-Walla Walla Recovery Unit is based in part on the inclusion of bull trout of these two river basins within the same Gene Conservation Group[1] by Oregon Department of Fish and Wildlife (Kostow 1995). This Gene Conservation Group also includes the John Day River bull trout. The delineation of the Gene Conservation Group is supported by the genetic analysis conducted by Spruell and Allendorf (1997). The Umatilla-Walla Walla Recovery Unit was further defined to include only the Umatilla and Walla Walla river basins for administrative and logistical reasons. Populations in the Umatilla-Walla Walla Recovery Unit are widely separated from those in the John Day Basin and are managed in different Oregon Department of Fish and Wildlife administrative units, as well as different U.S. Forest Service National Forests. The John Day Basin has an established bull trout working group and will be its own recovery unit.

Historically, the Umatilla and Walla Walla river basins contained important areas for anadromous salmon and steelhead production. Many actions identified for bull trout recovery will overlap with recovery objectives for anadromous fish species. Coordination of anadromous and resident fish efforts in the Umatilla-Walla Walla Recovery Unit is essential to ensure the recovery actions are not detrimental to all species concerned. In addition, this recovery unit geographically overlaps ceded lands of the Confederated Tribes of the Umatilla Indian Reservation. The Confederated Tribes of the Umatilla Indian Reservation have treaty rights that include fishing, hunting, and grazing. For purposes of recovery, the U.S. Fish and Wildlife Service considers a "recovered

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[1] As defined in Oregon Administrative Rule (635-07-501(18)), a Gene Conservation Group means a genetically distinct cluster of one or more populations within a taxonomic species that resulted because gene flow between the cluster and other populations of the same species has been zero or very low over sufficient geologic time.

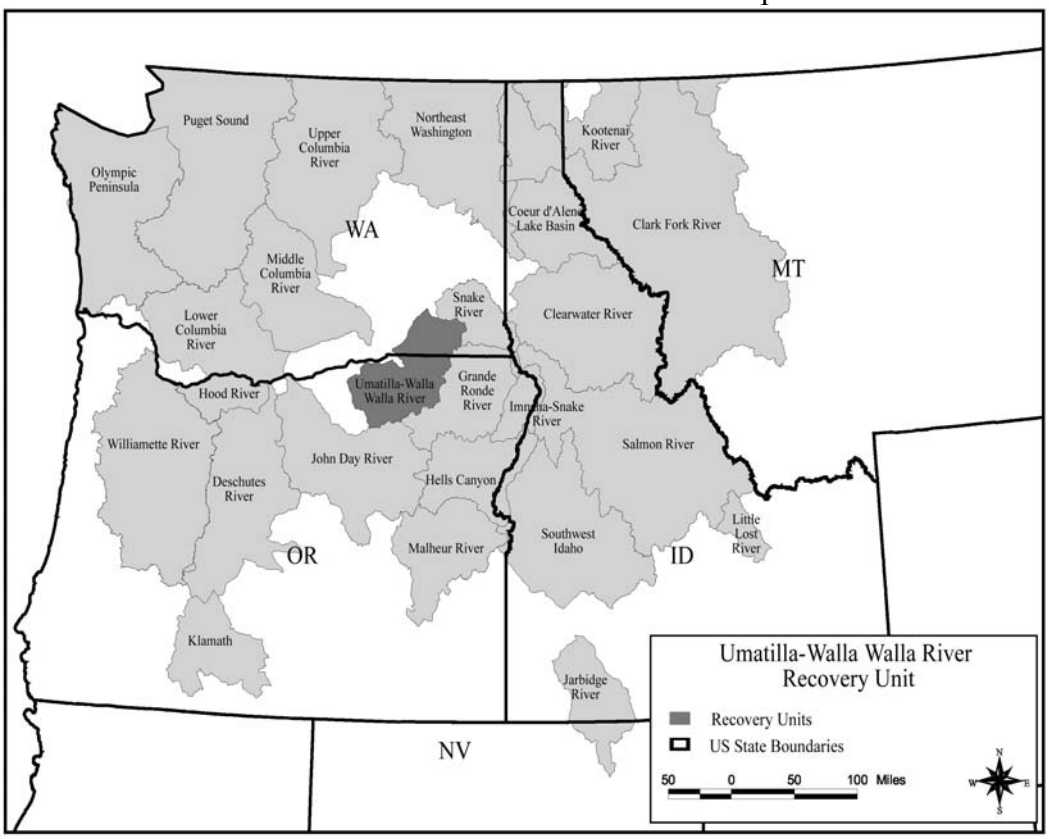


Figure 1. Bull Trout Recovery Units in the United States

status" to include the possibility for harvest within specific areas of the recovery unit. When the Umatilla-Walla Walla Recovery Unit has achieved its goal, the Washington Department of Fish and Wildlife, the Oregon Department of Fish and Wildlife, and the Confederated Tribes of the Umatilla Indian Reservation will determine the location and level of bull trout harvest that can be sustained while maintaining healthy populations.

Geographic Description

The recovery unit is part of the Columbia River Distinct Population Segment and is located in northeastern Oregon and southeastern Washington. It is bordered on the north by the Snake River, on the east by the Tucannon and Grande Ronde Rivers, on the south by the John Day River, and on the west by the Columbia River. Both the Umatilla and the Walla Walla Rivers drain the western slopes of the Blue Mountains

and enter the Columbia River from the east; the Umatilla River just downstream from McNary Dam (River Kilometer 469.9, River Mile 292) and the Walla Walla River upstream of the Umatilla River between McNary Dam and the confluence of the Columbia River with the Snake River (Oregon Water Resources Department (OWRD) 1974 and 1988).

The Umatilla River drains an area of approximately 2,540 square miles (6,579 square kilometers) and is approximately 89 miles (143 kilometers) from its mouth to where it divides into the north and south forks Umatilla River, each fork adding another approximately 10 miles (16 kilometers) of length. Major tributaries in addition to the north and south forks include Meacham Creek, Birch Creek, Butter Creek, and Wildlhorse Creek. Of these, the north and south forks and Meacham Creek contain the most current and potential bull trout spawning and rearing habitat for bull trout. The Umatilla River originates at elevations up to 4,228 feet (1,289 meters) and descends to an elevation of about 269 feet (82 meters) at its confluence with the Columbia River.

Average annual discharge of the Umatilla River Basin for calendar years 1995 to 1999 was 531,486 acre-feet (124 million cubic meters), measured at the gauging station near Umatilla, Oregon (River Kilometer 3, River Mile1.9). For a longer period of record, annual discharge at this gauge has averaged 345,700 acre-feet (80.7 million cubic meters) from 1928 to 1999. These figures do not include consumptive water use from irrigated agriculture (G. Torretta, U.S. Bureau of Reclamation, pers. comm. 2001).

The Walla Walla River drains an area of approximately 1,758 square miles (4,453 square kilometers), of which 73 percent or 1,278 square miles (3,309 square kilometers) is located in Washington and 480 square miles (1,243 square kilometers) is located in Oregon (U.S. Corps of Engineers (USCOE) 1997). The north and south forks of the Walla Walla River originate in Oregon at elevations of 4,920 to 5,576 feet (1,500 to 1,700 meters). The North Fork Walla Walla River, 18 miles (29 kilometers) in length, and the South Fork Walla Walla River, 27 miles (43 kilometers) in length, join to form the mainstem Walla Walla River about 4 miles (6.4 kilometers) southeast of the town of Milton-Freewater, Oregon. Other major

tributaries include the Touchet River, approximately 90 miles (145 kilometers) in length, and Mill Creek, approximately 35 miles (56 kilometers) in length. The Touchet River drains the northern and northwestern portions of the Walla Walla Basin before entering the lower mainstem Walla Walla River about 21.6 miles (34.8 kilometers) upstream of the Columbia River near the community of Touchet, Washington. From its headwaters in the Blue Mountains, Mill Creek dips south and flows for about 6 miles (10 kilometers) in Oregon (about 17 percent is in Oregon), then re-enters Washington to join the mainstem Walla Walla River downstream from the city of Walla Walla at River Mile33.6 (River Kilometer 54). The elevation of the Walla Walla River is about 340 feet (104 meters) at its confluence with the Columbia River in Washington. The highest point in the Walla Walla Basin is Table Mountain at 6,250 feet (1,905 meters) elevation (USCOE 1997).

Average annual runoff in the Walla Walla Basin is 462,000 acre feet (107.9 million cubic meters). Forty percent of the annual runoff comes from the Touchet subbasin which accounts for 22 percent of the drainage area. The South Fork Walla Walla River accounts for 30 percent of the runoff but only 4 percent of the drainage area (USCOE 1997).

The Blue Mountains form the drainage divide on the east and southeast border of the recovery unit. The mountain topography is characterized by flat-topped ridges, steep-walled canyons, mountain slopes, and narrow riparian valleys. The lowlands in both river basins are characterized by low terraces and gently rolling hills.

Geology. The recovery unit encompasses portions of two physiographic provinces, the Blue Mountain Province, and the Columbia Basin Province as described in Franklin and Dyrness (1984), or in terms of ecoregions, the Blue Mountains and the Columbia Plateau ecoregions (U.S. Forest Service (USFS) 1997).

Both provinces/ecoregions are underlain by the Columbia River Basalt formation, a series of thick lava flows that covered a vast area in Oregon, Washington, and Idaho during the Miocene. The basalt flows range in thickness from 1.5 to 45.7 meters, or 5 to 150 feet (OWRD 1988). Regional uplifting of the basalt gave rise to the Blue Mountains and defines the boundary between the two

provinces/ecoregions. This uplifting folded and faulted the basalt with arch-shaped folds (anticlines) forming the uplands and U-shaped folds (synclines) resulting in deposition basins between the upland areas. In the Umatilla River Basin the uplifting tilted the basalt to the north. The Walla Walla syncline is a major feature in the Walla Walla Basin (OWRD 1988).

More recent vulcanism such as the eruption of Mt. Mazama about 6,500 years ago, resulted in ash deposits over much of the central and northern Blue Mountains (Franklin and Dyrness 1984). In the upper Umatilla drainage it is an important component of the soils on the Umatilla National Forest (U.S. Forest Service (USFS) 2001).

Events during the Pleistocene epoch (1.6 million years to 10,000 years ago) affected the geology of the Columbia Plateau. Within the Walla Walla syncline a deep clay layer deposited on the basalt covers the central portion and is up to 152 meters (500 feet) thick in some places (Newcomb 1965). A thick alluvial fan formed from outwash materials carried down out of the mountains rests directly over the basalt along the margins of the Walla Walla Basin (OWRD 1988). Wind blown silt and fine-sand outwash from the glaciers deposited as thick blankets of loess across the Columbia Plateau give rise to the characteristic rolling hill topography of the lowland areas.

Also during the Pleistocene, two large temporary lakes formed periodically as a result of flood waters from glacial Lake Missoula and the Columbia River. Lake Lewis formed from the damming of the Columbia River at Wallula gap and covered a vast area that included the Walla Walla River valley. The Touchet beds, a thick deposit of silt and fine sand found in the lower Walla Walla valley, are believed to have been deposited by Lake Lewis (Newcomb 1965). Lake Condon was formed as flood waters ponded at the entrance to the Columbia Gorge (USFS 1997). Glacial-lake sediments and overlying glacial-stream deposits, located in the lowlands (below 229 meters or 750 feet elevation) of the Umatilla Basin near the Columbia River, resulted from the downstream damming of the ancestral Columbia River (OWRD 1988). Modern stream activity has deposited alluvium in the river valleys and floodplains of both basins.

Climate. The climate in the Umatilla-Walla Walla Recovery Unit is primarily continental, but is modified by inflows of marine air from the Pacific Ocean that brings rain in late fall and winter. Snow occurs at the higher elevations in winter. Summers are dry and hot. Winter mean monthly temperatures for the interior Columbia Basin range from minus 10 degrees Celsius (50 degrees Fahrenheit) to minus 3 degrees Celsius (37 degrees Fahrenheit), while summer temperatures range from 10 degrees Celsius (50 degrees Fahrenheit) to 15 degrees Celsius (59 degrees Fahrenheit) (Quigley *et al.* 1997). Annual precipitation averages less than 15 inches (38 centimeters) per year and ranges from as low as 7 inches (18 centimeters) in some areas near the Columbia River to up to 65 inches (165 centimeters) in the Blue Mountains. Occasional, intense thunderstorms occur in the basins. Rain-on-snow and rain-on-frozen soil events can occur as they did in the winters of 1995 to 1996, and 1996 to 1997, resulting in severe flooding and erosion (Bureau of Reclamation (BOR) 1997). Severe flooding also occurred during the winter of 1964 to 1965.

Vegetation. Native vegetation in the recovery unit is reflective of the precipitation and topographic patterns that exist in the region. Coniferous forests dominate in the mountainous regions at the higher elevations and with greater moisture. Within this zone true fir species (*Abies* spp.) dominate on the mountain plateaus and wetter, north-facing slopes, while ponderosa pine is the primary tree species at lower elevations, 900 to 1,500 meters (2,952 to 4,920 feet) (Franklin and Dyrness 1984) and on the drier, south-facing slopes. In places, the forest extends down into canyons where there is sufficient moisture to support their existence. These areas stand out in an otherwise grass dominated region that occurs on the lower mountain slopes and extends into the lowlands. The driest areas of the recovery unit support sagebrush/grass communities. Riparian areas support cottonwood (*Populus* spp.) and alder (*Alnus* spp.), as well as, willow (*Salix* spp.) and other shrub species.

Robert Stuart's narrative of his 1812 journey eastward from Astoria described the Umatilla River near the present day town of Pendleton: "bottoms well covered with cottonwood pofsefs (a good) many Swamps and Ponds in which reside a great multitude of beaver" (Rollins 1935). Many of the pioneers traveling through the area noted the cottonwoods along the river (Nagle 1998).

As a result of settlement and development in the Columbia River Basin, much of the native grassland has been converted to more steppe/grass communities. Changes in the forest composition have occurred as a result of timber harvest and suppression of fire.

Fire is a part of the historical ecosystem in the Umatilla-Walla Walla Recovery Unit. The native vegetation present when the white settlers arrived had evolved in the presence of fire and adapted to it. Fire was certainly used by native peoples to manipulate their environment. The Blue Mountains derived their name from the smokey, blue haze that characterized their appearance to the settlers, a result of the numerous fires that burned in the fall. Current vegetative conditions are quite different from historical times as a result of aggressive fire suppression and timber harvest (USFS 2001). According to the Umatilla and Meacham Ecosystem Analysis (2001) "these changes in vegetation have been accompanied by shifts in fire regimes such that many more forested acres are currently "at risk" from stand-replacement type wildfires than would have been the case 100 years ago; the extant fire-resistant ponderosa pine and western larch are much reduced. A loss of hardwood vegetation along the streams has also occurred."

Cultural/social. In the early 1800's when the European settlers arrived, Native Americans (Umatilla, Walla Walla, Cayuse, and Nez Perce) were well established in the Columbia Plateau region. These were semi-sedentary people who survived by harvesting the native flora and fauna for food, clothing, and shelter. Tribes used fire to increase hunting success (CH2MHill 1995). They acquired horses around 1730, and grazed them in the river valleys (CH2MHill 1995). Horses were important to the Umatilla Tribe who used them during their annual foraging trips into the Blue Mountains (Walker 1991). The annual report for 1877 by the Commissioner of Indian Affairs to the Secretary of the Interior estimated 17,000 horses and 5,000 cattle belonging to the Umatilla Tribe.

Today the Confederated Tribes of the Umatilla Indian Reservation have treaty rights to 158,303 acres (64,065 hectares) of reservation lands in the Umatilla River Basin (Torgeson 1999) and make use of ceded lands throughout the Umatilla and Walla Walla Basins and beyond, extending to the Snake River east of Baker City.

Areas of usual and accustomed, and joint use with other tribes extend beyond the ceded areas to the northeast, east, and south to the Snake River (Contor 1995). The Confederated Tribes of the Umatilla Indian Reservation are made up of the Umatilla, Cayuse, and Walla Walla Tribes (OWRD 1988).

The first of the Euro-Americans to arrive were the explorers and the fur trappers in the early 1800's. Beaver were systematically eradicated from rivers and streams across the inland west in the mid 1800s, and this effort most likely included the Umatilla and Meacham watersheds because of the proximity of the Fort Walla Walla fur post (Beckham 1995). Nagle (1998) speculated that most, if not all the beaver along the mainstem of the Umatilla had been eliminated out by the time the Euro-American settlers arrived.

Early explorers and fur trappers crossed over the Blue Mountains into the basin on what would become the Oregon Trail (CH2MHill 1995). This became a major pathway for settlers by the mid-1850's. The discovery of gold in the Powder, Burnt, and John Day river systems in Oregon stimulated settlement and with it the development of livestock and farming enterprises in the Umatilla Basin by the 1860's. The Homestead Act of 1862, and the Desert Land Act of 1877, promoted settlement in the region (CH2MHill 1995). The region became a major producer of wheat and livestock. Railroad lines from Walla Walla to the Columbia River and from Umatilla over the Blue Mountains to the Snake River at Huntington were operating by the late 1880's (CH2MHill 1995). The Union Pacific railroad route over the Blue Mountains parallels the mainstem Umatilla River then follows Meacham Creek to the headwaters before descending into the Grande Ronde Basin.

Major urban areas include the cities of Pendleton, Oregon; and Walla Walla, Washington. Walla Walla is the largest with an estimated population of 29,440, followed by Pendleton with 17,320. Smaller towns include Hermiston, Umatilla, and Milton-Freewater in Oregon, and College Place and Dayton in Washington. The estimated population of Hermiston, Milton-Freewater, Umatilla, College Place, and Dayton are 12,425; 6,690; 4,410; 7,110; and 2,555, respectively (http://bluebook.state.or.us/local/populations/populations.htm; and http://www.ofm.wa.gov/demographics.htm). All of the major urban areas are

intimately associated with the river system. The Umatilla River flows through Pendleton, the Walla Walla River flows through Milton-Freewater, Mill Creek flows through Walla Walla and College Place, and the Touchet River flows through Dayton.

