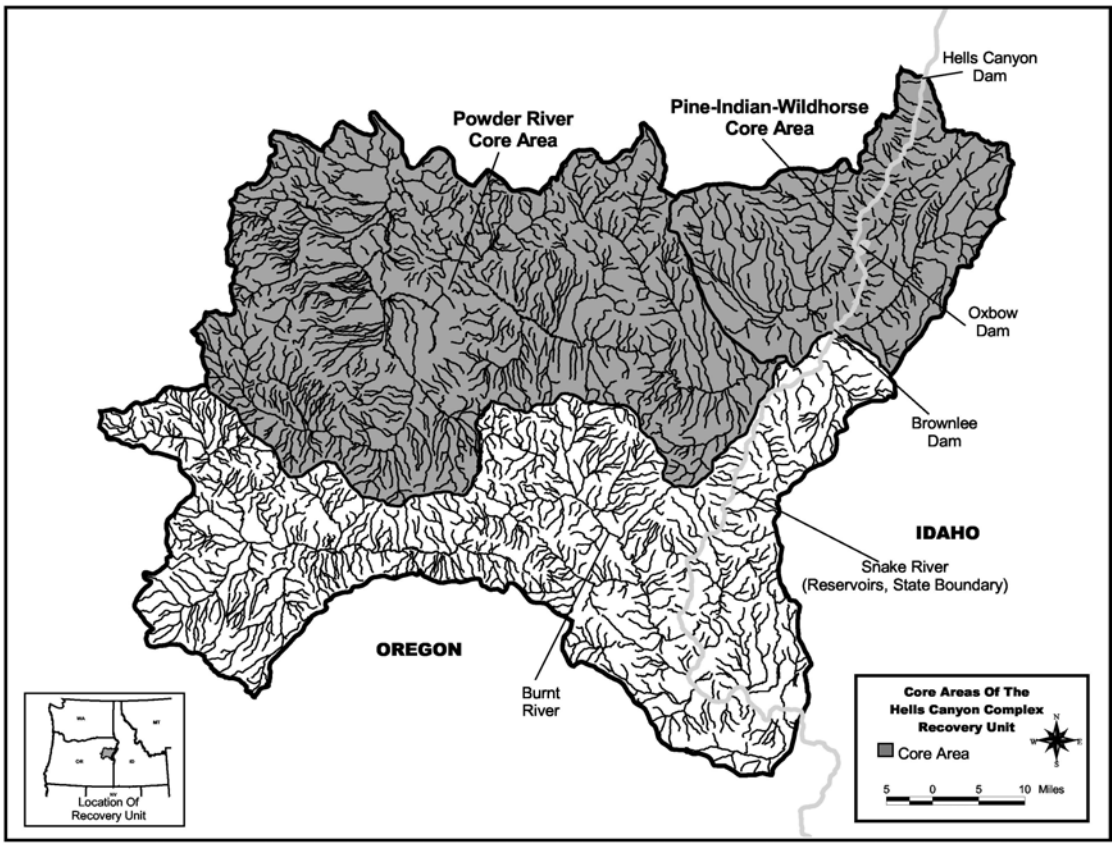
STRATEGY FOR RECOVERY

A core area represents the closest approximation of a biologically functioning unit. The combination of core habitat (*i.e.*, habitat that could supply all the necessary elements for the long-term security of bull trout including both spawning and rearing as well as foraging, migrating, and overwintering) and a core population (*i.e.*, bull trout inhabiting a core habitat) constitutes the basic core area upon which to gauge recovery within a recovery unit. Within a core area, many local populations may exist.

Bull trout currently occupy areas associated with each of the three Snake River reservoirs in the Hells Canyon Complex Recovery Unit (Figure 3). For Hells Canyon Reservoir, bull trout occur in the reservoir and two tributary basins, Pine Creek and Indian Creek. For Oxbow Reservoir, bull trout occur in at least two streams (*i.e.,* Bear Creek and Crooked River) within Wildhorse River, a tributary basin to the reservoir. For Brownlee Reservoir, bull trout occur in various streams within the Powder River basin, a tributary to the reservoir. Migratory bull trout occur in Hells Canyon Reservoir and likely spawn in the Pine Creek basin and perhaps the Indian Creek basin. Bull trout inhabiting the Wildhorse River and Powder River River basins are likely resident fish.