Rural residential development occurs along the Umatilla River upstream of Pendleton to the mouth of Bear Creek, where the Bar M Dude Ranch is located, and in the Meacham Creek watershed. Thirty-two households are situated between the mouths of Meacham Creek and Bear Creek, and an estimated 90 people are permanent residents in the Meacham watershed (USFS 2001). Some rural residential development also occurs along the South Fork Walla Walla River just downstream of Harris Park, along Mill Creek between Kooskooskie and Tiger Creek, and along the upper tributaries of the Touchet River (Jim, Lewis, and Burnt Creeks; North Fork Touchet; South Fork Touchet; and Wolf Fork Touchet Rivers).

Land use. Agriculture dominates land use in the recovery unit. Intensive agriculture, both irrigated and dryland, occur in the valleys and bench lands. Livestock grazing also occurs in areas not otherwise developed as cropland and in forested areas where the topography allows. Timber harvest occurs in the forested regions except in designated wilderness and in the upper Mill Creek subwatershed, which is the watershed for the city of Walla Walla.

The Umatilla National Forest encompasses approximately 446 square miles (1,155 square kilometers) in the recovery unit. The Wenaha National Forest was established in 1902 and included portions of present forest north of the Old Oregon Trail. It was incorporated into the Umatilla National Forest in 1920 (http://www.fs.fed.us/r6/uma/history). Most of the bull trout spawning and early juvenile rearing habitat in the recovery unit occurs on National Forest land. The North Fork Umatilla Wilderness encompasses all known spawning habitat in the North Fork Umatilla River.

Timber harvest on the Umatilla Reservation is handled through the tribal zoning office by way of a conditional use permit. To obtain a permit the permitee

must have a long-range timber management plan that addresses runoff, compaction, thermal cover for wildlife, etc.

Timber harvest of any significance in the Umatilla Basin dates from the 1850's to present time. Umatilla National Forest statistics show a rapid rise and peak in harvest during the 1970's, a significant drop in the 1980's, and further decline in the 1990's. Road construction paralleled the timber sale program in both time and location (USFS 2001). Less of the National Forest in the Umatilla Basin has been harvested compared to other areas in the Blue Mountains. During the peak harvest period (1970 to 1978), 26,374 acres (10,674 hectares) in the upper Umatilla and Meacham Basins were involved in Federal timber sales (USFS 2001).

Significant timber harvest on the National Forest in the upper Walla Walla Basin dates from after World War II. Prior to that most logging occurred on private timberlands dating from the mid-1920's. In the 1990's, the logging occurred at a higher rate on private lands (BOR 1997) and represented "a substantial proportion of the ongoing logging operations in the Walla Walla subbasin" (Northwest Power Planning Council (NPPC) 2001a).

Surface streams and springs were the major sources of water available to the early settlers and water rights date from the late 1850's. Irrigation districts formed in the Umatilla Basin by the early 1900's, and the Bureau of Reclamation had begun to assist irrigators in investigating reservoir sites to supplement reduced streamflows. Cold Springs Reservoir was constructed in 1908, and McKay Creek Reservoir was operational by 1927. By the 1920's the Umatilla River was fully appropriated during the summer months. Development of ground water began in the 1940's, but expanded greatly in the 1960's with the advent of wheeled irrigation systems and the subsequent expansion of acreage that could be economically farmed. The Umatilla River was withdrawn from further appropriation for the period June 1 to October 31 in 1985 (OWRD 1988).

Six major irrigation diversions (Stanfield, Cold Springs, Westland, Dillon, Maxwell, and Three Miles Falls Dams) are located in the lower 32 miles (51 kilometers) of the mainstem Umatilla River (OWRD 1988). All are screened. Large

quantities of water are diverted for irrigation uses at one or more of these points nearly year round. Prior to implementation of the Umatilla Basin Project in the early 1990's, these diversions dewatered entire reaches of the mainstem Umatilla River during late spring through fall. The Umatilla Basin Project is a cooperative project with U.S. Bureau of Reclamation, Oregon Department of Fish and Wildlife, Confederated Tribes of the Umatilla Indian Reservation, Bonneville Power Administration, irrigation districts, and Oregon Water Resources Department, that pumps Columbia River waters to certain irrigation districts in exchange for districts leaving Umatilla River flows instream during key anadromous fish migratory periods.

The pattern of development in the Walla Walla subbasin was similar, although the lack of suitable reservoir sites led to an earlier reliance on groundwater resources. Initially the shallow gravel aquifer was exploited, and by the mid-1930's wells were being drilled in the Columbia River basalt to meet growing needs of municipalities and the food processing industry (Newcomb 1965).

The upper Mill Creek watershed provides municipal water to the city of Walla Walla, and human entrance into the watershed, except for big game hunting and administrative uses, has been prohibited since the early 1900's. Conversely, much of the lower Mill Creek has been highly altered for flood control through the towns of Walla Walla and College Place.

Development of the mainstem hydroelectric system on the Columbia River brought inexpensive electricity to the region to run the pumps and aid further development in the basins. McNary Dam, situated in the Columbia River between the mouths of the Umatilla and Walla Walla Rivers at River Mile292 (River Kilometer 470), was completed in 1957 with provision for fish passage.

Fish Species. Fish species found during surveys of the lower mainstem Umatilla in 1996, include redband/steelhead *(Oncorhynchus mykiss gairdneri)*, mountain whitefish (*Prosopium williamsoni)*, chinook salmon (*O. tshawytscha)*, coho salmon (*O. kisutch),* lamprey (*Lampetra spp*.), northern pikeminnow (*Ptychocheilus oregonensis)*, suckers (*Catostomus spp.)*, chiselmouth (*Acrocheilus alutaceus)*, speckled dace (*Rhinichthys osculus)*, redside shiner (*Richardsonius balteatus)*,

sculpin (*Cottus spp.)*, carp *(Cyprinus carpio)*, smallmouth bass (*Micropterus dolomieui)*, brown bullhead *(Ictalurus nebulosus*), bluegill (*Lepomis macrochirus)*, and pumpkinseed *(Lemomis gibbosus)* (Contor 1997). Introduced species include brown bullhead, channel catfish *(Ictalurus natalis)*, bluegill, largemouth bass *(Micropterus salmoides*), smallmouth bass, white crappie *(Pomoxis annularis)*, and black crappie (*Pomoxis nigromaculatus*) (Oregon Department of Fish and Wildlife (ODFW) 1973), and pumpkinseed sunfish (J. Germond, Oregon Department of Fish and Wildlife, pers. comm. 2000).

The Umatilla Basin once supported runs of anadromous salmon, fall and spring chinook, and coho salmon. Summer steelhead have persisted, but at lower numbers than historical levels. Efforts by Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife to re-establish salmon from hatchery stocks have resulted in returning runs of fall chinook to Three Mile Dam since 1985, spring chinook since 1988, and coho since 1987 (Laws 1996). Fall chinook and coho spawn upstream and downstream of Pendleton, and spring chinook salmon spawn upstream of Pendleton (J. Germond, pers. comm. 2000).

In addition to bull trout, fish species present in the Walla Walla River Basin include spring and fall chinook salmon (presumed hatchery strays), redband trout/summer steelhead, mountain whitefish, brown trout (*Salmo trutta)*, brook and river lamprey, longnose dace (*Rhinichthys cataractae*), speckled dace, Umatilla dace (*R. umatilla)*, leopard dace *(R. falcatus)*, chiselmouth, peamouth (*Mylocheilus caurinus*), redside shiner, northern pikeminnow, bridgelip and largescale sucker, carp, bullhead and brown catfish, tadpole madtom (*Nortorus gyrinus*), channel catfish, smallmouth bass, largemouth bass, pumpkinseed, bluegill, white crappie, black crappie, warmouth (*Lepomis gulosus*), yellow perch (*Perca flavescens*), paiute sculpin (*Cottus beldingi*), margined sculpin (*C. marginatus*), torrent sculpin (*C. rhotheus*), 3-spine stickleback (*Gasterosteus anculeautus*), and sandroller (*Percopsis transmontana*) (NPPC 2001a).

The Walla Walla River once supported significant runs of spring chinook and steelhead. Fall chinook, chum, and coho salmon may have occurred in the Walla Walla River in smaller numbers. Information provided by the Confederated Tribes of

the Umatilla Indian Reservation indicates tribal fishers took chum, steelhead, coho, and eels at usual and accustomed sites in the lower Walla Walla River near the mouth. Summer steelhead are the only native anadromous salmonid found in the Walla Walla River Basin at present, although their status is "depressed based on chronically low production" (Washington Department of Fish and Wildlife (WDFW) 1993). The last significant run of spring chinook was reported in 1925 (Nielson 1950), and they persisted into the 1950's (Van Cleave and Ting, *in litt.* 1960).

During the 1999 mainstem snorkel survey salmonids were found near the mouth of the Touchet River in early July, but were gone my mid-August. During surveys in 2000, salmonids were found approximately 4 miles (6.4 kilometers) downstream of Mill Creek in late June and mid-August (G. Mendel, WDFW, pers. comm. 2000). Habitat in the lower reaches of the Walla Walla River and its tributaries presents a challenge to salmonids due to inhospitable temperatures (*i.e.*, greater than 75 degrees Fahrenheit or 24 degrees Celsius) for extended periods of time (Mendel *et al*. 1999). The most downstream observation of salmonids in the mainstem Touchet River was at Boles Bridge between Waitsburg and Prescott during the 1999 surveys.

Since 1984, hatchery steelhead have been released in the Walla Walla near Touchet (Martin *et al*. 2000). Hatchery steelhead smolts are also released in the Touchet River below the confluence of the Wolf Fork and Touchet River (Schuck *et al*. 1989) and at Dayton below the confluence of the South Fork Touchet and North Fork Touchet Rivers (G. Mendel, pers. comm. 2001). Hatchery spring chinook were reintroduced into the South Fork Walla Walla by Confederated Tribes of the Umatilla Indian Reservation in 2000 (NPPC 2001a). However Washington Department of Fish and Wildlife biologists have observed stray spring chinook entering and spawning in the basin in increasing numbers over the past four to six years (G. Mendel, pers. comm. 2001).

DISTRIBUTION AND ABUNDANCE

Status of Bull Trout at the Time of Listing

Oregon and Washington have used different classification systems to assess status of bull trout populations. The 1997 status of the Umatilla bull trout populations was categorized as "of special concern" in the North Fork Umatilla River, and as at "high risk" of extirpation in the South Fork Umatilla River and North Fork Meacham Creek (Buchanan *et al.* 1997). In 1996, Oregon bull trout in the Walla Walla Basin were classified as at "high risk" of extirpation in the North Fork Walla Walla River, at "low risk" in the South Fork Walla Walla River, and "of special concern" in Mill Creek (Buchanan *et al*. 1997). Washington Department of Fish and Wildlife considers the status of Mill Creek bull trout as "healthy" and Touchet River bull trout as "unknown" (WDFW 1997).

At the time of listing, the U. S. Fish and Wildlife Service used criteria in Reiman *et al.* (1993) to classify all bull trout subpopulations in the Umatilla-Walla Walla Recovery Unit as "depressed" (63 FR 31647). In the final listing rule (63 FR 31647) two bull trout subpopulations in the Umatilla River Basin were identified (Meacham Creek and the North Fork-South Fork Umatilla River), and three subpopulations were identified in the Walla Walla River Basin (South-North Fork Walla Walla River, Mill Creek, and Touchet River). Threats to long-term persistence included dams, forest management practices, roads, agricultural practices, grazing, and nonnative species. 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

Bull trout in the Umatilla-Walla Walla Recovery Unit exhibit both fluvial and resident life histories. Adult resident forms are generally less than 300 millimeters (12 inches) in length, while adult fluvial bull trout can exceed 500 millimeters (20 inches)

in length. Both forms spawn in headwater tributaries from late August into November, although the actual spawning season may vary within this period depending on local conditions in each stream. After spawning, fluvial bull trout return to overwintering areas in the mainstems of both river systems until the following spring when the upstream migration begins, presumably in response to increasing water temperatures. They spend the summer through fall in lower order tributaries or in the upper mainstems of the Umatilla and Walla Walla Rivers.

Scale analysis from bull trout captured in Mill Creek in 1998, showed bull trout up to nine years of age in the sample. Most fish captured in the upstream migrant trap and presumed upstream migrants were 5 years or older and those captured in the downstream migrant trap were age 4 or younger (Hemmingsen *et al*. 2001b). Scale analysis from 17 Umatilla River bull trout, including otoliths from two mortalities, showed bull trout larger than 250 centimeters (10 inches) were over 3 years of age (ODFW 1997).

Martin *et al*. (1992) reported that the minimum fork length of any observed spawning bull trout was 250 millimeters (10 inches) in three southeast Washington streams, including Mill Creek, and ranged up to 600 millimeters (24 inches) in size. Bellerud *et al*. (1997) observed spawning bull trout ranging in size from 100 millimeters (4 inches) to greater than 500 millimeters (20 inches), with most of them in 300 millimeters (12 inches) or larger size classes. Size of bull trout observed during Oregon Department of Fish and Wildlife spawning ground surveys in the South Fork Walla Walla River in 1995 ranged in size from approximately 200 millimeters (8 inches) to greater than 610 millimeters (24 inches) (Germond *et al*. 1996a). Based on the scale analysis in 1998, most Mill Creek spawners are age four or older (Hemmingsen *et al*. 2001b). Eroded caudal fins indicating prior spawning activity suggest Umatilla bull trout reach sexual maturity and spawn in their fourth year (ODFW 1997).

Additional information is needed on bull trout life history and abundance to better estimate adult abundance, monitor genetic health, and assess population viability in the recovery unit. A tentative list includes (1) annual abundance of breeders per local population and total for the recovery unit; (2) population structure

and connectivity; (3) life history characteristics including age at first spawning, incidence, regularity and timing of repeat spawning, and total life span; (4) reproductive success in production of pre-adult offspring; (5) survival rates to breeding adult; and (6) reproductive success in replacement of breeders (Kathryn Kostow, Oregon Department of Fish and Wildlife, pers. comm. 2001).

For planning purposes the Umatilla and the Walla Walla river basins were each divided into major reaches based on existing or potential habitat, they provide for resident and migratory bull trout. Two habitat categories were identified: (1) spawning, juvenile rearing, and resident habitat, and (2) overwintering, migration, and sub-adult rearing habitat. Each river basin will be discussed separately.

Umatilla Basin. For purposes of this recovery plan the recovery unit team has identified one local population, the upper Umatilla Complex, that includes the North Fork and South Fork Umatilla Rivers, although spawning has only been documented in the North Fork Umatilla River. Population numbers in Meacham Creek are believed to be below what can be considered a viable population at this time due to lack of evidence of spawning. Reach delineations for the Umatilla Basin are listed in Table 1.

Data from screw traps and radio-tagged bull trout show migrants in the mainstem Umatilla downstream of Meacham Creek (Reach I) in late October and early November. They currently use this reach as far downstream as Pendleton from late October until June when fish begin to migrate upstream, probably in response to warming water temperatures. Squaw Creek is also used by rearing and migrating bull trout (Contor *et al*. 1995). Juvenile rainbow trout have been observed downstream to Cayuse (River Kilometer 109, River Mile67.5) during summer and this is currently the downstream summer distribution limit for cold water species (Umatilla-Walla Walla recovery unit team, *in litt*, 1999a). Data from monitoring stations at Echo and Pendleton indicate the water temperatures increase above 12 degrees Celsius (54 degrees Fahrenheit) in this reach between June and October (ODFW, *in litt.* 1999b). The greatest bull trout adult densities were recorded at temperatures equal or less than 12 degrees Celsius (54 degrees Fahrenheit); no

Table 1. Reach delineations and habitat use by bull trout in the Umatilla River Basin as defined by the Umatilla-Walla Walla recovery unit team (ODFW, *in litt.* 1999a).

Reach	Habitat use by bull trout
I Umatilla River mainstem and tributaries from the mouth at the Columbia River upstream to the confluence with Meacham Creek	Adult migration and overwintering habitat and seasonal subadult rearing habitat
II Meacham Creek mainstem and tributaries (except for North Fork Meacham Creek)	Migration corridor by fluvial bull trout and potential adult overwintering
III North Fork Meacham Creek and its tributaries from the mouth to headwaters	Spawning and rearing
IV Mainstem Umatilla River and tributaries from Meacham Creek to the confluence of the North Fork and South Fork Umatilla	Used seasonally by rearing subadults and overwintering adults
V North Fork Umatilla and tributaries from the mouth to headwaters	Spawning, rearing and resident bull trout
VI South Fork Umatilla and tributaries from the mouth to headwaters	Rearing and resident bull trout and potential spawning

individuals were present at temperatures above 20 degrees Celsius (68 degrees Fahrenheit), as reported in the general literature (Buchanan and Gregory 1997). Very little is known about bull trout use of the mainstem and tributaries downstream of Pendleton, although a few bull trout have been observed there since 1994. Staff at the adult upstream migrant fish collection facility at Three Mile Dam recorded single bull trout in the spring of 1995, 1996, 1999 and 2000, and a bull trout was captured at the juvenile collection facility at Westland (River Mile27.3, River Kilometer 44) in 1994 (ODFW unpublished data). Bull trout were also angled at Echo in 1998 and at approximately River Mile42 (River Kilometer 68) in 1997, during the winter steelhead fishery. During November 1999, two bull trout were salvaged from lower McKay Creek, after McKay Reservoir water releases for fish migration were ended for the season.

Meacham Creek mainstem and tributaries (except for North Fork Meacham Creek) (Reach II) if restored could serve as future adult overwintering habitat. Suitable spawning and rearing habitat occurs in East Fork Meacham Creek, but bull trout have not been observed there (Germond *et al*. 1996b).

Most bull trout use in North Fork Meacham Creek (Reach III) occurs upstream of the confluence of North Fork Meacham and Bear Creeks and in Pot Creek. Resident bull trout are also found in this reach. When redd counts were initiated in 1994, two redds were observed in the reach between Bear Creek and Pot Creek and one redd was observed in Pot Creek. One redd, possibly that of a bull trout, was observed in Pot Creek in 1995, but none have been seen during surveys since that time. A few adult bull trout have been observed in the North Fork of Meacham Creek several miles above the mouth during summer steelhead escapement surveys in April and May and one during spring chinook prespawning surveys in July (P. Kissner, Confederated Tribes of the Umatilla, pers. comm. 2001).