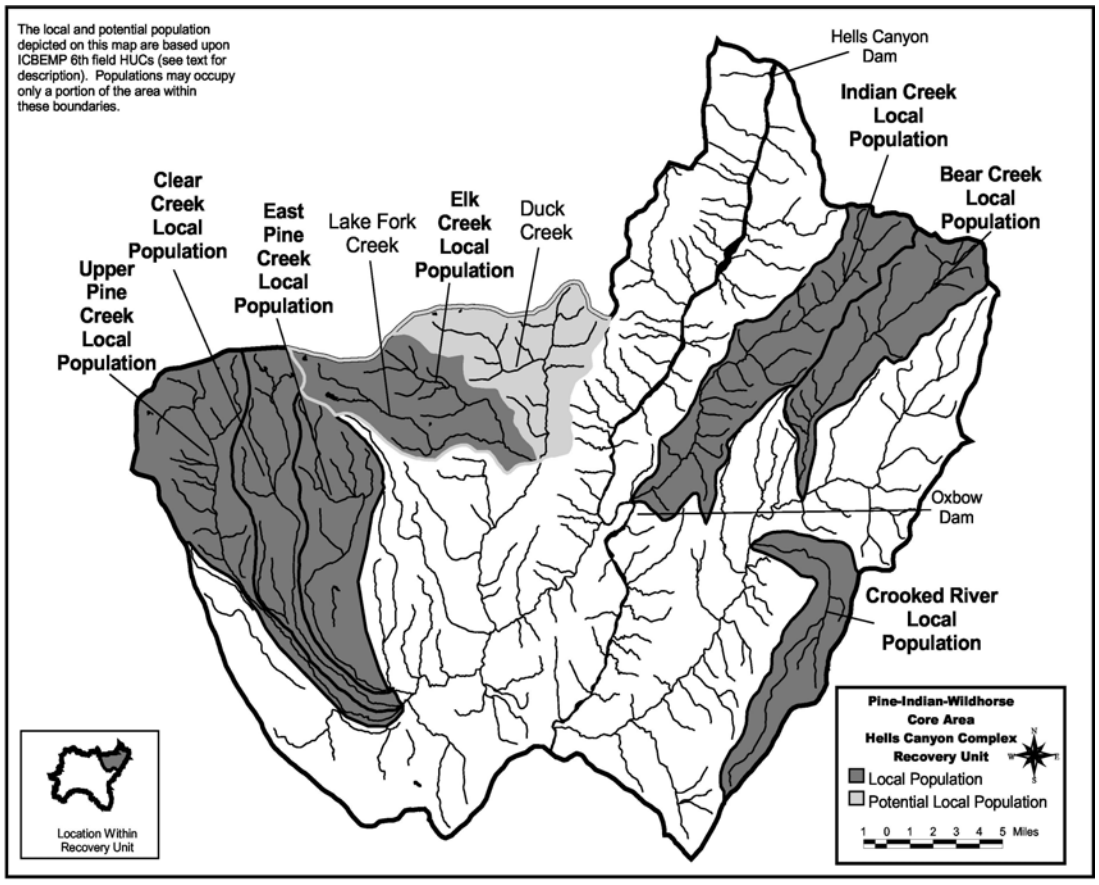
The Hells Canyon Complex Recovery Unit Team has identified two core areas within the recovery unit. The Pine-Indian-Wildhorse Core Aarea encompasses Hells Canyon Reservoir, Oxbow Reservoir, and their tributaries, namely Pine Creek, Indian Creek, and Wildhorse River (Figure 4). A total of seven local populations and two unoccupied areas with potential spawning and rearing habitat (*i.e.,* presently unoccupied areas that may be able to support a local population) was identified in the Pine-Indian-Wildhorse Core Area (Table 6). The Powder River core area encompasses the Powder River basin upstream from the confluence with Brownlee Reservoir (Figure 5). A total of 10 local populations and 1 unoccupied area with potential spawning and rearing habitat was identified in the Powder River Core Area (Table 6).

Figure 3. The Hells Canyon Complex Recovery Unit showing the locations of the Pine-Indian-Wildhorse and Powder River bull trout core areas.



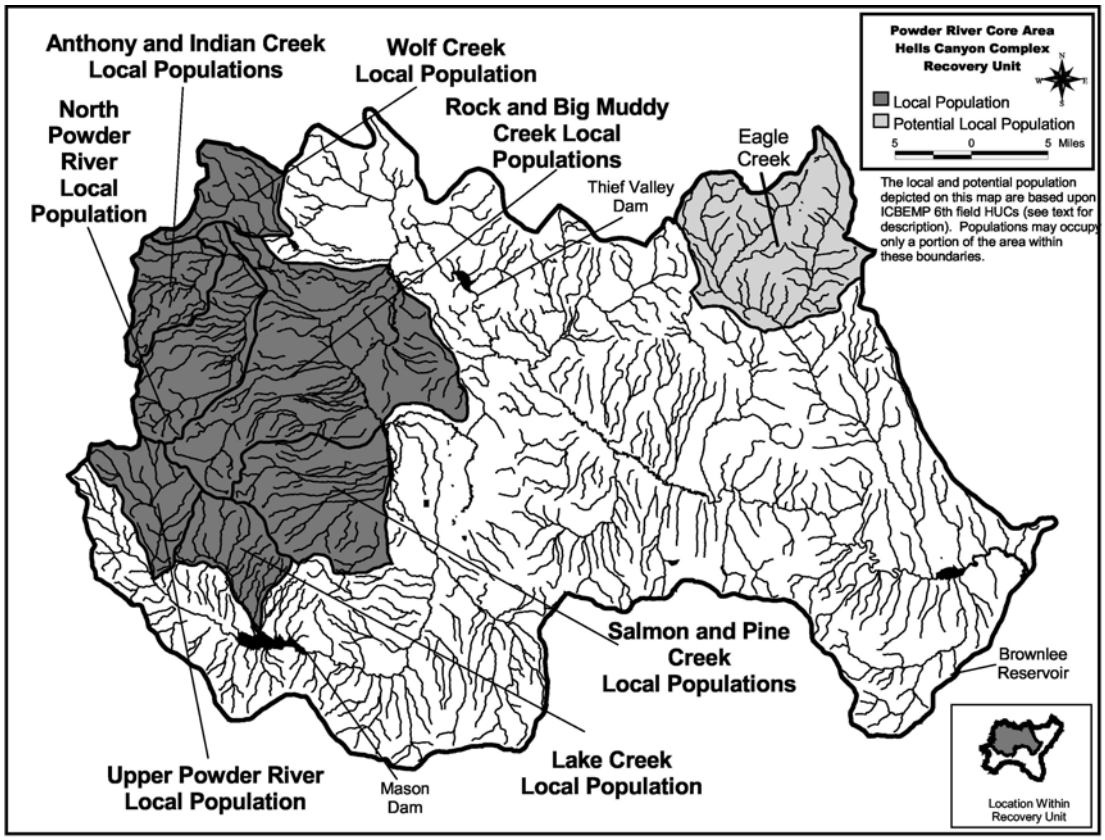
Brownlee Reservoir and the Burnt River basin are included in the Hells Canyon Complex Recovery Unit, but are not presently considered core areas or portions of core areas. Due to uncertainty about the potential roles of the two areas in bull trout recovery, the Hells Canyon Complex Recovery Unit Team identified that gaining a better understanding of the potential for Brownlee Reservoir and the Burnt River basin to contribute to bull trout recovery as a research need. Although bull trout may have been extirpated in Eagle Creek, a tributary to the lower Powder River, it is considered an area that can potentially support a local population (*i.e.,* potential local population). The ability of Brownlee Reservoir to provide foraging, migrating, and overwintering habitat, at least seasonally, for bull trout in Eagle Creek would greatly influence the recovery potential of the local population.

Figure 4. The Pine-Indian-Wildhorse Core Area showing the locations of bull trout local populations and areas with potential spawning and rearing habitat (see Table 6).



Bull trout have not been observed in the Burnt River basin. However, the basin has not been intensively surveyed specifically to investigate the presence of bull trout. Because bull trout occur in basins adjacent to the Burnt River basin and the Burnt River basin historically supported anadromous salmonids, it is plausible that bull trout may have or presently do occur in some portions of the basin. Moreover, habitat suitable for bull trout may exist in headwater tributaries of the Burnt River. Determining bull trout presence and the potential of the Burnt River basin to support bull trout is a primary research need.

Figure 5. The Powder River Core Area showing the locations of bull trout local populations and the area with potential spawning and rearing habitat (see Table 6).



Recovery Goals and Objectives

The goal for the bull trout recovery plan is to **ensure the long-term persistence of self-sustaining complex, interacting groups of bull trout distributed throughout the species' native range, so that it can be delisted**. To achieve this goal the following objectives have been identified for bull trout in the Hells Canyon Complex Recovery Unit:

- Maintain the current distribution of bull trout and restore distribution in previously occupied areas within the Hells Canyon Complex Recovery Unit.

Table 6. Bull trout core areas, local populations, and currently unoccupied potential spawning and rearing habitat in the Hells Canyon Complex Recovery Unit, Idaho and Oregon.

Core area	Local populations	Potential spawning and rearing habitat[1]
Pine-Indian-Wildhorse (Includes Hells Canyon and Oxbow reservoirs, Pine Creek (Oregon), and Indian Creek and Wildhorse River (Idaho) basins.)	1. Indian Creek (Idaho) 2. Bear Creek 3. Crooked River 4. Upper Pine Creek (including West Fork Pine Creek, Middle Fork Pine Creek, and East Fork Pine Creek) 5. Clear Creek (including Trail Creek and Meadow Creek) 6. East Pine Creek 7. Elk Creek (including Aspen Creek, Big Elk Creek, and Cabin Creek)	Lake Fork Creek Duck Creek
Powder River (Includes the Powder River basin downstream to the confluence with Brownlee Reservoir)	1. Lake Creek 2. Upper Powder River (Silver Creek and Little Cracker Creek) 3. Rock Creek[2] 4. Big Muddy Creek[2] 5. Salmon Creek 6. Pine Creek 7. North Powder River 8. Anthony Creek (including North Anthony Creek) 9. Indian Creek (Oregon) 10. Wolf Creek	Eagle Creek

[1] Potential spawning and rearing habitat are areas that are presently unoccupied, but may be able to provide spawning and rearing habitat for bull trout. Listed streams are based on discussions with the Recovery Unit Team.
[2] Rock Creek and Big Muddy Creek may form a single local population if connectivity is established in the future.

- Maintain stable or increasing trends in bull trout abundance.

- Restore and maintain suitable habitat conditions for all life history stages and forms.

- Conserve genetic diversity and provide opportunity for genetic exchange.

The current and recovered status of bull trout in the recovery unit were evaluated based on four population elements. These elements were derived from the best scientific information available concerning bull trout population dynamics and habitat requirements (Rieman and McIntyre 1993; Rieman and Allendorf 2001). The four elements were: 1) number of local populations, 2) adult abundance (defined as the number of spawning fish present in a core area in a given year), 3) productivity, or the reproductive rate of the population (as measured by population trend and variability), and 4) connectivity (as represented by the migratory life history form and functional habitat). For each element, the Hells Canyon Complex Recovery Unit Team classified bull trout into relative risk categories based on the best available data and the professional judgment of the team.

This approach to developing recovery criteria acknowledges that the status of populations in some core areas may remain short of ideals described by conservation biology theory. Some core areas may be limited by natural attributes or by patch size and may always remain at a relatively high risk of extinction. Because of limited data within the Hells Canyon Complex Recovery Unit, the recovery unit team relied heavily on the professional judgment of its members.

Local Populations. Metapopulation theory is an important consideration in bull trout recovery. A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meffe and Carroll 1994) (see Chapter 1). Multiple local populations distributed and interconnected throughout a watershed provide a mechanism for spreading risk from stochastic events. In part, distribution of local populations in such a manner is an indicator of a functioning core area. Based in part on guidance from Rieman and McIntyre (1993), bull trout core areas

with fewer than 5 local populations are at increased risk; core areas with between 5 and 10 local populations are at intermediate risk; and core areas with more than 10 interconnected local populations are at diminished risk.