The mainstem Umatilla River and tributaries from Meacham Creek to the confluence of the North Fork and South Fork Umatilla Rivers (Reach IV) is used seasonally by rearing subadult and overwintering adult bull trout. Rearing and migration also occur in Ryan Creek (Germond *et al*. 1996b). Reach IV has the potential to provide year round rearing habitat if restored.

The North Fork Umatilla River (Reach V) supports most of the spawning, rearing and resident bull trout use in the Umatilla Basin. Most of the spawning occurs in the North Fork Umatilla mainstem between Coyote and Woodward Creeks, in approximately 5 kilometers (3 miles) of habitat. Some rearing occurs in Coyote Creek (Germond *et al*. 1996b), and one redd was found during spawning surveys in 1999 (J. Germond, pers. comm. 2000).

Bull trout spawning has not been observed in the South Fork Umatilla (Reach VI) since 1994. At that time one redd was counted in the reach between the mouths of Thomas and Shimmiehorn Creeks, although it may conceivably have been a spring chinook redd (Jon Germond, pers. comm. 2000). Rearing occurs in Buck, Thomas,

Spring, and Shimmiehorn Creeks (Germond *et al*. 1996). With restoration the South Fork Umatilla may also support another local bull trout population.

Evidence of spawning activity has not been observed in Meacham Creek since 1994, although some rearing is known to occur. With restoration this system could potentially support a local bull trout population.

Redd count information for the North Fork Umatilla population is shown in Figure 2. A coordinated effort to collect spawning count data involving Oregon Department of Fish and Wildlife, Confederated Tribes of the Umatilla Indian Reservation, and U.S. Forest Service has been ongoing since 1994. The apparent increase in redd counts is generally attributed to more restrictive angling regulations instituted in 1994 and 1997. Population estimates for adult bull trout populations in the North Fork Umatilla River between 1994 to 2000, based on redd counts, ranged from 53 to 352, and averaged 165.

Walla Walla Basin. For purposes of recovery planning, the recovery unit team has identified three local populations: (1) Upper Walla Walla Complex, which includes the North and South Forks of the Walla Walla River; (2) Mill Creek and tributaries; and (3) the Touchet River and tributaries. These divisions may be further refined as we learn more about bull trout homing fidelity to spawning areas within these local populations. Other tributary streams where bull trout may occur, but where their presence/absence has yet to be confirmed, include Cottonwood Creek (mainstem Walla Walla tributary), Little Meadows Canyon and Big Meadows Canyon (North Fork Walla Walla River tributaries). Reach delineations for the Walla Walla Basin are shown in Table 2.

Bull trout spawn mainly in the South Fork Walla Walla River (Reach I) between Table Creek and the second major tributary above Reser Creek (River Kilometer 24.6 to 34.9, River Mile15 to 22), the lower 1.6 kilometers (7 miles) of Skiphorton, and the lower 0.8 kilometer (0.5 mile) of Reser Creek. The majority of spawning fish are found above Bear Creek (ODFW, *in litt*. 1999c). From 1992 to 2000, bull trout have been captured annually in a screen bypass trap on the South

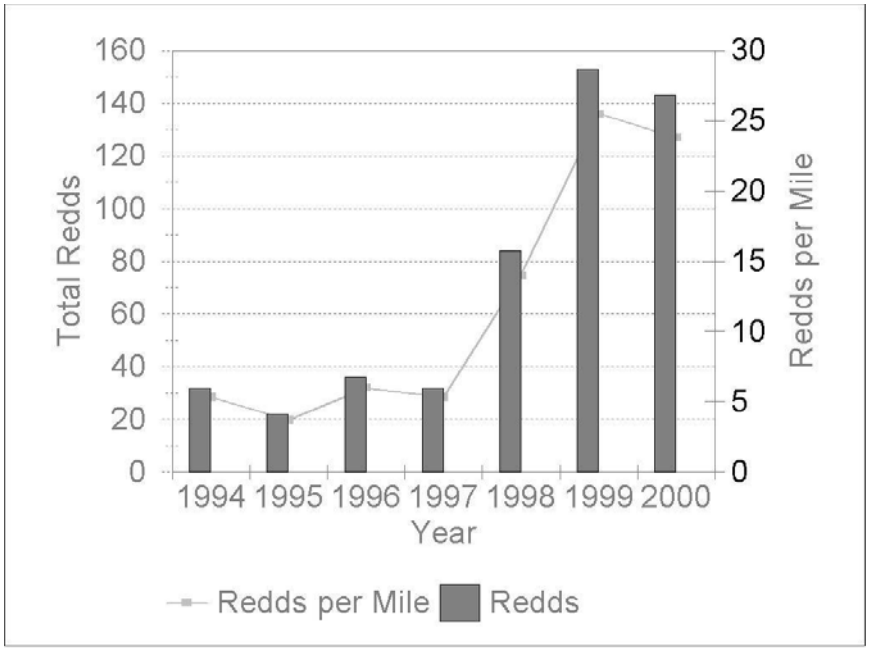


Figure 2. Total redds and redds per mile for the North Fork Umatilla River, 1994 through 2000.

Fork Walla Walla River, approximately 3 kilometers (2 miles) upstream of the forks. The largest number of bull trout captured was 211, in 1992 (B. Kilgore, *in litt*. 2001).

Use by bull trout subadults and juveniles has been observed in the North Fork Walla Walla River (Reach II), as well as by adult fish during winter and spring months. Ten redds were observed during October 2000 (T. Johnson, OWRD, pers. comm. 2001a). Some bull trout were captured in a screen bypass trap on the North Fork Walla Walla River located approximately 6.4 kilometers (4 miles) upstream of the forks between 1990 and 1992 (Confederated Tribes of the Umatilla Indian Reservation (CTUIR), *in litt*. 2001). Bull trout distribution and use of the North Fork Walla Walla River needs further investigation.

The mainstem Walla Walla River from the forks downstream to Cemetery Bridge in Milton-Freewater (Reach IIIA) provides year round subadult rearing habitat. From this reach downstream to the confluence with the Columbia River

Table 2. Reach delineations and their habitat use by bull trout in the Walla Walla Basin as defined by the Umatilla-Walla Walla recovery unit team (ODFW, *in litt*. 1999b).

Reach	Subreach	Habitat use by bull trout
I South Fork Walla Walla	A. Headwaters to Forest Service boundary	Year round habitat for all bull trout life history stages
	B. Forest Service boundary downstream to Harris Park	Year round subadult rearing and adult staging by fluvial fish
	C. Harris park downstream to the forks of the North and South Fork Walla Walla	Subadult rearing, and possible staging by adult fluvial fish
II North Fork Walla Walla	A. Headwaters downstream to the Forest Service boundary	Year round for subadult rearing and spawning
	B. Forest Service boundary downstream to the confluence with the South Fork Walla Walla	Overwintering adults and possible use by juvenile/subadult fish. Possible spawning, but needs to be investigated
III Mainstem Walla Walla River from the forks to confluence with the Columbia River.	A. From the forks downstream to Cemetery Bridge in Milton-Freewater	Year round subadult rearing and adult overwintering
	B. From Cemetery Bridge in Milton-Freewater downstream to the mouth	Overwintering and migration habitat
IV Mill Creek	A. Headwaters to the City of Walla Walla intake dam	Year round habitat for all bull trout life history stages
	B. Intake dam downstream to Bennington Diversion	Subadult rearing, migration, and adult staging and overwintering
	C. Bennington Diversion downstream to the confluence with the mainstem Walla Walla River. Reach includes Yellowhawk Creek	Overwintering and migration habitat
V Touchet River	A. North Fork Touchet and Wolf Fork Touchet from headwaters to mouth of North Fork Touchet	Year round all life stages

Table 2. Reach delineations and their habitat use by bull trout in the Walla Walla Basin as defined by the Umatilla-Walla Walla recovery unit team (ODFW, *in litt*. 1999b).

Reach	Subreach	Habitat use by bull trout
	B. South Fork Touchet	Spawning, rearing, resident and fluvial adults in Burnt Fork of the South Fork Touchet; sporadic subadult rearing in mainstem South Fork Touchet
	C. Mainstem Touchet from mouth of South Fork Touchet to confluence with Walla Walla	Overwintering

(Reach IIIB) the habitat is considered overwintering and migration, although bull trout use data are limited. Oregon Department of Fish and Wildlife screen bypass capture data from 1992 through 2000 show bull trout were captured at both the Eastside and Little Walla Walla diversions during the irrigation season (April to October) (B. Kilgore *in litt.* 2001). During fish distribution surveys conducted in the summer of 1998 in the Walla Walla River mainstem in Washington and in Yellowhawk Creek, bull trout were not encountered (Mendel *et al*. 1999). However, one bull trout adult was found in June 1999 below Burlingame Dam and in May 2000, an adult bull trout (approximately 34 kilometers (21 inches) in length) was observed in the mainstem Walla Walla River at McDonald bridge (southeast of Lowden) moving upstream in 12 degrees Celsius (59 degrees Fahrenheit) water and streamflow of about 124 cubic feet per second (3.5 cubic meters per second) (G. Mendel, pers. comm. 2000). Radio telemetry studies scheduled for 2001 are expected to define more clearly the use of the mainstem Walla Walla River by bull trout.

Spawning in Mill Creek (Reach IV) has been documented upstream of the Umatilla National Forest boundary. Spawning surveys from 1998 to the present from the City of Walla Walla intake dam upstream documented bull trout spawning in the mainstem and tributaries upstream of Low Creek, with Low Creek accounting for the highest redd densities (10 per kilometer or 6 per mile) in spawning tributaries. The mainstem Mill Creek between North Fork Mill Creek

and Deadman Creek had the highest densities of bull trout redds (15 per kilometer or 9 per mile) (Hemmingsen *et al*. 2001b).

Movement and life history of bull trout in Mill Creek are the focus of a research project that has been conducted by the Oregon Department of Fish and Wildlife since 1995. Both upstream and downstream movement were monitored. Upstream migrant bull trout were trapped as they exited the fish ladder at the dam associated with the water intake for the city of Walla Walla (River Kilometer 39.3, River Mile24) . Downstream migrant bull trout were captured using a 1.5-meter (5 foot) diameter rotary screw trap (manufactured by E.G. Solutions, Inc). This trap was placed in Mill Creek at River Kilometer 39.6 (River Mile25), which was the first adequate pool upstream of the dam described above. Both traps were sampled daily during operation, which generally occurred from late March through most of October each year. Captured bull trout were anesthetized, measured for fork length and weighed. Scales were collected for determination of age. Many bull trout that were 150 millimeters (6 inches) or longer were identified individually with 14-millimeters (0.6 inch) Passive Integrated Transponder (PIT) tags implanted in the abdominal cavity. Although the screw trap captured downstream migrants throughout each sampling season, most bull trout were captured during April, May, and June. In two of three years, the largest proportion captured tended to occur in April. In 1999, however, similar proportions were captured all three of these months. In contrast, less than 20 percent of the upstream migrants were captured before July in any year. Most, if not all, of these fish were likely headed upstream to spawn and 95 percent had passed by this location before October each year. Table 3 shows average fork lengths of bull trout captured from 1998 through 2000. Analysis of the data is ongoing (P. Sankovich, *in litt.* 2001).

Preliminary results from the radio-tagging studies indicate fluvial bull trout use of the mainstem of Mill Creek between the Intake Dam and the City of Walla Walla, presumably to overwinter. Most of the radio-tagged fish were located in the vicinity of the Intake Dam. The farthest downstream that a radio tagged fish was located was River Kilometer 6 (River Mile10) just upstream of

Table 3. Average fork lengths (millimeters) of Mill Creek bull trout by month, with numbers measured in parentheses (P. Sankovich, *in litt.* 2001).

Group	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Screw trap								
1998	147 (65)	148 (381)	153 (354)	154 (181)	152 (95)	160 (88)	238 (16)	311 (30)
1999	140 (20)	147 (113)	149 (129)	155 (123)	170 (65)	167 (90)	224 (27)	379 (48)
2000	-	151 (197)	157 (112)	157 (130)	137 (49)	166 (43)	235 (32)	243 (19)
Upstream trap								
1998				172 (2)	458 (77)	372 (44)	333 (34)	260 (5)
1999	270 (1)	296 (1)	880 (1)	528 (29)	407 (78)	383 (70)	372 (19)	354 (3)
2000				466 (38)	420 (75)	415 (66)	364 (28)	263 (3)

Walla Walla. Results of the radio-tagging studies are being summarized in preparation for publication (P. Sankovich, *in litt.* 2001).

The only available reports of bull trout downstream of Walla Walla in Mill Creek were one or two caught during the steelhead fishery downstream of Gose street bridge after the 1996 floods (J. Volkman, Confederated Tribes of the Umatilla Indian Reservation, pers. comm. 2000).

The current known spawning distribution in the Touchet drainage (Reach V) occurs in the North Fork Touchet River from Bluewood Creek to Spangler Creek, in Spangler Creek, and in the Wolf Fork Touchet River from Whitney Creek to 2.4 kilometers (1.5 miles) upstream of the Forest Service boundary (about 5.5 miles or 8.8 kilometers). A new bull trout population was identified in the Burnt Fork of the South Fork Touchet River in 2000 as evidenced by the presence of three age classes and four redds (G. Mendel, pers. comm., 2000). Fish were classified as resident based on fish sizes, but in June of 2001, an adult

migratory bull trout radio-tagged in Dayton moved into the Burnt Fork of the South Fork Touchet. Therefore, there is apparently a migratory component to the South Fork Touchet population. Subadult rearing also occurs in Lewis Creek (North Fork Touchet), Robinson Fork (Wolf Fork Touchet) and in the Griffen Fork (South Fork Touchet). Of note in the North Fork Touchet River was the observation of fry in September 1998 and again in mid-September of 2000. However, in August 2000 there were no fry detected in the same North Fork sites. The indication is that eggs or fry may be in the gravel year around. Hatching may be delayed by very cold water, or there may be a late spawning component to the population. Additional research is needed to address these uncertainties.

Adult bull trout were captured annually in the anadromous downstream migrant trap at Dayton: 18 in 1999, and 28 in 2000 (J. Krakker, U.S. Fish and Wildlife Service (USFWS), pers. comm. 2001). Fluvial bull trout are presumed to overwinter in the mainstem, although their abundance, distribution and use patterns in the mainstem and tributaries have not been determined. Bull trout are currently being radio-tagged in the mainstem Walla Walla and Touchet Rivers in a cooperative effort between Washington Department of Fish and Wildlife, Oregon Department of Fish and Wildlife, and Confederated Tribes of the Umatilla Indian Reservation.

A population estimate for bull trout in the Walla Walla River Basin is not available at this time. Martin *et al*. (1992) measured juvenile densities in Mill Creek and Wolf Fork Touchet River by electroshocking. Their results showed juvenile densities of 5.2 fish per 100 square meters (119.6 square yards) in Mill Creek and 1.9 fish per 100 square meters (119.6 square yards) in Wolf Fork Touchet River.

Redd surveys have been conducted annually in the Walla Walla Basin through a coordinated effort involving the Oregon Department of Fish and Wildlife, U.S. Forest Service, Confederated Tribes of the Umatilla Indian Reservation, and Washington Department of Fish and Wildlife since 1994. Figure 3. shows total redd counts for the Walla Walla Basin for the period of record. Variation in locations and timing of redd surveys has occurred among

years, particularly in the Touchet subbasin for the ten years surveys have been done (Mendel *et al*. 2000). Redd surveys conducted during 1998 and 1999 covered the same reaches, although the 1999 survey was started about two weeks earlier than in 1998 and included two more areas. The total number of redds per kilometer was 5.5 (8.9 per mile) in 1998 and 10.5 (16.9 per mile) in 1999 (Mendel *et al*. 2000). Total redds and redds per mile for the South Fork Walla Walla population for the period 1994 through 2000 are shown in Figure 4.

Use of the Columbia River mainstem by Umatilla and Walla Walla bull trout is unknown. Access to the Columbia River from both the Umatilla and Walla Walla Rivers is limited to those times of the year, generally from November to May, when flows and temperature are more suitable for bull trout. Limiting factors in the Columbia River between the two basins have not been assessed, and use in this reach by bull trout remains a research need.

There are no significant fish disease issues in the recovery unit at this time. Whirling disease has been present since the 1980s in the adjacent Grande Ronde Basin, which also has several populations of bull trout. However, bull trout there do not exhibit signs of the disease.

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 Basin, showed them to be relatively resistant to all strains of Infectious Hematopeietic Necrosis Virus tested. Bull trout had detectable levels of antigen to *Renibacterium salmoninarum* (bacterial kidney disease) but no evidence of the disease (Engleking 2001).

Figure 3. Annual redd counts in the Walla Walla Basin from 1994 through 2000 (ODFW, *in litt.* 2000 and WDFW, *in litt.* 2000).

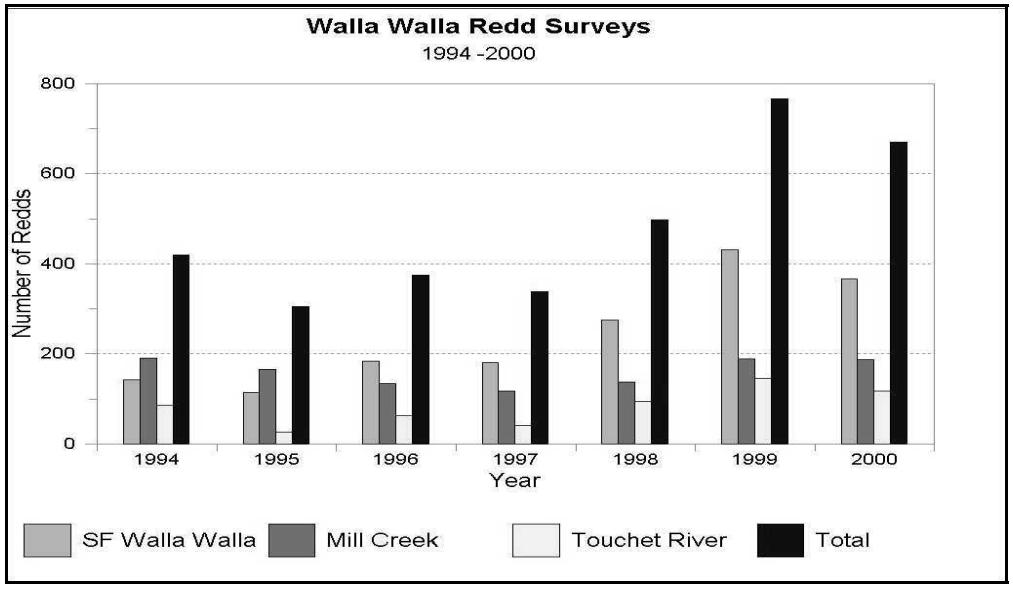
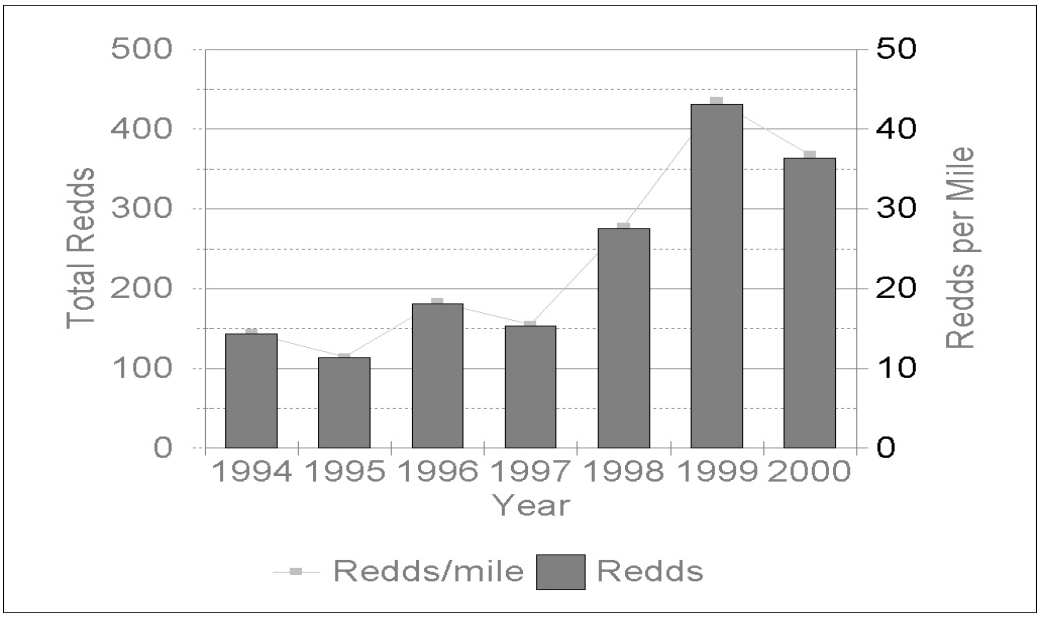


Figure 4. Total redds and redds per mile for the South Fork Walla Walla bull trout local population (ODFW, *in litt.* 2000 and WDFW, *in litt.* 2000).



REASONS FOR BULL TROUT DECLINE

There are several documents referenced in this chapter that assess watershed conditions in relation to providing suitable habitat for fish and wildlife. Most of the recovery unit has been examined by one or more of these documents that have provided useful information for assessing threats to bull trout and recommending actions to recover them. Several more are planned including a watershed assessment for the entire Umatilla Basin and sub-watershed plans for Squaw, Meacham, Buckaroo and Mission watersheds initiated and funded by Confederated Tribes of the Umatilla Indian Reservation (Oregon Department of Environmental Quality (ODEQ) 2001) and one in progress for the North Fork Walla Walla. A watershed assessment for the South Fork Walla Walla Basin and portions of the Touchet subbasin not already completed would be useful in the recovery effort.

Threats to bull trout arise from the modification or destruction of their habitat or from direct take, (*e.g.*, harvest, disease, injury, etc.). Fish habitat in both basins in the Umatilla-Walla Walla Recovery Unit have been altered significantly since European settlement, affecting not only bull trout, but anadromous species as well. Salmon and steelhead are considered an important part of the historic prey base for bull trout. Historic land uses affecting bull trout habitat in the Walla Walla Basin include forest management, livestock grazing, irrigated agriculture, urbanization and flood control management. Liberal harvest regulations and fish stocking programs have also been implicated in the decline of bull trout.

The Umatilla and Meacham Ecosystem Analysis encompassed all of the current bull trout habitat in the Umatilla Basin that occurs on the National Forest. The analysis covered all of the basin upstream of the confluence of the mainstem and Meacham Creek. It identified streamside roads, railroads, timber harvest, livestock grazing and development within the floodplain as land uses influencing watershed response within the analysis area. Existing public and private management facilities and past and present management activities that contribute to fish habitat problems include: (1) riparian road and railroad construction and

use, and associated toxic spills; (2) riparian grazing (mostly on private land in these watersheds); (3) riparian (and to a lesser extent, upland) timber harvest; (4) recreational and municipal water developments and withdrawals; (5) recreational use of riparian area; and (6) livestock water developments (USFS 2001). In addition, Buchanan *et al*. (1997) identified channel modification for flood control, agricultural development, and competition with stocked hatchery rainbow trout in the Umatilla Basin as factors affecting bull trout.

In the Walla Walla Basin, the 1997 Washington Salmonid Stock Inventory identified habitat degradation from forest management practices, agricultural activities, livestock grazing, and development, and interactions between introduced steelhead and brown trout as factors affecting bull trout production in the Touchet drainage. The South Fork Touchet River Watershed Analysis (Washington Department of Natural Resources (WDNR) 1998) identified lack of pool habitat for resting, staging and rearing, a lack of large woody debris, and a destabilized main channel as the major limiting factors affecting all life stages of fish in the watershed and attributed them to forest management and human development. Mill Creek downstream of the City of Walla Walla watershed has been impacted by roads, residential development, and agricultural and forest management practices (WDFW 1997, Buchanan *et al*. 1997). Urbanization and attendant flood control structures are concentrated in and around Walla Walla and College Place, Washington.

At the time of listing, the U.S. Fish and Wildlife Service considered dams, forestry and agricultural practices, and grazing to be threats to bull trout in the Walla Walla River Basin. The U.S. Fish and Wildlife Service considered forestry and agricultural practices, as well as grazing to be threats to bull trout in the Umatilla River Basin. The discussion that follows addresses, in general, categories of threats identified at the time of listing. A separate section on water quality was added because some of the water quality issues are attributed to more than one category and not easily isolated.

Water Quality

There are water quality issues affecting aquatic habitat in the recovery unit as evidenced by inclusion of many segments of both river systems on the 303(d) list of water quality impairments developed through Section 303 of the Clean Water Act. Water quality impaired stream segments do not meet water quality standards to protect designated beneficial uses as defined by the States (in the case of Oregon) or by the Environmental Protection Agency. States or the Environmental Protection Agency are required to set load allocations (Total Maximum Daily Loads or TMDLs) for the various impairment parameters and develop management plans to bring water quality within load allocations. Most of the water quality issues are of a nonpoint source nature and landscape based rather than point source. Their affects can accumulate as they enter the stream network and move downstream, so that the origin of impact may be far removed from where it is detected, making assignment of the threat problematic.

Nine water quality impairments are listed on the 1998 303(d) list for the Umatilla Basin. The Umatilla Total Maximum Daily Load process identified temperature and excess soil erosion as the most widespread concerns in the Umatilla Basin (ODEQ 2001) resulting from land uses including forest management, agriculture, transportation, and urbanization. Restoration of riparian habitat is the primary strategy to achieving Total Maximum Daily Load targets for temperature and turbidity (ODEQ 2001). Other parameters on the 303(d) list include pH, bacteria, turbidity, ammonia, nitrate, habitat, and flow.

Sedimentation is a concern in Wildhorse, Tutuilla, McKay, and Birch Creeks (tributaries in Reach I) as inputs to the mainstem Umatilla River. Storm events that result in increased sediment inputs occur in April when bull trout would be present in this reach. Farm chemicals are also a concern in Reach I. The extent to which sedimentation and chemicals are or would be limiting to bull trout is unknown.

Streams in the Walla Walla Basin listed on the 1998 303(d) list for Washington include Mill Creek for instream flow, temperature, and pH; Touchet River for fecal coliform and temperature; and the Walla Walla River for temperature,

pH, fecal coliform, instream flow, and eight toxic compounds (DDE, DDT, chlordane, dieldrin, heptachlor, heptachlor epoxide, hexachlorobenzene, and PCB). These pesticides were documented in tissue samples from fish captured near the mouth of the Walla Walla River, an area influenced by the impoundment of the Columbia Riverbehind McNary Dam. Streams in the Walla Walla Basin listed on the 1998 303(d) list for Oregon include Mill Creek for temperature, South Fork Walla Walla River for temperature, and the North Fork Walla Walla River for temperature and instream flow.

In addition to temperature, sediment is also considered a major problem in the lower Walla Walla River (Bureau of Reclamation (BOR) 1999), although turbidity was not a parameter on the 303(d) list for the Walla Walla Basin. U.S. Bureau of Reclamation (1999) estimated the amount of sediment delivered to the Walla Walla Basin (Oregon and Washington) to be about 800,000 tons annually, mostly from sheet and rill erosion on cropland, although erosion from stream banks and roads is locally significant. The cumulative effects of this soil loss can be seen at the mouth of the Walla Walla where a large delta has developed (BOR 1999).

South Fork Walla Walla water quality monitoring by the U.S. Bureau of Land Management in 1999 and 2000 showed phosphates were elevated above the standard. No source for the phosphates on U.S. Bureau of Land Management land was identified (U.S. Bureau of Land Management (BLM) 2000).

Dams

This section discusses passage barriers and diversions in the recovery unit. Some are known to impact bull trout movement, and others are likely to effect bull trout but impacts have not been documented. Many of the passage concerns are being addressed because they also affect anadromous species. In other instances additional data is needed to better define the problems and craft workable solutions.

Umatilla Basin. Major dams in the Umatilla Basin occur in the lower 145 kilometers (90 miles) of the mainstem and tributaries, are associated with irrigation

diversions, and have been or are being addressed for passage and screening needs as they relate to anadromous species.

However, the needs of bull trout were not considered when these facilities were designed, and some of the facilities may pose problems for bull trout. For example, while upstream passage at Three Mile September 20, 2002am would not be a problem for bull trout, downstream passage through the east bank ladder might pose a problem for very large bull trout attempting to migrate to the Columbia River. The size of fish using this exit would be limited by the width of the spaces in the diffuser grating. Fish may also pass Three Mile Falls Dam via the west bank bypass facility or go over the dam. Bull trout trapped at Three Mile Falls Dam when water temperatures are unfavorable for a successful migration through the lower Umatilla River are trucked upstream to either Thornhollow (River Kilometer 73.3 or River Mile46) or higher in the system and returned to the stream.

Passage problems identified for anadromous species at Feed Canal Dam (Knapp *et al*. 1998) on the mainstem Umatilla may pose similar problems for bull trout. A project to notch both the Feed Canal and Westland Canal to improve passage has been proposed. However, the project cost is quite high, and funds have not been secured to complete the project.

A study by Confederated Tribes of the Umatilla Indian Reservation of barriers in the Umatilla mainstem and tributaries downstream from the north and south forks identified a variety of barriers and channel obstructions/modifications, (*e.g.*, dams, culverts, bridges, blocks, dikes), that were either partial or complete barriers to anadromous fish. Most were on tributaries not known to be currently used by bull trout. All but three were manmade and actions to modify or remove were recommended (E. Hoverson, *in litt.* 1998a).

Most of the pump diversions on the Umatilla River upstream of Pendleton have been screened, although some of the screens may not meet current criteria to protect fish. Usually bull trout have migrated upstream by June when the effect would be more noticeable. The effect of the diversions on flows in the summer is unknown, although it may be addressed in the Total Maximum Daily Load the

Confederated Tribes of the Umatilla Indian Reservation is preparing for Reservation land.

Walla Walla Basin. Numerous dams and diversion structures have been constructed on the mainstem Walla Walla River and tributaries for agriculture and flood control. Some have been removed. For example, Marie Dorian Dam at River Kilometer 78 (River Mile48) (Oregon) on the mainstem Walla Walla River was formerly a passage barrier, but was removed in 1996 and Maiden Dam on the lower mainstem Touchet River was removed in1997.

As in the Umatilla Basin, efforts to restore anadromous species in the Walla Walla Basin have resulted in improvements to many passage barriers, which will also benefit migratory bull trout. A partial list of diversions in the Walla Walla Basin is shown in Appendix A.

In Oregon, a grade control structure at Nursery Bridge on the mainstem Walla Walla River (River Kilometer 73 or River Mile45) is laddered but is a barrier at low flows. A new ladder was installed in summer of 2001, but its effectiveness to pass bull trout has not been assessed. Fish passing the ladder via the viewing window are videotaped. However, because of the less than ideal lighting conditions fish less than approximately 30 centimeters in length (12 inches) cannot be accurately identified from the videotape (T. Bailey, Oregon Department of Wildlife, pers. comm., 2002). It may be possible to accurately identify smaller bull trout by directly viewing fish through the window. The ladder was not designed specifically to pass smaller size fish, so if smaller bull trout are not able to ascend the ladder, they would trapped below the dam and at risk of perishing when the diversion is operating.

Mojonnier Dam (also called Burlingame Dam) (approximately River Kilometer 61 or River Mile40) on the mainstem Walla Walla River had an old ladder that was not functional at low flows. Modifications were implemented in 1998 with a new ladder, and in 1999 with new screens. The new screens and water control devices were all funded through the Bonneville Power Administration. The project is complete, except for an operations and maintenance plan. Effectiveness will be

assessed when results from the Walla Walla radio telemetry project have been analyzed.

Temporary gravel push-up dams associated with irrigation diversions in the South Fork Walla Walla River from Harris Park downstream to the North Fork Walla Walla River confluence, and in the North Fork Walla Walla River from the U.S. Forest Service boundary to the confluence with the South Fork Walla Walla River, could be barriers to fish movement. The Walla-Walla Basin Watershed Council, Oregon Water Resources Department, and Oregon Department of Fish and Wildlife are working with landowners to address these problems and most, if not all, have been addressed. There are 5 gravel push-up dams on the mainstem Walla Walla River in Washington that could be barriers to fish migration. These are being addressed through the efforts of the Walla Walla and Columbia County Conservation Districts and Confederated Tribes of the Umatilla Indian Reservation. Continued monitoring for passage barriers is needed.

On Mill Creek in Oregon, anadromous fish passage past the City of Walla Walla water intake dam on Mill Creek (River Kilometer 22.2 or River Mile14) was blocked until 1985, when an adult fish ladder was installed (Martin *et al*. 1992). Remnant Kooskooskie Dam may be a partial barrier, but its impacts to bull trout are unknown. It does not meet current passage criteria for juveniles or fish less than 20 centimeters (8 inches) in length (G. Mendel, pers. comm., 2002).

There are also two dams on Mill Creek within Washington: the diversion dam that directs water into Bennington Lake, and the "division" dam that divides the waters of Mill Creek into Mill, Yellowhawk, and Garrison Creek channels. The Bennington Lake Diversion Dam is 4.5 to 7.6 meters (15 to 25 feet) high and forms the upstream end of the flood control channel on Mill Creek (River Kilometer 59 or River Mile36.7) just east of Walla Walla. A proposal has been submitted to Bonneville Power Administration for improving the fish ladder on the Bennington Lake Diversion dam including installation and operation of a fish trap to determine the number of bull trout, steelhead, and spring chinook that pass upstream of the dam in subsequent years. Mill Creek downstream of Bennington Dam is diked and contains concrete capped gabions fully spanning a wide flood channel for about 5

kilometers (3 miles) before it is confined into a narrow concrete channel with a low flow trough in the bottom of the channel. This concrete section continues downstream for about 4 kilometers (2.5 miles) before it widens into a broad flood channel with full spanning weirs. At the lower terminus the creek is directed over two or three concrete drops and a concrete apron under a bridge. Below this bridge apron the creek is down cutting and the height from the apron to the natural stream substrate is increasing, creating a potential barrier to bull trout movement.

The Bennington Lake diversion on Mill Creek near the city of Walla Walla was unscreened until the fall of 2000. However the canal has only been screened for low flows, adequate for the yearly filling of the lake. Flood control gates are not screened.

The ladder at Hoffer Dam on the lower Touchet River was damaged in 1996, and is under review for modification by 2002 or 2003. The Dayton Steelhead Acclimation Pond Dam on Touchet River is a partial barrier during steelhead trapping. It has a slot for fish passage, but during snorkeling below the dam 14 bull trout were observed in the pool. Biologists do not know why bull trout do not use the slot, but it could be trap avoidance (G. Mendel, pers. comm., 2001). A passage barrier near the mouth on Lewis Creek (North Fork Touchet River tributary) that resulted from flood repair work in 1996 will be worked on this year.

Of the irrigation and domestic pumps in the Oregon portion of the Walla Walla River inventoried by Oregon Water Resources Department, 80 percent are currently screened. Ditch screens were in place by June 2001, and pump screens should be in place by the end of the year (T. Johnson, pers. comm. 2001b). Appendix A contains a list of diversions in Oregon and their screen status. Screen needs in Washington need to be inventoried and addressed. Many diversions have screens that do not meet current National Marine Fisheries Service criteria. Appendix A contains a partial list of gravity-fed diversions occurring in Washington.

The screen and bypass facility at the City of Walla Walla diversion on Mill Creek (between Tiger and Low Creeks) are inadequate to protect bull trout from take as evidenced by the discovery in 1999 of passive integrated transponder (PIT) tags

recovered from the city water system and dead bull trout counts at the bypass facility. The City of Walla Walla has completed plans for a new screen and obtained funding through Bonneville Power Administration. Screens will be installed as soon as water conditions allow in 2001 and will be monitored for effectiveness.

The Yellowhawk Diversion diverts water from Mill Creek into Yellowhawk Creek and Garrison Creek. Yellowhawk Creek is connected to the Walla Walla mainstem, but has many unscreened diversions and there are obstructions to passage within the stream channel. Fish passage exists from the Walla Walla River into lower Garrison Creek downstream of the Burlingame diversion. From 1986 to 1989, adult steelhead were observed spawning in Garrison Creek about 6 kilometers (4 miles) upstream from the creeks confluence with the Walla Walla River. These fish were about 2 kilometers (1 mile) downstream of the Lions City Park Pond Dam, which is an upstream and downstream passage barrier to fish. Other private ponds are barriers to fish movement in Garrison Creek. Garrison Creek may need to be screened to exclude all fish, or commit to passage improvement work along its full length, to be considered suitable fish habitat. There may not be enough water to run all three stream channels in the summer. Yellowhawk and Mill Creeks should be considered for passage and rearing enhancement.