Currently the Pine-Indian-Wildhorse Core Area has seven local populations including: Indian Creek, Bear Creek, Crooked River, upper Pine Creek (including West Fork Pine Creek, Middle Fork Pine Creek, and East Fork Pine Creek), Clear Creek (including Trail Creek and Meadow Creek), East Pine Creek, and Elk Creek (including Aspen Creek, Big Elk Creek, and Cabin Creek). Based on this information, the Pine-Indian-Wildhorse Core Area is considered at intermediate risk from stochastic events. The Powder River Core Area currently contains 10 local populations including: upper Powder River (Silver Creek and Little Cracker Creek), Lake Creek, Pine Creek, Salmon Creek, Rock Creek, Big Muddy Creek, North Powder River, Anthony Creek (including North Fork Anthony Creek), Indian Creek, Wolf Creek and is also considered at intermediate risk.

Adult Abundance. The recovered abundance levels in the Hells Canyon Complex Recovery Unit were determined by considering theoretical estimates of effective population size, historical census information, and the professional judgment of recovery team members. In general, effective population size is a theoretical concept that allows us to predict potential future losses of genetic variation within a population due to small population sizes and genetic drift (see Chapter 1). For the purpose of recovery planning, effective population size is the number of adult bull trout that successfully spawn annually. Based on standardized theoretical equations (Crow and Kimura 1970), guidelines have been established for maintaining minimum effective population sizes for conservation purposes. Effective population sizes of greater than 50 adults are necessary to prevent inbreeding depression and a potential decrease in viability or reproductive fitness of a population (Franklin 1980). To minimize the loss of genetic variation due to genetic drift and to maintain constant genetic variance within a population, an effective population size of at least 500 is recommended (Franklin 1980; Soule 1980; Lande 1988). Effective population sizes required to maintain long-term genetic variation that can serve as a reservoir for future adaptations in response to

natural selection and changing environmental conditions are discussed in Chapter 1 of the recovery plan.

For bull trout, Rieman and Allendorf (2001) estimated that a minimum number of 50 to 100 spawners per year was needed to minimize potential inbreeding effects within local populations. Furthermore, a population size between 500 and 1,000 adults in a core area is needed to minimize the deleterious effects of genetic variation due to drift.

For the purposes of bull trout recovery planning, abundance levels were conservatively evaluated at the local population and core area levels. Local populations containing fewer than 100 spawning adults per year were classified as at risk from inbreeding depression. Bull trout core areas containing fewer than 1,000 spawning adults per year were classified as at risk from genetic drift.

Accurate adult abundance estimates for bull trout in the recovery unit were not available, and consequently, local populations could not be evaluated relative to the risk of inbreeding. However, given that current local populations exist at low abundance levels, the Recovery Team recommends that genetic risks from inbreeding be monitored closely. The Hells Canyon Complex Recovery Unit Team currently estimates that each core area (Pine-Indian-Wildhorse and Powder River) currently contains less that 500 adult fish per year. Based on the aforementioned guidance, these core areas are currently at risk from genetic drift.

Productivity. A stable or increasing population is a key criterion for recovery under the requirements of the Endangered Species Act. Measures of the trend of a population (the tendency to increase, decrease, or remain stable) include population growth rate or productivity. Estimates of population growth rate (*i.e.* productivity over the entire life cycle) that indicate a population is consistently failing to replace itself also indicate an increased extinction risk. Therefore, the reproductive rate should indicate the population is replacing itself, or growing.

Since estimates of the total population size are rarely available, the productivity or population growth rate is usually estimated from temporal trends in indices of abundance at a particular life stage. For example, redd counts are often used as an index of a spawning adult population. The direction and magnitude of a trend in the index can be used as a surrogate for the growth rate of the entire population. For instance, a downward trend in an abundance indicator may signal the need for increased protection, regardless of the actual size of the population. A population that is below recovered abundance levels, but that is moving toward recovery, would be expected to exhibit an increasing trend in the indicator.

The population growth rate is an indicator of probability of extinction. This probability cannot be measured directly, but it can be estimated as the consequence of the population growth rate and the variability in that rate. For a population to be considered viable, its natural productivity should be sufficient for the population to replace itself from generation to generation. Evaluations of population status will also have to take into account uncertainty in estimates of population growth rate or productivity. For a population to contribute to recovery, its growth rate must indicate that the population is stable or increasing for a period of time.

Connectivity. The presence of the migratory life history form within the Hells Canyon Complex Recovery Unit was used as an indicator of the functional connectivity of the recovery unit. If the migratory life form was absent, or if the migratory form is present but local populations lack connectivity, the core area was considered to be at increased risk. If the migratory life form persists in at least some local populations, with partial ability to connect with other local populations, the core area was judged to be at intermediate risk. Finally, if the migratory life form was present in all or nearly all local populations, and had the ability to connect with other local populations, the core area was considered to be at diminished risk. Currently, in both core areas the migratory life form persists in at least some local populations with partial ability to connect with other local populations, and as such are considered to be at intermediate risk.