Solutions for screens and passage at Titus ditch/diversion are being explored with the conservation district. A proposal has been submitted by Confederated Tribes of the Umatilla Indian Reservation to Bonneville Power Administration for funding of design work for Titus as well as several other screen projects in the Walla Walla Basin under the Columbia Plateau provincial rolling review process.

Fish entrainment in ditches at the end of irrigation season is a source of mortality and a concern for bull trout. Better coordination between water users, fish screen technicians, and fish managers is needed.

Forest Management Practices

Forest management practices include timber harvest and associated road construction. Land recreation development and management on public land are also included in this section, as most of the Federal land is in the forested zone.

Forest management activities and the associated regulation of those activities must be viewed within the context of time. There is certainly a past, present, and future component of forestry issues within the Umatilla/Walla Walla Basin. Examples may include the construction of forest roads adjacent to and in close proximity to watercourses and dragging of logs across streams. Removal of large woody debris from stream channels is another example of issues once believed to be an appropriate activity.

Forest management practices and their ability to degrade aquatic habitat are a concern in Umatilla Reaches II through VI, essentially the area covered by the Umatilla and Meachum Ecosystem Analysis. Impacts from timber harvest on the National Forest over the past 100 years were most notable in Spring Creek and Thomas Creek subwatersheds (South Fork Umatilla), upper Meacham/Allen (Allen Creek subwatershed), and upper Meacham/Wilbur subwatershed (Meacham Creek approximately between East Fork and North Fork Meacham Creeks) (Crabtree 1996). Data for timber harvest from private lands were not available or sufficient to assess impacts during the analysis.

In the Umatilla Basin, the recovery unit team identified the loss of riparian canopy from harvest as an issue in Reaches I and II, Reach III mostly downstream of Bear Creek on private land, Reach IV on private land and on the National Forest on roaded areas in the riparian zone. Loss of riparian habitat along the stream in Reach VI is due mainly from road construction and diking.

Crabtree (1996) identified high stream temperature as probably the most limiting factor for salmonid populations in the majority of streams analyzed in the Umatilla and Meachum Ecosystem Analysis. Stream sedimentation is excessive in a few reaches, while canopy cover and pool and wood frequency are low in others.

According to the Umatilla and Meachum Ecosystem Analysis, standards for temperature as recommended in the *Interim Strategies for Managing Anadromous Fish-producing watersheds in Eastern Oregon and Washington, Idaho, and Portions of California* (USFS and Bureau of Land Management (BLM) 1995), usually referred to as PACFISH, are not met in the Meacham watershed based on available data, while the North Fork Umatilla meets the temperature standard for 3 of the 4 years of record. The PACFISH temperature standard is for anadromous salmonids (not to exceed 64 degrees Fahrenheit (18 degrees Celsius) for migration and rearing, and 60 degrees Fahrenheit (16 degrees Celsius) for spawning). Oregon Department of Environmental Quality temperature standards for spawning salmon are more conservative (55 degrees Fahrenheit or 13 degrees Celsius) than PACFISH, and the temperature standard for bull trout is 50 degrees Fahrenheit (10 degrees Celsius) when bull trout are present.

The Umatilla Total Maximum Daily Load identified near-stream vegetation disturbance and removal as sources of thermal pollution (*i.e.*, increased stream temperature above the natural background levels), by increasing the amount of solar radiation reaching the stream surface (ODEQ 2001). The Total Maximum Daily Load process identified restoration of riparian areas as a major objective for improving stream temperature and reducing sediment production in the Umatilla Basin.

The loss of riparian vegetation primarily from road construction is a major factor along North Fork Walla Walla River and is to a lesser extent from trail construction in the North Fork Walla Walla and South Fork Walla Walla Rivers. Washington Department of Natural Resources determined that the lower elevation segments in the Touchet subbasin did not meet target canopy closure levels (lacked shade). High shade hazard determinations were assessed for 64 percent of the total assessed stream length in the South Fork Touchet and 48 percent of the Wolf Fork Touchet River (WDNR 1998).

Loss of large wood for recruitment to streams is considered historical resulting from harvest and road building activities and stream cleaning after flood events. The recovery unit team identified loss of future large wood recruitment to the

stream as an issue in Umatilla Reaches II, III, IV, primarily private and tribal land, as well as the lower 5 kilometers (3 miles) and 2 kilometers (1.5 miles) of Shimmiehorn Creek in Reach VI on the National Forest. U.S. Forest Service considers it a localized problem on the National Forest affecting relatively few streams, for example the lower 5 kilometers (3 miles) of the South Fork Umatilla River, and 0.8 kilometer (0.5 mile) of mainstem Umatilla River (M. Northrup, USFS, pers. comm. 2000). The PACFISH wood frequency standard is generally met in the Umatilla subwatershed, and in roughly half of the Meacham subwatershed for which there are data (USFS 2001). Additional assessments are needed to further define problem areas and recommend solutions.

Loss of future large wood is also considered a localized problem on the National Forest in the North Fork Touchet subbasin (G. Mendel, pers. comm. 2001). The South Fork Touchet River Watershed Analysis (WDNR 1998) identified a net loss of in-channel large wood and poor near-term large wood recruitment potential throughout most of the watershed from previous land uses, including logging. Significant changes in the morphologic character of many channels has occurred resulting in wider, shallower, and straighter channels than earlier in the century (WDNR 1998)

Sediment from forest roads was identified as a concern in Umatilla Reaches III, IV, V, and VI by the recovery unit team. The Umatilla and Meachum Ecosystem Analysis identified excessive roads and compaction as concerns, based on road densities. Subwatersheds with high road densities (greater than or equal to 2.0 per square mile) include upper North Fork Umatilla River, Buck Creek, Thomas Creek, Spring Creek, Shimmiehorn Creek, and upper South Fork Umatilla River (Reach VI) in the Umatilla portion and Upper Meacham/Wilbur, East Fork Meacham, and Owsley Creeks in the Meacham Creek (Reach III) portion (USFS 2001). Past harvest in the headwaters of lateral tributaries and high road densities in Reach IV (*e.g.*, Bear, Ryan, Lick and Rock Creeks, and in the headwaters of Johnson, Woodward, Coyote Creeks), and other unnamed creeks outside the North Fork Wilderness Area (Reach V) may be contributing to sedimentation.

Crabtree (1996) demonstrated a significant statistical difference ($p = 0.00851$) between embeddedness of least managed (subjected to forest management activities) and most managed subwatersheds in the Umatilla and Meachum Ecosystem Analysis area. Good correlation (correlation coefficient = 0.5817) was found between subwatershed road density and cobble embeddedness. The Umatilla and Meachum Ecosystem Analysis (USFS 2001), which incorporated Crabtree's findings, states, "The statistically significant difference between unmanaged and the rest of the subwatersheds suggest a relationship between intensity of management activities and fish."

Historical use of the North Fork Walla Walla and South Fork Walla Walla River roads and their several fords have contributed to sediments within the system. Due to flooding problems and maintenance difficulties, the North Fork Walla Walla road no longer fords the creek. However, the current road paralleling the river may still contribute to the problem. Other sediment contributors include the Elbow Creek (tributary to the South Fork Walla Walla) road constructed in the late 1970's, and the Lincton Mountain and Cache Hollow roads associated with Reach Ia in the Walla Walla mainstem. The Elbow Creek road was used historically for commercial log hauling, but had been closed by the time bull trout were listed. Boise Cascade Corporation has removed four bridges on their lands in this drainage.

In the upper South Fork Touchet subbasin, access to private land is by a road located in a very narrow stream bottom. Use and maintenance of this road contributes excessive sediment to the stream. In cooperation with landowners, methods to reduce sediment inputs in this area should be thoroughly evaluated, and implemented where feasible and appropriate.

Mill Creek Reach IVB has many roads from historical timber harvest, which now service mainly rural residences and hobby ranches in the area. A sediment plume was observed this year entering Mill Creek from Blue Creek. The source has not been confirmed, but timber harvest and roads are suspected (Mendel, pers. comm. 2001).

The road up to Bluewood ski area is a sediment source to the Touchet River and the Bluewood Road culvert may be a passage barrier at low flows (Mendel *et al*. 2000). There has been discussion on paving this road and the U.S. Forest Service is in formal consultation with U.S. Fish and Wildlife Service on the road and recreation at Bluewood. The North Fork road on the Touchet River, the Wolf Fork Road, and the upper South Fork Touchet Road are either constraining the stream, adding silt, or in the case of the Wolf Fork and South Fork, cross the stream on stream fords at several sites (WDNR 1998). The Wolf Fork Road fords the stream in four places that are sediment sources. Bull trout often spawn in these fords where the gravel has been disturbed. These redds are vulnerable to disruption or destruction during fall and winter while eggs and fry are in the gravel (G. Mendel, pers. comm. 2001).

Improperly placed logging roads and skid trails have been implicated in increased sediment delivery to fish bearing streams from landslides and debris flows in the South Fork Touchet, Robinson Creek and Wolf Fork Touchet sub-watersheds (WDNR 1998). Based on current levels of forest practices, it was calculated that the management related surface erosion increased sediment delivery over background rates in these subwatersheds by the following: (1) upper South Fork Touchet River, 35 percent; (2) lower South Fork, 65 percent; (3) Robinson Creek, 309 percent; and (4) Wolf Fork Touchet, 52 percent (WDNR 1998).

Recreation trails were identified as another sediment source, such as the South Fork Walla Walla trail and Buck Creek trail in the North Fork Umatilla Wilderness. Both trails were damaged during the 1996 flood due to their locations in the floodplains close to the streams. The trail up Spangler Creek (Touchet subbasin) blocks a tributary with trail and log weirs.

Several road culverts in Umatilla tributaries in Reach IV (county road) and Reach VI (Forest Service road) were identified as passage barriers by members of the recovery unit team. However, the two culverts on Forest Service roads in Reach VI are not in streams currently occupied by bull trout (M. Northrup, pers. comm. 2001). Ongoing U.S. Forest Service road activities are covered under section 7 consultation with the U.S. Fish and Wildlife Service, which has recommended obliteration of 17.7

kilometers (11 miles) of road adjacent to Spring Creek, a tributary to Thomas Creek (South Fork Umatilla River), and removal of three additional roads.

A culvert assessment on Umatilla National Forest roads is in progress. Culverts will be assessed for passage for all native species at all life stages at all flows. Field work has been completed in the Umatilla and Walla Walla Basins and the data are being analyzed. Three or four culvert barriers have been identified in the Touchet subbasin (J. Sanchez, USFS, pers. comm. 2001). A blocked culvert on Tate Creek in the upper Wolf Fork spawning reach is a barrier to bull trout (G. Mendel, pers. comm. 2001).

Loss of channel complexity may be limiting bull trout in the North Fork Meacham Creek from Pot Creek downstream. Until floods in the early 1990's made maintenance difficult, a four-wheel drive road with multiple stream crossings occupied the bottom from the mouth up to Pot Creek. Much of the road has been washed away, but the stream banks and bedload have not completely stabilized. A dike from the railroad constrains the channel at the mouth. The lower three miles of the South Fork Umatilla River also lack channel complexity due to channelization and diking for the road. Bridge abutments constrict the channel.

The South Fork Touchet River Watershed Analysis (WDNR 1998) using aerial photographs from 1937 and 1995 demonstrated that most of the channels have undergone a variety of large-scale changes during that time. In general they have become shorter (less sinuosity), steeper, wider and more braided. There is a limited number of pools throughout the channels in the watershed. This may be attributed to braiding and straightening of the channels and to an overall lack of large woody debris. Study findings indicate that (1) special attention should be given to the active channel migration zone, not only from a forest management perspective but also from the standpoint of human development, (2) the small swales or depressions are vital groundwater links to the valley bottom and can become active surface channels during storm events, and (3) non-fish bearing channels are principal conduits for debris avalanches and flows in this region. The 1996 floods substantiate these findings of the study (WDNR 1998).

Changes in the hydrograph or the watershed's response to precipitation may have occurred as a result of forest management. Responses would include higher peak flows in the spring or during runoff events and lower summer flows. Lack of flows from June to September in Meacham Creek above Butcher Creek and in Thomas and Spring Creeks in the South Fork Umatilla watershed may have been influenced by land management activities. The South Fork Umatilla and Thomas Creek had historic, productive steelhead fisheries, suggesting that lack of flows may have been the exception, rather than the rule. Low flows from June into September prevent migratory bull trout on their spawning migration from entering Meacham Creek from the mainstem Umatilla River. Past harvest may have affected timing and magnitude of flows in the South Fork Walla Walla River, North Fork Walla Walla River, and Mill Creek, although there are no data to support this hypothesis.

The extent to which timber harvest has affected peak flows is not well understood. Results from a pilot watershed study in Buck Creek drainage (South Fork Umatilla) by Helvey and Fowler (1997) showed a small increase in peak discharge in two of three treated (harvested) watersheds, but the magnitude of the annual snowmelt peak did not change significantly. They concluded that increases in sediment after timber harvest may be more due to soil disturbing activities rather than to increased erosive power of the stream. Findings from a much larger scale watershed study in a Rocky Mountain forest (average of 118 hectares (291.6 acres) as opposed to an average of 56.3 hectares (139 acres) in the Helvey and Fowler study) found a 66 percent increase above the average pre-harvest peak flow rate (Burton 1997).

In the upper Umatilla, cumulative effects analyses based on timber harvest and road density shows that for the most part, extensive logging has occurred in the less responsive, higher elevations where hydrologic effects are moderated by climate. However, two subwatersheds (Spring Creek and upper Meacham/Wilbur) with large numbers of harvested openings are in hydrologically responsive (respond more rapidly to precipitation events) settings, and have greater risk of earlier, higher peak flows that could destabilize channels (Clifton 1996). Effects from livestock grazing and recreation have not been quantified and incorporated into the analysis. Valley-

bottom roads, the railroad, and private land uses are the major hydrologic impacts in lower subwatersheds (Clifton 1996).

Factors other than land use, (*e.g.*, slope, elevation, and soils), can also affect a watershed's response to climatic factors. For example, Meacham watershed has a more rapid response compared to the upper Umatilla watershed due to lower elevations, steeper slopes and shallower soils (USFS 2001). Observations by members of the recovery unit team indicate the South Fork Umatilla River releases water earlier than the North Fork Umatilla River for similar reasons.

The Umatilla and Meachum Ecosystem Analysis watershed analysis identified Lower Umatilla/Hagen, lower North Fork Umatilla, Lower South Fork Umatilla in the Umatilla and Camp Creek, middle Meacham, middle North Fork Meacham, and upper Meacham/Wilbur subwatersheds as having a high potential for use of fire to enhance sustainability (USFS 2001). However, the presence of major bull trout spawning and rearing habitat within these areas presents a risk of impact to bull trout populations from loss of habitat due to catastrophic fire. While there is also an inherent risk from a managed fire (prescribed burn) or other risk reducing methods such as thinning, the U.S. Fish and Wildlife Service determined during informal consultation with the U.S. Forest Service that two prescribed fires in the Walla Walla Basin and three in the Umatilla Basin were not likely to adversely affect bull trout (USFWS 1998c and 1999).

Livestock Grazing

Crabtree (1999) identified past grazing of livestock as a contributor to degradation of aquatic habitat in watersheds analyzed during the Umatilla and Meachum Ecosystem Analysis process, although the effects are not presently quantified due to lack of data. It is believed that lands on the Umatilla National Forest have improved considerably since the severe livestock (sheep, cattle, horses) grazing of the Euro-American settlement period (approximately 1880 to 1910) (USFS 2001). All U.S. Forest Service allotments in the Umatilla Basin have been sheep allotments since 1965 and are not considered to contribute to lack of riparian function (M. Northrup, pers. comm. 2000). One allotment in the Walla Walla Core Area was

grazed by cattle until the early 1990's, and has not been grazed since. Grazing of cows and horses occurs almost exclusively on private and tribal lands within the recovery unit. Some straying and trespass onto the National Forest occurs.

In spite of gains made in generally improved livestock management, the recovery unit team identified areas with continued grazing impacts in the Umatilla Reaches I from Pendleton to Meacham Creek and downstream of Pendleton (associated with feedlots) and Reach IV (from Meacham Creek upstream to the forks), in the Meacham Creek drainage (Reaches II and III), and in the North Fork Umatilla (Reach V), the latter from trespass livestock. A CH2MHill study (1995) reported damage from cattle grazing on private land in the Meacham Creek drainage. Past and current livestock grazing impacts were noted in the North Fork Walla Walla River (both subreaches), the mainstem Walla Walla River (from Joe West Bridge downstream to confluence with Little Walla Walla) and Mill Creek (from the City of Walla Walla intake dam downstream to Bennington Diversion).

Effects include loss of riparian cover and function, increased stream temperatures from lack of shade, loss of nutrients to streams from vegetation, and destabilized streambanks vulnerable to erosion, which may limit use in these areas by bull trout.

The Tribes have submitted a proposal to the U.S. Forest Service to exercise their treaty rights to graze livestock on National Forest land. U.S. Forest Service and Tribal representatives are currently working on a draft agreement to implement the Tribal grazing rights on the National Forest.

Agricultural Practices

Threats to bull trout resulting from agricultural development may include loss of riparian forests and a functional riparian system, increased stream temperature, loss of large wood and channel complexity, loss of stream flow through irrigation diversions, and impairments to water quality from return flows and agricultural runoff.

The recovery unit has experienced extensive agricultural development in the lower elevations of both rivers (*i.e.*, the Umatilla River from Meacham Creek to the mouth, the South Fork Walla Walla River from Harris Park to the forks, the North Fork Walla Walla River from the National Forest boundary downstream, and the mainstem Walla Walla River from the forks to the mouth).