Recovery Criteria

Recovery criteria for bull trout in the Hells Canyon Complex Recovery Unit are the following:

5. **Maintain current distribution of bull trout in the 17 local populations identified, and expand distribution by establishing bull trout local populations in 3 areas identified as potential spawning and rearing habitat**. The number of existing local populations and areas identified as containing potential spawning and rearing habitat by core area are: Pine-Indian-Wildhorse Core Area, 7 existing local populations and 2 areas with potential spawning and rearing habitat; and Powder River Core Area, 10 existing local populations and 1 area with potential spawning and rearing habitat (Table 6). Achieving criterion 1 entails: (1) maintaining existing local populations; (2) implementing activities intended to evaluate the feasibility of establishing additional bull trout local populations in potential spawning and rearing habitat, and (3) encouraging the establishment of additional bull trout local populations in potential spawning and rearing habitat in both core areas of the recovery unit (*e.g.*, by implementing recovery tasks to provide accesses to the areas and restoring habitat). Establishing additional local populations will contribute to achieving criteria 2 and 3, and increase the likelihood of achieving the recovery goal for the Hells Canyon Complex Recovery Unit.

6. **Estimated abundance of adult bull trout is at least 5,000 individuals in the Hells Canyon Complex Recovery Unit.** The recovered abundance of adult bull trout for the recovery unit was estimated based on professional judgement of the Recovery Unit Team in consideration of surveyed fish densities, habitats, and potential fish production after threats have been addressed to allow expansion of distribution within existing local populations and establishment of additional local populations in the three areas with potential spawning and rearing habitat. The recovered abundance of adult bull trout should be evenly distributed between the two core areas and would protect the core area from the deleterious effects of genetic drift.

7. **Adult bull trout exhibit a stable or increasing trend for at least two generations at or above the recovered abundance level within the Pine-Indian-Wildhorse and Powder River core areas**. The development of a standardized monitoring and evaluation program which would accurately describe trends in bull trout abundance is identified as a priority research need. As part of the overall recovery effort, the U.S. Fish and Wildlife Service will take the lead in addressing this research need by forming a multi-agency technical team to develop protocols to evaluate trends in bull trout populations.

4. **Specific barriers inhibiting bull trout movement in the Hells Canyon Complex Recovery Unit have been addressed.** Many barriers to bull trout movement and migration exist within the recovery unit, and this recovery plan recommends several tasks to identify, assess, and reduce barriers to bull trout passage. Although achieving criteria 1 through 3 is expected to depend on providing passage at barriers (including barriers due to physical obstructions, unsuitable habitat, and water quality) throughout the recovery unit, the intent of criterion 4 is to note specific barriers to address or tasks that must be performed to achieve recovery (*i.e.*, barriers evaluated and appropriately addressed if found to be feasible). Specific barriers to address that are required to achieve this criterion are Oxbow Dam in the Pine-Indian-Wildhorse Core Area, and Thief Valley Dam, Mason Dam, and Wolf Creek Dam in the Powder River Core Area (see task 1.2.4). Achieving criterion 4 also entails implementing additional tasks addressing barriers created by such factors as irrigation diversions, stream dewatering, and road crossings (*i.e.*, tasks 1.2.2, 1.2.3, and 1.2.6) sufficiently to achieve criteria 1 through 3. Tasks intended to assess the feasibility of providing passage should be conducted with coordinated review during implementation with the U.S. Fish and Wildlife Service.

Recovery criteria for the Hells Canyon Complex Recovery Unit were established to assess whether recovery actions are resulting in the recovery of bull trout. The Hells Canyon Complex Recovery Unit Team expects that the recovery process will be dynamic and will be refined as more information becomes available. While removal of

bull trout as a species under the Endangered Species Act (*i.e.*, delisting) can only occur for the entity that was listed (Columbia River Distinct Population Segment), the criteria listed above will be used to determine when the Hells Canyon Complex Recovery Unit is fully contributing to recovery of the population segment.

Artificial Propagation

The Hells Canyon Complex Recovery Unit Team has identified that reaching a recovered condition within 25 years could require the use of artificial propagation. Artificial propagation could involve the transfer of bull trout into unoccupied habitat within the historic range (ODFW 1997). In addition, artificial propagation could involve the use of Federal or state hatcheries to assist in recovery efforts (MBTSG 1996). The Hells Canyon Complex Recovery Team recommends that studies be initiated to determine the effectiveness and feasibility of using artificial propagation in bull trout recovery.

Any artificial propagation program instituted in the Hells Canyon Complex Recovery Unit must follow the joint policy of the Fish and Wildlife Service and the National Marine Fisheries Service regarding controlled propagation of listed species (65 FR 56916). The overall guidance of the policy is that every effort should be made to recover a species in the wild before implementing a controlled propagation program. If necessary, an appropriate plan would need to be approved that considers the effects of transplantation on other species as well as the donor bull trout populations. Transplanting listed species must be authorized by the U.S. Fish and Wildlife Service and meet applicable State fish-handling and disease policies.

While artificial propagation has played an important role in the recovery of other listed fish species, where possible, the overall recovery strategy for bull trout in the Hells Canyon Complex Recovery Unit will emphasize the removal of threats and habitat restoration. Recovery should emphasize identifying and correcting threats affecting bull trout and bull trout habitats. Artificial propagation programs should not be implemented unless reasons for decline have been addressed.

ACTIONS NEEDED

Recovery Measures Narrative

In this chapter and all other chapters of the bull trout recovery plan, the recovery measures narrative consists of a hierarchical listing of actions that follows a standard template. The first-tier entries are identical in all chapters and represent general recovery tasks under which specific (*e.g.*, third-tier) tasks appear when appropriate. Second-tier entries also represent general recovery tasks under which specific tasks appear. Second-tier tasks that do not include specific third-tier actions are usually programmatic activities that are applicable across the species' range; they appear in *italic type*. These tasks may or may not have third-tier tasks associated with them; see Chapter 1 for more explanation. Some second-tier tasks may not be sufficiently developed to apply to the recovery unit at this time; they appear in *a shaded italic type (as seen here)*. These tasks are included to preserve consistency in numbering tasks among recovery unit chapters and intended to assist in generating information during the comment period for the draft recovery plan, a period when additional tasks may be developed. Third-tier entries are tasks specific to the Hells Canyon Complex Recovery Unit. They appear in the implementation schedule that follows this section and are identified by three numerals separated by periods.

The Hells Canyon Complex Recovery Unit Chapter should be updated or revised as recovery tasks are accomplished, environmental conditions change, or monitoring results or other new information becomes available. Revisions to the Hells Canyon Complex Recovery Unit Chapter will likely focus on priority streams or stream segments within core areas where restoration activities occurred, and habitat or bull trout populations have shown a positive response. The Hells Canyon Complex Recovery Unit Team should meet annually to review annual monitoring reports and summaries, and make recommendations to the U.S. Fish and Wildlife Service.

1 Protect, restore, and maintain suitable habitat conditions for bull trout.

1.1 Maintain or improve water quality in bull trout core areas or potential core habitat.

1.1.1 Reduce sediment production from roads and other sources (*e.g.,* mines, over-grazed areas) known to be contributing sediment to streams. Roads and other sources of sediment delivery to streams have been identified in a number of assessments in the Pine-Indian-Wildhorse Core Area and Powder River Core Area (*e.g.,* assessments conducted by the Powder River Basin Watershed Council, U.S. Forest Service, and Southwest Basin Native Fish Watershed Advisory Group). Activities such as removing unnecessary roads, stabilizing road crossings, relocating roads out of sensitive riparian areas, and altering grazing practices should be used to reduce sediment delivery to streams.

1.1.2 Assess sediment production from roads and potential sources in areas that have not been evaluated and implement actions to reduce sediment production if appropriate. Some areas in the Hells Canyon Complex Recovery Unit (*i.e.,* those not addressed in existing assessments) have not been assessed for sediment production. These areas should be assessed and appropriate corrective actions implemented.

1.1.3 Assess mine sites for potential negative effects on bull trout and bull trout habitats and rehabilitate sites determined to be problems. Two abandoned mines (Alaska and Bluejacket mines) cover a relatively large area in the headwaters of Indian Creek, and a recently rehabilitated mine (Copper Coin Mine) also occurs in the basin. These and numerous other historically and currently active mining sites throughout the Hells Canyon Complex may be negatively affecting bull trout through sedimentation, acidic discharge, and toxic discharge originating from tailings and other

waste products. Mining sites should be evaluated and corrected, if necessary.

1.1.4 Assess and attempt to mitigate negative effects of nonpoint sources of pollution on bull trout and bull trout habitats. Many land management practices (*e.g.,* forestry, agriculture, mining, and residential development and urbanization) produce nonpoint sources of pollution potentially affecting bull trout and bull trout habitats (*e.g.,* by negatively affecting water temperature, dissolved oxygen, and pH). The effects of nonpoint sources of pollution should be assessed and mitigated.

1.1.5 Assess the presence of residual concentrations of fish toxicants in sediments. Fish toxicants were used to remove nongame fishes in some areas of the recovery unit. The effects of the practice on bull trout are unknown. However, depending on the chemicals used, residual concentrations may remain in sediments and potentially affect aquatic systems for varying periods of time after application of the chemicals. The presence of the chemicals in sediments should be investigated so that the long-term effects on bull trout can be assessed and remedies developed, if appropriate.

1.2 Identify barriers or sites of entrainment for bull trout and implement tasks to provide passage and eliminate entrainment.

1.2.1 Identify water diversion structures and ditches affecting bull trout and implement actions to reduce negative effects. Numerous water diversions and ditches exist in the Hells Canyon Complex Recovery Unit, notably in the Pine Creek and Powder River basins, as well as some in the Crooked River watershed in the Wildhorse River basin, that have not been evaluated for their effects on bull trout (*e.g.,* as passage barriers and sites of entrainment). Diversions and ditches should be inventoried,

evaluated for effects on bull trout, and actions implemented to prevent negative effects on bull trout.

1.2.2 Provide fish passage at water diversions known to be fish passage barriers. Numerous relatively small water diversion structures are known barriers to bull trout movement. These structures should be removed or appropriate fish passage structures installed on them. Examples of areas where water diversion structures are known to be fish passage barriers include the North Powder River, Powder River, and the Anthony Creek and North Anthony Creek watersheds.

1.2.3 Identify dewatered areas where insufficient stream flow creates passage barriers, and develop and implement actions to provide fish passage. Reduced stream flows from water diversions create fish passage barriers (*e.g.,* through either complete drying of streams or contributing to unsuitable habitat conditions) in numerous areas of the Hells Canyon Complex Recovery Unit, especially in the Powder River basin. These areas should be assessed relative to instream flow needs of bull trout, and opportunities to eliminate passage barriers developed and pursued (*e.g.,* through changes in reservoir operations, and purchase or lease of existing water rights).