Changes in the hydrograph, as expressed in peak flows and low flows, may have occurred as a result of channel alteration and large scale vegetation change. Flood control projects were designed to move the water through the channel as quickly as possible and prevent it from interacting with the floodplain. Removing the connection to the floodplain reduced the capacity of the riparian zone to store water and contribute to base flow later in the season. The higher velocity flows are more erosive, which can lead to down-cutting of the streambed. Channelized sections of river provide little if any productive fish habitat due to their lack of complexity and a functional riparian zone.

Umatilla Basin. The Umatilla River from Meacham Creek to the mouth could potentially provide overwintering habitat for all salmonids. Bull trout occurrence is rare downstream of Pendleton, and they are most likely limited there by temperature and water quality. Stream temperature data at Echo indicates temperatures in this reach would not be limiting to bull trout from November to early May. Riparian vegetation is limited through almost the entire reach, and it is also lacking in large wood needed for bank stability. Most of the wood that does find its way downstream is removed by landowners to protect pastures. Three quarters of the reach is diked to provide flood protection. In fact, 127 kilometers (79 miles) of the 145 kilometers (90 miles) of the mainstem Umatilla River (from forks to the mouth) show some human-caused channel alteration, restriction and/or diking (Close 1999).

Historical operations of the McKay Reservoir involved the storage of McKay Creek flows through the winter and spring months (November to May) for release during the summer for irrigation. During storage periods, the lower 10 kilometers (6

miles) of McKay Creek from the reservoir to the Umatilla River is essentially dewatered, because no water releases occur. Through the Umatilla Basin Project, stored water in McKay Reservoir is now released for flow augmentation (spring and fall), to assist rearing and migrating salmonids in the Umatilla River.

After reintroduction of spring chinook and coho salmon to the basin, and implementation of the Umatilla Basin Project, it was discovered that adult salmon (and now steelhead and bull trout) were attracted to McKay Creek, particularly in the fall months when flows in McKay Creek are considerably cooler than in the Umatilla mainstem due to drafting of cool water from McKay Reservoir. It was not desired to have adult salmon ascend McKay Creek to spawn because of the lack of suitable habitat during the months when water was stored.

In 1995, a fish weir, designed to prevent passage of adult salmonids, was constructed at the mouth of McKay Creek, to prevent adult salmon and steelhead from accessing the lower 10 kilometers (6 miles) of the stream below McKay Reservoir. In December of 1999, large numbers of juvenile rainbow/steelhead trout and salmon were discovered using lower McKay Creek as rearing habitat, upstream of the fish barrier. Juvenile salmonids can pass through the fish barrier weir by swimming between the bar slats. Two bull trout and about 2,300 juvenile coho salmon, 1,100 juvenile steelhead/redband trout, one adult steelhead trout, and 600 whitefish were salvaged from McKay Creek in December of 1999, when flows from McKay Dam were curtailed. These fish were released in good condition into the Umatilla River. However, several hundred additional juvenile salmonids perished in dry channel areas, along with several adult coho and fall chinook salmon.

The Bureau of Reclamation has coordinated with Confederated Tribes of the Umatilla Indian Reservation and Oregon Department of Fish and Wildlife to evaluate reservoir storage operations regarding flow releases from McKay Reservoir, and has established minimum perennial streamflows in McKay Creek for evaluation. An interim year round minimum flow of 10 cubic feet per second (0.3 cubic meter per second) was implemented beginning in November, 2000, after the cessation of fish water releases. The minimum flow of 10 cubic feet per second (0.3 cubic meter per

second) was recommended by Oregon Department of Fish and Wildlife and Confederated Tribes of the Umatilla Indian Reservation biologists as a sufficient base to maintain salmonids in McKay Creek, if they stay in the creek. When flow releases for fish migration in the Lower Umatilla River end in fall, water releases will be ramped down gradually to minimize any potential stranding of salmonids, and increase the opportunity for fish rearing in McKay Creek to safely migrate out of the creek into the mainstem Umatilla River. This change in operations was intended to protect fish residing in Lower McKay Creek, and decrease the potential mortality of listed species (*i.e.*, bull trout and steelhead trout).

Contor *et al*. (1995) identified 16 water diversions on the Umatilla Indian Reservation between River Kilometer 90 and 132 (River Mile56.1 and 81.8) during habitat surveys in 1994, and indicated they had impacted surface flows. Seven of the diversions were designated as "pasture" use and were screened. Their impact to bull trout is unknown.

Walla Walla Basin. The mainstem Walla Walla River was diked downstream of the North and South Forks in 1952 and is managed for flood control (USCOE 1997). Significant alteration and armoring of streambanks has taken place along the South Fork Walla Walla River from Harris Park to the forks. In addition to lacking riparian vegetation, the channels are simplified and lack the complexity of habitat important to bull trout. The loss of side channel habitat and its rearing and refuge areas diminishes habitat value to salmonids. The U.S. Army Corps of Engineers is working with the Walla Walla Basin Watershed Council to explore opportunities to modify some of the levees to improve stream channel function to benefit fish. Two properties have been identified for floodplain restoration projects (USCOE 2000).

Multiple reaches of various streams within the Washington portion of the Walla Walla Basin, including the mainstem Walla Walla River, mainstem Touchet River, Dry Creek, and Mill Creek are seasonally dewatered, particularly in dry years. In general, water rights exceed available streamflow. The Walla Walla River and its tributaries in Oregon have been withdrawn from further appropriation since 1986,

under the Umatilla Basin program (OWRD 1988). Exceptions include water for domestic livestock, fish and wildlife, or water released from future storage (BOR 1997), and 35 cubic feet per second (1 cubic meter per second) for frost control (mid-March to late April, and only 3 to 5 nights per year) (T. Darnell, Oregon State University Extension Service, pers. comm. 2001). The Walla Walla River and tributaries in Washington were withdrawn from further consumptive appropriations during the primary irrigation season in 1977, under the Walla Walla River Basin Management Program (WAC 173-532). Limited exceptions were made for stock and domestic supplies, where no other practical sources are available.

Mill Creek in the City of Walla Walla is seasonally dewatered (June through September or October) due to the diversion of water from the Mill Creek channel into Yellowhawk and Garrison Creeks, creating passage problems for fish and loss of rearing habitat for a portion of the year. This division of water occurs both to satisfy existing senior water rights, and to maintain flows for fish in Yellowhawk/Garrison Creeks. There is generally insufficient water to maintain flows in all three streams during the summer low-flow period. Yellowhawk and Mill Creek provide some potential for enhancement of rearing habitat.

Streamflow in the mainstem Walla Walla River is diverted at the East Side Diversion, upstream of Nursery Bridge near the town of Milton-Freewater, Oregon during the irrigation season. This dewaters approximately 5 kilometers (3 miles) of the river necessitating a salvage operation to rescue stranded fish. For example, in 1999, 6,482 steelhead/redband trout, 108 bull trout, 29 whitefish, and 32 lamprey ammocetes were salvaged and returned to the river above the Nursery Bridge. In addition, 43 hatchery steelhead smolts (from Washington releases) were salvaged and hauled downstream to the mouth of the Walla Walla River. In 2000, a total of 3,887 fish were salvaged, including 15 bull trout. In addition to salmonids, lamprey and other nongame species were salvaged.

Salvaged bull trout ranged in size from 15 to 38 centimeters (6 to 15 inches). The presence of several age classes of bull trout in the salvage indicates the diversion of water from the mainstem Walla Walla River is affecting migrating and subadult

rearing bull trout. The extent of impacts to the bull trout population are unknown at this time.

The only full time, real time gauges in the Washington portion of the recovery unit are on the lower Walla Walla River and Mill Creek. There are temporary flow gauges in the lower Walla Walla River, lower Touchet River, and in Yellowhawk Creek. Additional stream gauges would help determine gaining/losing reaches of the river, account for instream flow water rights, regulate existing rights that are provisioned to instream flows, and assess flows relative to instream flow targets. Installation of permanent gauges is being considered at several sites. Funding is being sought through Bonneville Power Administration, but the status of the grant is uncertain at this point. Oregon Water Resources Department's Upriver Water Management Program is working with private landowners in the Walla Walla Basin in Oregon to improve low flows in the upper basin.

Ditch consolidation and conveying irrigation water through pipelines instead of open ditches would benefit bull trout and other species by leaving more water instream that would otherwise be lost to evaporation and seepage from the diversion canal. Consolidation of the Milton Ditch with the Little Walla Walla diversion would result in more efficient use of the water diverted and improve fish passage by eliminating the need for a push-up dam at the mouth of Couse Creek.

Transportation Network

Roads extend up the mainstem Umatilla River to the North and South Forks, up the South Fork Umatilla River and Thomas Creek into the headwaters, and up Meacham Creek into the headwaters. Channel diking and levees constructed to protect roads is common throughout portions of the mainstem Umatilla River and Wildhorse Creek (Shaw and Sexton 2000). The Total Maximum Daily Load Transportation Workgroup found the railroad occupies 95 kilometers (59 miles) in the historical floodplain of the Umatilla River, in addition to Meacham Creek (ODEQ 2001). Impacts include dikes or levees that restrict natural hydrological functions, loss of sinuosity and seasonal floodplain recharge, and restriction of growth of

streamside vegetation (ODEQ 2001). The Union Pacific Railroad parallels mainstem Meacham Creek for approximately 85 percent of its length, constraining 11 percent of the active channel (CH2MHill 1995). Its construction and maintenance have significantly altered the channel and riparian zone of this stream resulting in loss of both shade to the stream and channel complexity (CH2M Hill 1995).

In addition to the loss of riparian shade and large wood for recruitment, road and railroad construction often includes armoring of streambanks with large rock. This can affect stream temperatures by the heating of the rocks in the sun and transfer of the energy to the water, as in the case of Meacham Creek ODFW, *in litt*. 1999b). Meacham Creek contributes water that is warmer than the Umatilla River at their confluence and this is caused in part by the presence of the railroad and its role in reducing shade to the stream (NPPC 2001b).

The railroad presents additional problems associated with its operation and maintenance, and the potential for spills is always present. Derailed railcars spilled ammonium nitrate and potash in solid form near Meacham Creek in 1991; in 1998, diesel and phosphoric acid spilled 91 meters (300 feet) from the mainstem Umatilla River at Homley, approximately River Kilometer 113 (River Mile 70); and in 1999, toluene was spilled near River Kilometer 71 (River Mile 44), approximately 61 meters (200 feet) from stream. Fortunately, none of these spills resulted in fish kills.

Road and railroad maintenance activities that may impact aquatic habitat include herbicide spraying of vegetation along railroad right of way, sidecast of ballast material into the creek, and the use of petrochemical lubricants on railroad equipment. Unpaved and poorly designed roads deliver sediment to streams.

Transportation networks that follow stream courses have resulted in the straightening, channelization, and diking of the streams with an attendant loss of riparian vegetation and side channel habitat in the North Fork Walla Walla River and in Mill Creek. Portions of the North Fork Walla Walla road that paralleled the stream have been relocated as a result of problems from annual flooding. At high flows the

river still washes out the road, and in some places the road no longer exists as the river has restored some of the meanders.

A comprehensive culvert inventory of State and County road barriers for the Walla Walla Basin is not available. Washington Department of Fish and Wildlife is conducing a statewide culvert inventory, but the current focus is in Puget Sound and it may be some time before it is done in eastern Washington.

Roads also serve as corridors for weed expansions. Exotics compete with native species, eventually replacing them. Organisms that depend on the native species may not adapt to the new invader species. Effects on bull trout and the organisms they feed on is unknown. Some species may not hold soil as well as the native species, increasing the erosion potential.

The area near the confluence of Meacham Creek and the Umatilla River is a concern in the Umatilla Basin. The South Fork Walla Walla and North Fork Walla Walla River, and the Mill Creek watershed were identified as potential problem areas for exotic plants in the Walla Walla Basin. Weed species of concern on the Umatilla National Forest include Spotted Knapweed (*Centaurea maculosa*), Diffuse Knapweed (*C. Diffusa*), Russian Knapweed (*C. Repens*), Common Burdock (*Arctium lappa*), Tansy Ragwort (*Senecio jacobaea*), Scotch Thistle *(Onopordum acanthium*), Yellow star thistle *(Centaurea solstitialis*), Dalmation Toadflax (*Linaria dalmatica*), Leafy Spurge (*Euphorbia esula*), Houndstongue (*Cynoglossum officinale*), Sulfur Cinquefoil (*Potentilla recta*), White Top (*Lepidium latifolium*), and Musk thistle (*Carduus nutans*) (V. Erickson, USFS, pers. comm. 2001; D. Crabtree, USFS, pers. comm. 2001).

Mining

Historical gravel mining has occurred in the mainstem Walla Walla River downstream of Nursery Bridge Dam. Some permitted gravel mining occurred in 1997 and 1998, but the permit has not been renewed at the request of the U.S. Fish and Wildlife Service, to avoid further alteration in the water table (B. Brown, Oregon

Division of State Lands, pers. comm. 2001). The impact of historical gravel mining on bull trout is unknown.

Residential Development

Several urban areas straddle streams and rivers in the recovery unit - Pendleton on the Umatilla River, Milton-Freewater on the Walla Walla River, and the City of Walla Walla on Mill Creek. In addition there is rural residential development along the Umatilla River and tributaries occupied by bull trout, including upper Meacham Creek, Mill Creek from the City of Walla Walla intake dam downstream to the mouth, and along tributaries of the Touchet River upstream of Dayton (*e.g.*, North Fork Touchet River, Wolf Fork Touchet River, Lewis Creek, and Jim Creek). Some of the developments are in very narrow canyons with little room for development without constricting the stream channel and affecting the riparian buffers, (*e.g.*, tributaries of the Touchet River). Several recreational cabins are located on the South Fork Walla Walla River between Harris Park and the U.S. Forest Service boundary and are used seasonally. Threats to bull trout include loss of riparian vegetation and channel complexity when streambanks are armored to protect structures, water quality problems from improperly treated wastewater, failed septic systems, storm water runoff and residential and industrial pollutants, and improperly designed or illegal fill and removal activities. The extent of these threats to bull trout have not been fully evaluated.

Conversion of and in the floodplain to development and subdivision with resulting loss of riparian and floodplain function and water quality are issues in the recovery unit. There are opportunities to protect flood prone areas from development through land use planning, conservation easements, zoning ordinances, and from re-development through buyout programs. In the Umatilla Basin most of the channelization has been done to protect agricultural lands and the transportation network and was discussed previously under these headings.

In the Walla Walla Basin, Mill Creek from Bennington Diversion downstream to the mainstem Walla Walla River was diked for flood control in 1942, in the

Touchet near Waitsburg in 1951, and Dayton in 1965 (USCOE 1997). The flood control channel in Mill Creek is not only a passage barrier at its downstream terminus (see section on dams), but provides little in the way of fish habitat. There has been some discussion with the National Marine Fisheries Service, the City of Walla Walla, U.S. Army Corps of Engineers, and others on opportunities for improving fish habitat through a weir section between the Division and Bennington Diversion Dams. It is unlikely that bull trout currently use this section due to its poor habitat condition. Improvements to diked or channelized reaches in the recovery unit by increasing channel complexity and sinuosity and restoring riparian vegetation could potentially provide, depending on the reach, subadult rearing, overwintering, and migration habitat.

Nutrient inputs from sewage treatment plants have been reduced through the upgrading of facilities in the communities of Walla Walla, Waitsburg, and Dayton. In Milton-Freewater, an irrigation ditch system doubles as a storm runoff system for the city. Contaminants from city streets can enter the ditch system at 16 points in the city. It is likely that pesticides, herbicides, and fertilizers from urban and residential uses enter the surface water and ground water systems (BOR 1999). The city is working on stormwater plan with Oregon Department of Environmental Quality.

Point source discharges, such as wastewater treatment plans, are regulated by permits (National Pollution Discharge Elimination System) that set conditions for pollution discharge to receiving waters such as temperature, toxic substances, etc. During the Umatilla Total Maximum Daily Load process elevated stream temperature was attributed to five point sources, all municipal waste treatment facilities in the lower Umatilla Basin. Only two treatment facilities are allowed to discharge during the period of June through September, when temperature criteria are most likely to be violated. Wasteload allocations (allowable effluent temperature) that were established will be incorporated during permit renewal (ODEQ 2001).

The recovery unit team identified two possible sources of thermal effluent, the adult holding facility for spring chinook on the South Fork Walla Walla River, and the City of Walla Walla wastewater treatment plant on Mill Creek. These point

sources will be assessed during the Walla Walla Total Maximum Daily Load process currently underway.

Both the City of Pendleton and the City of Walla Walla use surface water for their municipal water supplies. Pendleton has a water right for 10.5 cubic feet per second (0.3 cubic meter per second) and draws water through a series of infiltration galleries that lie in the alluvium from about 0.8 kilometer (0.5 mile) downstream of Thorn Hollow to just above Squaw Creek in the Umatilla River (NPPC 2001b). This captures much if not all of the cold water from springs that would normally flow into the river. The impact to bull trout habitat, particularly stream temperature, resulting from the diversion has not been assessed. However, the project does present an opportunity to restore floodplain connection at the point of diversion and at the springs by breaching the dike at both places.

As previously mentioned, the City of Walla Walla draws its water from Mill Creek. Up to 28 cubic feet per second (1.6 cubic meters per second) is under permit for hydropower production and another water right for 20 cubic feet per second (0.6 cubic meter per second) is undeveloped. Minimum flows were set as part of the hydropower license agreement and are in force when the hydropower plant is operating. The minimum flows were established based on needs for juvenile steelhead rearing habitat and may not be adequate for bull trout, since this reach supports subadult rearing in addition to adult staging and overwintering. A re-evaluation of instream flow requirements for salmonids is needed, especially in light of the city's request for a withdrawal for use in the winter.

Fisheries Management

Fisheries management in both States is guided by the each State's policies implemented by the respective Departments of Fish and Wildlife. In Oregon the Confederated Tribes of the Umatilla Indian Reservation are co-managers with Oregon Department of Fish and Wildlife. Overall management direction for native fish in Oregon is provided by the Wild Fish Policy (OAR 635-007-0525 through OAR 635-007-0529), although work is being completed on a new Draft Native Fish

Conservation Policy and a Draft Introduced Fishes Policy. Guidance in Washington is provided by the Wild Salmonid Policy, and the Bull Trout and Dolly Varden Management Plan (WDFW 2000). Enforcement in Oregon is handled by the Wildlife Division of the Oregon State Police. In Washington enforcement is a program within the Washington Department of Fish and Wildlife.