1.2.4 Investigate and implement methods to provide two-way fish passage at Oxbow Dam, Thief Valley Dam, Mason Dam, and Wolf Creek Dam. Two-way fish passage is necessary at Oxbow Dam to establish connectivity of bull trout local populations in the Wildhorse River basin with other local populations with the Pine-Indian-Wildhorse Core Area. Passage at the other three dams is necessary to establish connectivity among bull trout local populations in the upper Powder River basin and other areas of

the Powder River basin, as well as to encourage establishing bull trout in the Eagle Creek watershed.

1.2.5 Inventory and assess road crossings to identify fish passage barriers and implement actions to provide passage where appropriate. Although road crossings that inhibit fish passage have been inventoried and assessed in some areas or the Hells Canyon Complex Recovery Unit, especially at culverts, a comprehensive survey has not been conducted in all areas (*e.g.,* public and private lands in the Indian Creek and Wildhorse River basins). A survey should be conducted to identify fish passage barriers at road crossings and develop a program to provide passage where necessary (*e.g.*, through placement of appropriate size and properly functioning culverts).

1.2.6 Provide fish passage at road crossings that have been identified as fish passage barriers. Assessments conducted on State- and County-owned roads and some public lands in the Pine Creek and Powder River basins have identified road crossings that are barriers to fish passage (see specific sites in Fedora (1998) and Mirati (1999)). Actions to provide fish passage at these sites should be implemented.

1.3 Identify impaired stream channel and riparian areas and implement tasks to restore their functions.

1.3.1 Restore shade and canopy cover provided by riparian vegetation along select stream reaches where riparian habitats have been degraded. Various land management activities have degraded riparian habitats by removing vegetation, which has reduced the amount of shade and canopy cover of some stream reaches. Examples of streams where revegetating select reaches would improve both aquatic and riparian habitats to benefit bull trout

include the mainstem Powder River above Haines, North Powder River below Anthony Creek, Pine Valley, Indian Creek (Idaho) and Wildhorse River, as well as mainstem stream reaches that may provide overwintering areas for bull trout. Programs involved in riparian restoration projects include the U.S. Fish and Wildlife Service Partners for Fish and Wildlife, Oregon Department of Fish and Wildlife Restoration and Enhancement Program, and the Natural Resources Conservation Service Conservation Reserve Program.

1.3.2 Reduce degradation of aquatic and riparian habitats caused by livestock grazing. Overgrazing has degraded aquatic and riparian habitats through such activities as removal of riparian vegetation, and increases in sedimentation and stream bank instability. Examples of areas where habitats have been degraded include certain reaches of Pine Creek, Clear Creek, Elk Creek, East Pine Creek, Meadow Creek, Indian Creek (Idaho), Wildhorse River, and all stream reaches in the Pine Creek basin and upper Powder River basin occupied by bull trout. In some areas, actions to reduce negative effects of grazing have been implemented, but only along select reaches. For example, the U.S. Forest Service portion of Meadow Creek has been fenced but the meadow, which is on private land, has not. Recommended actions include proven approaches such as fencing, changes in timing and use of riparian pastures, off-site watering, and salting.

1.3.3 Adjust grazing practices to prevent negative effects on streambanks and riparian areas affecting bull trout habitats. Grazing allotments on the Payette National Forest have established riparian management objectives, which were developed in consultation with the U.S. Fish and Wildlife Service. Practices should be adjusted if annual monitoring of the allotments indicates that objectives are not being achieved. The

Idaho Soil Conservation Commission and Natural Resources Conservation Service can provide private livestock producers with technical assistance for grazing in riparian areas on private lands.

1.3.4 Identify and implement actions to restore stream and riparian habitats that have been degraded. The effects of stream channelization, agricultural and urban development, and mining have degraded habitats by confining and straightening streams, reducing recruitment of large woody debris, and reducing riparian vegetation. Examples of areas affected by channelization for agricultural and urban development include the Powder River Valley and lower reaches of streams along the Elkhorn Mountain front (*e.g.,* Big Muddy Creek, Rock Creek, Pine Creek, and Salmon Creek), and areas affected by mining include Cracker Creek and the Powder River upstream of Phillips Reservoir. Actions should address improving riparian vegetation and recruitment of woody debris in streams, and encouraging the restoration of characteristics of natural stream channels.

1.3.5 Improve degraded aquatic and riparian habitats in the Indian Creek and Wildhorse River watersheds. Habitats in the two basins have been degraded from timber harvest and road construction and maintenance, resulting in relatively moderate to high road densities, especially in bull trout spawning and rearing habitat. Actions to mitigate for the effects of roads and improve habitats include such activities as reducing road density, relocating roads, road closures, and road reconstruction.

1.4 Operate dams to minimize negative effects on bull trout in reservoirs and downstream.

1.4.1 Evaluate effects of reservoir operations on bull trout and implement operational changes to prevent negative effects and benefit bull trout if necessary. Reservoir operations (*e.g.,* water level manipulations, release schedule and method) may affect bull trout and bull trout habitat within a reservoir as well as in downstream areas (*e.g.,* through entrainment, thermal regimes, downstream flows). The effects of reservoir operations on bull trout and bull trout habitat should be evaluated and, if necessary, altered to prevent negative effects and benefit bull trout. Numerous reservoirs exist throughout the Hells Canyon Recovery Unit (*e.g.,* the three Snake River reservoirs of the Hells Canyon Complex, and Thief Valley Reservoir and Phillips Reservoir in the Powder River basin). Regulatory authorities (*e.g.,* Endangered Species Act consultations, Federal Energy Regulatory Commission licenses, and State license) vary with the ownership and uses of the reservoirs.