Angling. Compliance reports in 1991 and 1992, when harvest of bull trout was legal, indicate most Oregon anglers complied with angling regulations on bull trout (Table 4) (ODFW, *in litt.* 2001). The reports also noted that there was a small group of anglers who targeted bull trout in the South Fork Walla Walla River during September. Although most of these anglers caught and released bull trout as the report notes, they would have been targeting them during spawning (ODFW, *in litt.* 2001). Later reports, in 1995, indicated anglers had difficulty correctly identifying bull trout (ODFW, *in litt.* 2001). No reports were filed in 1993, or from 1996 to 1999.

Poaching is always a concern, but it does not appear to be a problem based on compliance reports (J. Germond, pers. comm. 2001b). Bull trout angling remains a high priority for enforcement through the Oregon State Police Cooperative Enforcement Program. Staff from Oregon State Police and Oregon Department of Fish and Wildlife meet annually to set priorities for enforcement through the Cooperative Enforcement Program. In the past the high priority areas for education and enforcement were the South Fork Walla Walla and North Fork Umatilla Rivers. Oregon State Police officers spend several days each year riding/hiking in bull trout areas during the trout season watching and checking anglers for regulation compliance. However, researchers from the Oregon Department of Fish and Wildlife and the Confederated Tribes of the Umatilla Indian Reservation have documented two bull trout mortalities attributed to unlawful angling activity in 2002. One dead bull trout was found with a large hook with bait in its mouth and the second fish was evidenced by a severed head that had been deposited in the stream. In addition researchers have periodically reported evidence of illegal angling activity as evidenced by bait containers and terminal angling gear designed for bait angling, a prohibited activity (ODFW, *in litt.* 2002).

Table 4. Data from operation plan reports compiled by Oregon State Police, 1991 through 2002. Compliance index is not applicable (NA) when there is no legal angling activity allowed.

Area patrolled	Year	Compliance Index
South Fork Walla Walla	1991	92.6 percent
Umatilla and Walla Walla rivers combined (Oregon)	1992	81.2 percent
Bull trout season closed	1994	NA
North Fork Umatilla South Fork Walla Walla	1995	NA No illegal take reported
South Fork Walla Walla primarily	2000	NA No illegal take reported
Walla Walla River, South Fork Walla Walla River	2001	NA No illegal take reported
Umatilla and Walla Walla River systems	2002	NA No illegal take reported

Angling in the Umatilla-Walla Walla Recovery Unit on non-reservation lands is closed to take of bull trout. However, bull trout may be caught incidentally in other fisheries (*i.e.*, hatchery marked steelhead, spring chinook, and trout). In Oregon, trout season is from May 26 to October 31 in streams upstream of the Reservation in the Umatilla Basin and in the Oregon portion of the Walla Walla Basin. Gear is restricted to artificial flies and lures only. Fisheries on anadromous species occur between the Highway 730 bridge upstream to the Reservation boundary. Seasons vary with species and bait is allowed. In Washington the regular trout season is from June 1 to October 31, gear is restricted to single barbless hooks, and bait is not allowed.

Fisheries on bull trout and steelhead are open to Tribal members on the Reservation and ceded lands, but closed to non-tribal members. Some bull trout are taken, but most are caught and released. Most fishing takes place in the Umatilla

Basin. An estimate of incidental catch and/or harvest of bull trout by Tribal members is not available.

There are verified reports of a few bull trout being caught in the winter steelhead fishery in the mainstem Umatilla River from the mouth upstream to Meacham Creek and there is opportunity during the spring trout opener. The mainstem from Meacham Creek to the confluence of the North and South Forks of the Umatilla River has good access on public lands on the National Forest and at the Bar M Ranch, although the volume of anglers has diminished since changes in angling regulations were instituted beginning in 1994, when stocking of catchable trout was eliminated.

Poaching and incidental harvest mortality has been identified as a concern in the South Fork Walla Walla River, the mainstem Walla Walla River at Nursery Bridge, and is suspected in Mill Creek where investigation is warranted. There are anecdotal reports of bull trout being caught during the trout opener in the mainstem Walla Walla River near Nursery Bridge (C. Contor, Confederated Tribes of the Umatilla Indian Reservation, pers. comm. 2001). Poaching and hooking mortality are known to occur in the Touchet River above Dayton.

Bull trout are vulnerable to poaching and harassment in the fall during staging and spawning in the North Fork Umatilla River. They are similarly threatened during spawning in the North Fork Touchet and Wolf Fork Touchet Rivers. Spawning activity can begin as early as mid-August in the Umatilla-Walla Walla Recovery Unit. There has been some discussion in Oregon to close angling in the South Fork Walla Walla River above Bear Creek in August to protect spawning bull trout. Washington is considering fishing regulation changes (early closures, or permanent closures) to protect bull trout in known or suspected spawning areas of the upper Wolf Fork and North Fork Touchet Rivers.

While there is certainly opportunity for incidental take of bull trout either from mis-identification of bull trout or illegal harvest, there is no data to estimate what that might be or its effects on bull trout populations in the recovery unit. There

is a need to assess whether sport angling regulations are impacting bull trout through direct or indirect mortality in order to better target enforcement efforts and make informed decisions on changes in regulations to better protect bull trout.

Efforts to improve identification of bull trout by anglers could also reduce illegal harvest. Areas identified by the recovery unit team for targeted enforcement include the South Fork Walla Walla River from Harris Park upstream, the mainstem Walla Walla River at Nursery Bridge and Cemetery Bridge; upper Mill Creek and the Touchet River upstream of Dayton and in the North Fork Touchet River.

Stocking. Loss of anadromous species in the recovery unit is believed to have affected bull trout by removing an important prey species and the contribution of nutrients salmon carcasses provided to the ecosystem. Ongoing efforts to re-establish naturally reproducing chinook salmon and restore depressed steelhead runs in the recovery unit are viewed as a benefit to bull trout. Nevertheless, because we have little knowledge of historical species interactions between native salmonids, or non-salmonids for that matter, in the recovery unit, managers need to coordinate and monitor recovery of listed steelhead, chinook, and bull trout in the context of the fish species assemblage to insure that recovery efforts for one species does not compromise recovery of another.

Species interaction through competition for food and space with nonnative rainbow trout may have been a threat to bull trout in the past in the Umatilla River mainstem upstream of Meacham Creek and in the North Fork Umatilla River and South Fork Umatilla River. The stocking program also encouraged angler activity that would have increased opportunity for incidental catch of bull trout. Stocking of nonnative rainbow trout was terminated in these reaches in 1994 and was subsequently terminated in the mainstem Umatilla River downstream of Meacham Creek in 2000.

Stocking of rainbow trout in the South Fork Walla Walla River by the Oregon Department of Fish and Wildlife was terminated in 1994. Prior to 1999, Washington Department of Fish and Wildlife stocked rainbow trout in Mill Creek between

Bennington Diversion and Yellowhawk Diversion Dam and these fish would have had access to the mainstem Walla Walla River through Yellowhawk and Garrison diversions. Stocking of rainbow and brown trout in the Touchet River was discontinued in 2000. Washington Department of Fish and Wildlife no longer stocks rainbow trout or brown trout in the Walla Walla River Basin in Washington.

Nonnative Species. The Umatilla Basin is relatively free of exotics that might pose a threat to bull trout. Some exotic species have been introduced by fish management agencies to provide additional fishing opportunities, and some species have been introduced illegally. Controlling illegal introductions is extremely difficult because authorities usually don't find out about it until after the fact and finding the responsible parties to prosecute is very difficult, if not impossible. Education of the public on the dangers and consequences of illegal introductions is a necessary task.

There are largemouth bass in McKay Reservoir, and there is potential for them to exit the reservoir when it spills and take up residence downstream in McKay Creek and in the Umatilla River where bull trout have been observed. There are also smallmouth bass in the lower mainstem of the Umatilla River. Impacts to the Umatilla bull trout population from interactions with these and other nonnative species is unknown.

Crappie were observed recently in the mainstem Walla Walla River upstream of Nursery Bridge. Their origin is unknown and is presumed to be the result of an illegal introduction (J. Germond, pers. comm. 2001b). The mainstem Walla Walla River from the Little Walla Walla River downstream to the mouth contains numerous exotic species, but their impact on bull trout is unknown, as is the extent of use in this reach by bull trout. Brown trout occur in mainstem Touchet River between Dayton and Waitsburg and in the North Fork Touchet and Wolf Fork Touchet Rivers where they occupy the same reaches as some bull trout in the lower portion of their summer rearing and spawning range (Mendel *et al*. 2000). Interactions between bull trout and brown trout have not been assessed.

Cultural and social attitudes may be a threat to bull trout. Until recently they were viewed as an undesirable species primarily due to their predation on species considered more desirable, (*e.g.*, salmon and rainbow trout). With education attention focused on bull trout and their value as part of the historical ecosystem, much of this is changing, but bias against bull trout remains and may complicate their recovery.

Disease. Maintaining healthy habitats that in turn support healthy fish will minimize the effects of pathogens that are part of the natural environment. However, there is always some risk of invasion by exotic parasites and disease organisms that could eradicate a population. To prevent spread of diseases that might impact bull trout, Oregon Department of Fish and Wildlife maintains a fish health monitoring program at fish hatcheries and maintains a permit transport system to track transports of fish. Pre-transfer examinations of fish are done to prevent spread of fish pathogens. Fish are tested when biologists make them available or when collected for other reasons. Risk assessments are done prior to movement of fish above barriers. In special circumstances wild fish populations are tested for disease if moribund or dying fish are reported and samples submitted to the laboratory (R. Holt, ODFW Fish Health Laboratory, pers. comm. 2001).

The presence of whirling disease in the Grande Ronde Basin is a concern and periodic monitoring for whirling disease in the Umatilla and Walla Walla Basins has been recommended by the Oregon Department of Fish and Wildlife pathologists. Public information programs, such as those implemented for whirling disease in Montana and Utah, are useful in educating anglers about the fish disease, how it is transmitted, and things they can do to minimize disease transmission.

Isolation and Habitat Fragmentation

Genetic work on bull trout in the Umatilla and Oregon portion of the Walla Walla Basin was completed by Spruell and Allendorf (1997). Bull trout in both basins share the same lineage as do bull trout in the John Day Basin. All three basins are considered one gene conservation group by Oregon Department of Fish and

Wildlife. Additional sampling has been done in the Walla Walla Basin by Washington Department of Fish and Wildlife that includes samples from the Touchet. This work will investigate within population and between population variations within the Walla Walla Core Area.

Current population modeling of bull trout populations suggests each local population or complex of several interconnected local populations should include an average of at least 1,000 adults spawning each year (Rieman and Allendorf 2001).

Based on this standard the bull trout population in the Umatilla Basin, which at this time is confined to the North Fork Umatilla, is not large enough to withstand genetic effects associated with small population size or to ensure long-term persistence. If there is a remnant bull trout population in North Fork Meacham Creek it would not be considered viable due to low abundance. Lack of connectivity between the North Fork Umatilla River and Meacham Creek due to thermal and low flow barriers limits the ability of bull trout to access suitable spawning and rearing habitat in the Meacham subbasin. Bull trout rearing in the South Fork Umatilla River has been observed, although spawning by bull trout has not been documented. Expansion of bull trout populations into the South Fork Umatilla River has some potential, but lack of channel complexity in the lower river and lack of flows in Thomas and Spring Creeks and other factors as yet unknown may be limiting connectivity.

Similarly, the three bull trout populations in the Walla Walla Core Area are not of a sufficient size individually to resist genetic affects associated with small population size. Degraded habitat and operation of irrigation diversions potentially limits the interchange between bull trout populations from late spring and early summer through fall, although there is the potential for them to share overwintering habitat in the mainstem Walla Walla River during the winter. Sightings of bull trout in the mainstem Walla Walla River downstream of the Mill Creek confluence are extremely rare. Radio telemetry projects proposed in 2001 will help define bull trout migratory patterns in the mainstem Walla Walla River. It does not appear that the Mill Creek bull trout migrate downstream of the City of Walla Walla, based on

telemetry studies conducted by Oregon Department of Fish and Wildlife (Hemmingson *et al*. 2001b). The Touchet River local population is isolated from the other Walla Walla bull trout local populations, and similar to the North Fork Umatilla populations, is vulnerable to catastrophic events due to the isolation and the limited known spawning distribution within the subbasin.

Interchange between the Umatilla and Walla Walla bull trout local populations via the Columbia River is unknown at this time. A few bull trout have been encountered in recent years at Three Mile Dam on the Umatilla River near the confluence with the Columbia River. Connectivity through the Columbia River would be desirable and provide a route for re-establishment should populations in either basin become extirpated.

ONGOING RECOVERY UNIT CONSERVATION MEASURES

Efforts to recover anadromous species are ongoing in both basins with a high level of cooperation between fishery entities on various projects. Spawning surveys have been a cooperative effort for many years. Both basins have active local watershed groups dedicated to finding workable solutions to restoring native fish runs. The following list is by no means complete, but is representative of ongoing efforts within the recovery unit.

Both State agencies, the Confederated Tribes of the Umatilla Indian Reservation, and U.S. Forest Service staff work cooperatively on spawning and habitat surveys, salvage efforts, and research projects. A cooperative research project is ongoing among the Washington Department of Fish and Wildlife, Oregon Department of Fish and Wildlife, Confederated Tribes of the Umatilla Indian Reservation, irrigation districts and the Walla Walla Basin Watershed Council, monitoring bull trout distribution in the Walla Walla River, Mill Creek, and the Touchet River using radio telemetry.

State of Oregon

On January 14, 1999, Governor Kitzhaber expanded the Oregon Plan for Salmon and Watersheds (State of Oregon 1997) to include all at-risk wild salmonids, including bull trout, 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. The Oregon Plan is being implemented through the various State agencies that have authority over natural resources, local watershed councils, and individual landowners. Guidance for aquatic habitat restoration and enhancement,

watershed assessment, and monitoring plans have been developed. Annual progress reports are published on the Oregon Plan web site (http://www.oregon-plan.org/).

Planning efforts in the Oregon Department of Fish and Wildlife have focused on formation of local bull trout working groups to develop conservation strategies for Oregon bull trout populations. This effort was begun in 1993 and these working groups were later used to form the foundation for bull trout recovery unit teams. Once bull trout were listed work on conservation strategies was incorporated into the U.S. Fish and Wildlife Service's recovery planning effort. Bull trout distribution mapping using the agency's Geographic Information System began in 1996. The statewide bull trout assessment, Status of Oregon's Bull Trout (Buchanan *et al.* 1997), was published in 1997.

Oregon has reduced or eliminated rainbow trout stocking programs, adopted changes in angling regulations to prohibit take of bull trout, and modified regulations on other fisheries to reduce incidental take.

In 2000, Oregon Department of Fish and Wildlife made changes to in-water work periods to protect fish during vulnerable life stages including migration, spawning, and rearing. Guidelines provide the public with periods when in-water activities may be conducted and have the least impact to fish. The agency has also developed and distributed bull trout identification posters to provide better public awareness and initiated a multi-year bull trout research project in northeastern Oregon in 1995 to study bull trout life history, ecology, and genetics. Funding has been provided through a grant from the Bonneville Power Administration. Mill Creek in the Walla Walla subbasin is one of the study areas. Funding through a section 6 cooperative agreement with the U.S. Fish and Wildlife Service has assisted with spawning surveys to monitor bull trout populations.

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 (NPPC 2001b).

Oregon Water Resources Department completed its river diversion inventory and distribution list in the summer of 2000. This list accounts for all diversions and water rights of record for the upper Walla Walla River (upstream of 15th Street bridge in Milton-Freewater). This information should improve the agency's ability to manage water resources and identify opportunities to improve stream flows for fish.

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 such as 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 such as stored, surface, or groundwater (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. Oregon Water Resources Department has processed some water transfers. Transferring out-of-stream use to instream use has the potential to improve stream flows for bull trout.

Inventories of push-up dams and fish screens in the upper Walla Walla Basin have been completed by the Oregon Department of Fish and Wildlife with the Oregon Water Resources Department (see Appendix A under Oregon sites). In conjunction with the headgate project, several push-up dams were modified to improve fish passage. Modifications included construction of rock weirs, rock bars, and proper submergence of the headgate to allow proper operation and fish passage. Additional improvements in fish passage in the Walla Walla subbasin in 2001 include construction of a new City of Walla Walla diversion screen on Mill Creek and a new fish ladder at Nursery Bridge. The new screen will improve bull trout survival at the City of Walla Walla's diversion (see discussion of the problem in the section under Dams). Bull trout at least 30 centimeters (12 inches) in length have been documented using the ladder at Nursery Bridge.

Timber harvest on private land is regulated by the Oregon Department of Forestry (ODOF), which has been instrumental in developing site-specific direction and regulation of forest management activities on private and State-owned forest lands. The Oregon Forest Practices Act (FPA) in 1972 implemented a comprehensive set of regulations that deal with all aspects of the growing and harvesting of forest tree species across the forest habitats under their jurisdiction. Recommendations for appropriate management practices are provided through best management practices (BMP's). The forest practices and best management practices are periodically reviewed for adequacy in protecting aquatic resources and water quality.

The Oregon Department of Forestry has implemented comprehensive engineering, forest habitat management, education, and enforcement programs for forest landowners and forest operators. The department employs full-time professional foresters to oversee the implementation of the Forest Practices Act within the recovery unit. Oregon Department of Forestry works closely with the Oregon Department of Fish and Wildlife and Oregon Department of Environmental Quality in the development and implementation of forest practices. The Forest Practices Act has been recognized for playing a positive role in improving water quality and fisheries habitat.

A sufficiency analysis of the Forest Practices Act mandates (adequacy rules to protect water quality) by Oregon Department of Forestry and Oregon Department of Environmental Quality will be completed sometime in 2002. Water quality parameters addressed in the analysis include temperature, sedimentation, aquatic habitat modification, bio-criteria, and others (ODEQ 2001).

The Forest Practices Act has gone through numerous changes throughout the years to reflect current data that supported changes in the best management practices (BMP's). Changes have and will continue to occur as scientists, foresters, interest groups and the public gain a deeper understanding of the cumulative and interactive effects of forest management. Recent examples of in-depth reviews of forestry practices in Oregon include the Independent Multidisciplinary Science Team Report (IMST Report) and the recommendations provided to the Oregon Governor by the Ad Hoc Forest Practices Committee on Salmon and Watersheds. Continued improvement in forest practices should benefit fish habitat by reducing impacts to water quality during harvest activities.

Gravel mining in Oregon is regulated by the Division of State Lands. The Oregon State Police monitors compliance with Division of State Lands fill and removal rules and permits in Oregon. Permits may be conditioned to avoid or minimize impacts to fish.

The Umatilla Total Maximum Daily Load process was completed in 2001, and is being implemented under the Oregon Plan for Salmon and Watersheds (see previous discussion). Load allocations were defined for temperature, sediment, aquatic weeds and algae, ammonia, and bacteria. Temperature and excess soil erosion were identified as the most widespread water quality concerns in the basin. Both concerns will be addressed primarily by restoring riparian vegetation (ODEQ 2001).

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

released pertaining to flow and temperature parameters on the 303(d) list. The Oregon Department of Agriculture has agreed to review the plans every two years as needed to evaluate their adequacy as the primary tool of agriculture-related Total Maximum Daily Load implementation. The initial review is scheduled to begin early in 2002 (ODEQ 2001).

State of Washington

The Governor's office in Washington State has developed a statewide strategy (Washington Governor's Salmon Recovery Office 1999) that describes how State agencies and local governments will work together to address habitat, harvest, hatcheries, and hydropower as they relate to recovery of listed species, including bull trout. 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 (WDFW 2000). The Washington Department of Fish and Wildlife no longer stocks brook trout in streams or lakes connected to bull trout occupied waters. Fishing regulations prohibit harvest of bull trout, except for a few areas where stocks are considered "healthy," within the State. A healthy stock was defined as not meeting any of five criteria[2] used to describe changes in stock status and fitness, while at the same time experiencing production levels within natural variations in survival consistent with available habitat (WDFW 1997). 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,

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2 The five criteria are (1) long-term negative trend, (2) short-term severe decline, (3) chronically low numbers, (4) decreases in fitness as evidenced by small numbers of spawners, changes in spawn timing, or other reduction in genetic variability, and (5) lack of data to assess status (Washington Department of Fish and Wildlife 1997).

which consists of an inventory of stream reaches and associated habitat parameters important for the recovery of salmonid species and bull trout.

Washington has reduced or eliminated rainbow and brown trout stocking programs, adopted changes in angling regulations to prohibit take of bull trout, and modified regulations on other fisheries to reduce incidental take.

The Washington Department of Ecology has responsibility for restoring and maintaining stream flows and does this by (1) providing technical support to local watershed planning groups to develop new or amended stream flows, (2) providing basic watershed planning support services, including hydrology, water law, water right processing, and data to local watershed planning groups, (3) conducting technical studies and adopting instream flows by rule, (4) accepting water into the Trust Water Right Program (RCW 90.42 and 90.38) for the purpose of instream flow augmentation through leases, purchases and donations, and water derived from irrigation efficiency improvements, and (5) developing a strategy that envisions all stakeholders in the Columbia/Snake River system coming together to develop a new management program (including instream flows and conditions for issuing new water rights) for this system (W. Neve, Washington Department of Ecology, pers. comm. 2002; Washington Department of Ecology 2001).

Washington Department of Fish and Wildlife is using its voluntary Cooperative Compliance Screen Program to screen diversions. The program provides 85 percent of design and installation of approved fish screens. They have over 400 applicants, and have received almost $1 million in funding. As of July 2002, the program has resulted in installation of 35 of the 156 to 160 screens targeted for the year. Streams in the Walla Walla Core Area included in the program are the Walla Walla River, Mill Creek, Touchet River, Wolf Fork Touchet River, North Fork Touchet River, and South Fork Touchet River (D. Karl, Washington Department of Fish and Wildlife, pers. comm. 2002).

Timber harvest on private land is regulated by Washington Department of Natural Resources (WDNR), which has been instrumental in developing site-specific

direction and regulation of forest management activities on private and State-owned forest lands. The Washington Forest Practices Act (FPA) in 1974 implemented a comprehensive set of regulations that deal with all aspects of the growing and harvesting of forest tree species across the forest habitats under their jurisdiction. Recommendation for appropriate management practices are provided through best management practices (BMP's). The forest practices and best management practices are periodically reviewed for adequacy in protecting aquatic resources and water quality.

Washington Department of Natural Resources has implemented comprehensive engineering, forest habitat management, education, and enforcement programs for forest landowners and forest operators. Washington Department of Natural Resources employs full-time professional foresters to oversee the implementation of the Forest Practices Act within the recovery unit. Washington Department of Natural Resources works closely with the Washington Department of Fish and Wildlife and Washington Department of Ecology in the development and implementation of forest practices. The Forest Practices Act has been recognized for playing a positive role in improving water quality and fisheries habitat. It has gone through numerous changes throughout the years to reflect current data that supported changes in the best management practices (BMP's). Changes have and will continue to occur as scientists, foresters, interest groups and the public gain a deeper understanding of the cumulative and interactive effects of forest management.

In January 2000, the Washington Forest Practices Board (2000) adopted new emergency forest practice rules based on the Forests and Fish Report (USFWS *et al.*, *in litt.* 1999). 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 relies 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 includes 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 Forests 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 "Ag, Fish, and Water" (The Agriculture, Fish and Water Program). The U.S. Fish and Wildlife Service is considering the possible impacts and potential benefits from this process relative to bull trout recovery.

In Washington portion of the Umatilla-Walla Walla Recovery Unit, fill and remove permits are issued by Walla Walla County Regional Planning. Oversight is provided by Washington Department of Ecology's Shorelands and Environmental Assessment Program. Hydraulic projects are monitored by the Enforcement Program of Washington Department of Fish and Wildlife. Permits may be conditioned to avoid or minimize impacts to fish.

Tribes

The Confederated Tribes of the Umatilla Indian Reservation is currently working on a Total Maximum Daily Load for Reservation lands in the Umatilla Basin. It is envisioned that the Total Maximum Daily Loads for reservation lands will target water quality standards similar to those under development by the Oregon Department of Environmental Quality and hence provide similar levels of water quality protection (ODEQ 2001).

Local Efforts

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 the status of fish and wildlife resources, limiting factors, and recommended actions at the subbasin level.

The draft Umatilla subbasin summary (NPPC 2001b) and draft Walla Walla subbasin summary (NPPC 2001a), encompass the Umatilla-Walla Walla Recovery Unit, and are consistent with bull trout recovery planning efforts to identify limiting factors. The draft Umatilla subbasin summary identifies elevated temperature, degraded channel conditions, reduced instream habitat diversity and flows, degraded riparian habitat, and lack of passage as contributing to the decline of bull trout. The overall fisheries goal of the draft Umatilla subbasin plan is "restore the health and function of the Umatilla River ecosystem to ensure continued viability of these important populations" (NPPC 2001b). According to the subbasin plan this goal will be achieved by implementing sixteen strategies that address protection of indigenous fishes; habitat restoration including water quality, flows, instream and riparian habitat and passage barriers; monitoring populations to assess effectiveness of habitat improvements; use of artificial propagation to restore salmon and steelhead runs; develop a restoration plan for Pacific lamprey; develop a restoration plan for freshwater shellfish; and improve out-of-basin survival of migratory fish. The draft Walla Walla subbasin summary identifies degraded channel conditions, reduced instream diversity, degraded riparian, insufficient flows, elevated temperature, and lack of passage as factors limiting bull trout. The overall fisheries goal of the draft Umatilla subbasin plan is to " protect, enhance and restore wild and natural populations of summer steelhead, bull trout, shellfish and other indigenous fish in the Walla Walla subbasin". According to the subbasin summary this goal will be achieved by implementing fifteen strategies that address protection of indigenous fishes; habitat restoration; monitoring populations to assess effectiveness of habitat improvements; use of artificial propagation to restore salmon and steelhead runs; assess warm water fisheries compatibility with conservation of indigenous salmonids; develop a restoration plan for Pacific lamprey; and improve out-of-basin survival of migratory fish. The Umatilla-Walla Walla recovery unit team will continue to utilize this planning process to identify and seek funding for projects to aid bull trout recovery.

The Bonneville Power Administration has provided funding for numerous anadromous and bull trout habitat and research projects by the Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, and the

Confederated Tribes of the Umatilla Indian Reservation in the recovery unit. Examples of habitat projects include the Umatilla River channel modification to improve fish passage during low flows, placement of screens and construction of ladders at irrigation diversions, fencing and riparian vegetation planting to improve riparian habitat, and placement of large wood and boulders to improve instream habitat. Research projects include studies on bull trout life history, ecology, and limiting factors and studies to determine bull trout movement patterns. A list of specific projects can be viewed at the Bonneville Power Administration's web site for the Umatilla, http://www.efw.bpa.gov/EW/CONTRACTS/SUMMARY/UMATILLA.htm. and Walla Walla, http://www.efw.bpa.gov/EW/CONTRACTS/SUMMARY/WALLA_WALLA.htm, Basins.

The Walla Walla watershed group was established under Washington House Bill 2514 to address water quantity issues (*i.e.*, instream flows), as they related to the Walla Walla Total Maximum Daily Load. The Washington Department of Ecology is a participant in this group. Formation of the Umatilla and Walla Walla watershed councils has been instrumental in coordinating and inspiring local planning and recovery activities. Both watershed councils are active participants in the Total Maximum Daily Load process. The Walla Walla watershed council produced a Walla Walla Watershed Action Plan (1999). The plan identifies actions necessary to achieve the goals and objectives of the Walla Walla Watershed Council: "protect the resources of the watershed, deal with issues in advance of resource degradation, and enhance the watershed's health". Improvements to water quality in both river systems is the eventual expected outcome as well as increased awareness among local landowners and the general public on the benefits of watershed health and the means to protect it.

The Walla Walla Conservation District and the Columbia County Conservation District in southeast Washington have secured funds from State and Federal sources and they are implementing riparian and instream habitat enhancements, fish screens and ladders for improved fish passage. They also contribute monies and assistance to monitoring habitat conditions and educational efforts.

In 2000, the U.S. Fish and Wildlife Service negotiated a settlement agreement with three irrigation districts to gain higher instream flows in the Walla Walla River near Milton-Freewater, Oregon, and downstream of Milton-Freewater in Washington. The agreement was revised and improved in 2001. The irrigation districts and other water users in the Walla Walla Basin are also participating in development of a Habitat Conservation Plan to address threats to listed fish species. Flow restoration identified by the U.S. Army Corps of Engineers (1997) as necessary for reintroduction of chinook salmon into the Walla Walla Basin would benefit bull trout, steelhead, and lamprey.

The Oregon Water Resources Department, Walla Walla Basin Watershed Council, Natural Resource Conservation Service, and landowners completed the headgate and measurement device installation project prior to irrigation in 2001 season. These devices will allow diversion control and data collection. This data will be helpful if users wish to participate in Conserved Water Applications, instream leasing and conversion from flood to sprinkler. These processes will be ongoing as landowners determine their irrigation needs and objectives.

Conversions from ditch to sprinkler irrigation in the South Fork Walla Walla River and ditch consolidations in upper Walla Walla River Basin have been completed.

The City of Pendleton is considering converting from use of spring water to a diversion of Umatilla River water for its water supply. The addition of cold spring water back into the Umatilla River would improve water temperatures for bull trout in the vicinity of Squaw Creek and would have the effect of expanding habitat available to bull trout in this section of the river.

U.S. Forest Service

The U.S. Forest Service installed numerous instream structures in the mainstem Umatilla River, lower South Fork Umatilla River, Thomas Creek, and mainstem Meacham Creek in 1999. The structures have benefited instream fish habitat by providing pool habitat that could make these sections more hospitable to bull trout.

Until recently, the Buck Creek Trail in the North Fork Umatilla Wilderness was situated in the floodplain of Buck Creek and crossed the stream in seventeen places. In 1999, the U.S. Forest Service reconstructed 98 meters (320 feet) of trail, relocated 6 kilometers (3.9 miles) of the trail to the to the edge of the floodplain, and reduced the number of stream crossings to one. In addition, 17.6 meters (11 miles) of trail in Spring Creek Riparian Habitat Conservation Area were obliterated. Rehabilitation of the riparian area and relocation of the trail will reduce the potential for sediment to enter the stream and allow the riparian vegetation to re-establish and provide shade to the stream, thus improving fish habitat.

U.S. Bureau of Land Management

Use of the South Fork Walla Walla Road, serving several private parcels within U.S. Bureau of Land Management land, has been restricted to the period July 1 through August 15, a period when bull trout are not spawning and the eggs of other salmonid species are no longer in the gravel. Bridges on the South Fork Walla Walla Road once maintained by Boise Cascade were closed in 1991, after which access was achieved by fording the South Fork Walla Walla River within a 4 kilometer (2.5 mile) stretch of stream above Harris Park. Seven crossings are located within this segment of the river. A gate was installed to prevent fording of the South Fork Walla Walla River during the closure period, road maintenance is not allowed, and heavy equipment or vehicles over 680 kilograms (1,500 pounds) gross vehicle weight are not allowed in the stream (USFWSb, *in litt.* 1998). Water quality is monitored by the U.S. Bureau of Land Management. Monitoring in 2000 showed temperature and most other water quality parameters within State water quality standards (BLM 2000).

About one mile of the South Fork Walla Walla trail was moved away from the stream along the South Fork of the Walla Walla River in 1999. Most of the relocated trail was not moved out of the floodplain, but was moved over to the toe of the hill slope. Although it is still in the floodplain, its impact to the stream is much reduced. The trailhead area is located on U.S. Bureau of Land Management managed land and its use is monitored by that agency and reported annually at section 7 consultation meetings with U.S. Fish and Wildlife Service. Through informal consultation, the U.S. Fish and

Wildlife Service determined that the relocation trail projects and recreation use at the South Fork Walla Walla trail head were "not likely to affect" bull trout (USFWS, *in litt*. 1998a and 1999). Based on routine patrols and reports from the U.S. Forest Service, no unauthorized activities occurred during the 2000 season, nor were significant impacts to resources of the area documented, although some minor impacts occurred in the form of general litter, fire rings, and vegetation damage (BLM 2000). Annual monitoring has shown no significant increase in numbers or change in activities in the past several years (BLM 2000).

Natural Resource Conservation Service

Programs that address agricultural activities include the Conservation Reserve Program (CRP), the Conservation Restoration and Enhancement Program, and the Environmental Quality Incentive Program, all under the direction of the U.S. Department of Agriculture Natural Resource Conservation Service. In the Walla Walla Basin in Oregon, there are there are 5,361 hectares (13,247 acres) under the conservation reserve program. These projects address agricultural development on steep slopes and in riparian areas by taking the land out of production and restoring vegetation to hold the soil and prevent or reduce soil erosion. The benefit to fish is reduced sediment that would otherwise flow into streams and impact fish habitat.

U.S. Bureau of Reclamation

The Bureau of Reclamation's Umatilla Basin Project has improved passage flows downstream from Pendleton for juvenile and adult anadromous fish by augmenting flows from September through June by meeting irrigation demand with flows from the Columbia River rather than the Umatilla River. The improved flows would benefit migration and foraging conditions for bull trout in the lower river. Modifications have been made to McKay Reservoir operations to protect fish residing in lower McKay Creek and decrease potential to strand fish when flows are cut off.

Multi-agency Efforts

A Memorandum of Agreement between the U.S. Environmental Protection Agency and the Washington State Department of Ecology is being negotiated and near settlement, establishing U.S. Environmental Protection Agency as the lead entity for mainstem Columbia and Snake River Total Maximum Daily Loads in Washington. Four-way communication exists between U.S. Environmental Protection Agency, and the States of Oregon, Washington, and Idaho regarding the mainstem Columbia and Snake River Total Maximum Daily Limits. The U.S. Environmental Protection Agency is the lead on temperature for the mainstem Columbia/Snake Rivers, the State of Oregon is lead for the lower Columbia Total Dissolved Gases, and the State of Washington is lead for the Upper Columbia Total Dissolved Gasses Total Maximum Daily Load.

The Total Maximum Daily Load process has been initiated in the Walla Walla Basin. Temperature is the only Total Maximum Daily Load being addressed "basin wide". In Oregon the necessary field data has been collected and a temperature model is being developed based on topography, channel morphology, vegetation, and flows. A Draft Total Maximum Daily Load and Management Plan will be completed and sent out for public comment in December 2001. Total Maximum Daily Loads are scheduled to be completed on the Walla Walla River, Touchet River, and Mill Creek by 2005. The multi-state effort has involved Oregon Department of Environmental Quality, Washington Department of Energy, U.S. Environmental Protection Agency, and the Walla Walla Basin Watershed Council. Benefits expected from implementation of the Total Maximum Daily Load management plans include improved water quality and fish habitat, and increased awareness and support within local communities for improving water quality and watershed health in general.

Through the Umatilla Total Maximum Daily Load process a Water Quality Management Plan was developed to address forest, agricultural, urban and transportation sources of water quality impairment (ODEQ 2001; also see under Umatilla at http://waterquality.deq.state.or.us/wq/TMDLs/TMDLs.htm).

Management practices on the National Forest that affect or may affect listed species require consultation with the listing agency, U.S. Fish and Wildlife Service or National Marine Fisheries Service, under section 7 of the Endangered Species Act. Management guidance to the Federal land managers is provided in the Umatilla Forest Plan as amended by the Interim Strategies for Managing Anadromous Watersheds in Eastern Oregon and Washington, Idaho, and Portions of California (USFS and BLM 1995), also referred to as PACFISH. Additional actions for Federal lands east of the Cascades will be implemented once the Interior Columbia Basin Ecosystem Management Plan Record of Decision is issued.

The U.S. Army Corps of Engineers is working with the Walla Walla Basin Watershed Council to explore opportunities to modify some of the levees to improve stream channel function to benefit fish. Two projects have been approved that would benefit approximately 2 kilometers (1.5 miles) of river by allowing the river to meander, increasing stream length and adding to riparian zone vegetation (USCOE 2000; C. Hyland, U.S. Army Corps of Engineers, pers. comm. 2001).