1.4.2 Reduce levels of dissolved gases in water released from Brownlee Reservoir. Entrainment of gases in water released from some reservoirs result in supersaturated levels of total dissolved gases in water downstream, which can induce gas bubble trauma in fish. High levels of total dissolved gases have been observed in water spilled from Brownlee Reservoir with supersaturated conditions extending downstream in both Oxbow Reservoir and Hells Canyon Reservoir. These gas levels may negatively affect the health of bull trout in the Pine-Indian-Wildhorse Core Area. Operational and structural modifications should be implemented at Brownlee Dam to reduce dissolved gases. In addition, operations at Oxbow Dam and Hells Canyon Dam should be assessed to determine whether they contribute to elevated dissolved gas levels downstream.

1.5 Identify upland conditions negatively affecting bull trout habitats and implement tasks to restore appropriate functions.

1.5.1 Evaluate potential effects of degraded upland areas on stream and riparian habitats and implement actions to restore historic vegetation and processes where appropriate. Some land management practices (*e.g.,* grazing and timber management) have degraded upland areas or produced conditions that have, or have the potential to, negatively affect stream and riparian habitats. These areas should be evaluated and actions to restore historic vegetation and processes (*e.g.,* fire regime) should be implemented to benefit bull trout and bull trout habitat.

2 Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on bull trout.

2.1 Develop, implement, and enforce public and private fish stocking policies to reduce stocking of nonnative fishes that affect bull trout.

2.2 *Evaluate enforcement policies for preventing illegal transport and introduction of nonnative fishes.*

2.3 Provide information to the public about ecosystem impacts of introducing nonnative fishes.

2.4 *Evaluate biological, economic, and social effects of control of nonnative fishes.*

2.5 Implement control of nonnative fishes where found to be feasible and appropriate.

2.5.1 Evaluate the presence of introduced fishes in bull trout core habitat and their potential interactions with bull trout, and develop

and implement a plan to reduce potential negative effects. Several species of fish have been introduced in the Hells Canyon Complex Recovery Unit and may negatively interact with bull trout (*e.g.,* through hybridization, competition, and predation). The distribution of these species throughout the recovery unit and their potential effects on bull trout need to be evaluated so that an action plan to address the effects can be developed and implemented. Higher priority should be placed on investigations of brook trout, hatchery rainbow trout, largemouth bass, and smallmouth bass.

2.6 Develop tasks to reduce negative effects of nonnative taxa on bull trout.

2.6.1 Implement coordinated efforts among resource agencies to remove or suppress brook trout in the Indian Creek and Wildhorse River basins if determined to be feasible. Brook trout are the most common introduced salmonid in the Indian Creek and Wildhorse River watersheds. Bull trout-brook trout hybrids have been observed and are likely negatively affecting bull trout.

3 Establish fisheries management goals and objectives compatible with bull trout recovery, and implement practices to achieve goals.

3.1 Develop and implement State and Tribal native fish management plans integrating adaptive research.

3.1.1 Incorporate bull trout recovery actions into fish and habitat management plans relevant to the Hells Canyon Complex Recovery Unit. Management plans affecting the Hells Canyon Complex Recovery Unit have been developed by various entities (*e.g.,* State and Federal agencies, Tribes, industry groups, and watershed councils). Bull trout recovery should be incorporated into these management plans and assistance in implementing bull

trout recovery strategies requested from all parties involved in the plans.

3.1.2 Coordinate bull trout recovery monitoring with activities conducted under management plans and adaptively integrate the results of research into management plans and programs. Several aspects of the Hells Canyon Complex Recovery Unit (*e.g.,* physical habitat attributes, biological variables, water quality features) are monitored under various management plans. Monitoring activities pertinent to bull trout should be coordinated among plans and incorporate results from research. Examples of plans or programs with monitoring components include U.S. Forest Service management plans and the Oregon Plan for Salmon and Watersheds monitoring program.

3.1.3 Restore the historic prey base for bull trout by reestablishing viable populations of anadromous fish. The Hells Canyon Complex and other dams have eliminated anadromous fish from the recovery unit. Juvenile anadromous fish were likely an important prey source for bull trout in the recovery unit, and their absence has likely reduced the overall productivity of the watersheds upstream of Hells Canyon Dam. Although stocked species may provide a prey source to bull trout, reestablishing viable runs of anadromous fish would increase overall productivity of the recovery unit and increase the prey base available to bull trout. Coordination with task 1.2.4 is required, and passage at Hells Canyon Dam and Brownlee Dam should be addressed.

3.2 Evaluate and prevent overharvest and incidental angling mortality of bull trout.

3.2.1 Develop, implement, and evaluate angling regulations intended to minimize incidental mortality of bull trout. Although harvesting bull trout is prohibited in both the Idaho and Oregon portions of the Hells Canyon Complex Recovery Unit, studies in other areas within the range of bull trout have documented incidental harvest due primarily to anglers' inability to accurately identify bull trout. Regulations using such restrictions as closed areas where bull trout may be susceptible to angling during certain times should be implemented in conjunction with continuing efforts to improve anglers' knowledge of regulations and fish identification (*i.e.,* signs and educational materials). Compliance with these regulations should be evaluated at target areas (*e.g.,* popular access areas where bull trout occur and small, isolated populations), and regulations modified, if appropriate, for improvements.

3.3 Evaluate potential effects of introduced fishes and associated sport fisheries on bull trout recovery and implement tasks to minimize negative effects on bull trout.

3.3.1 Evaluate the effects of fish stocking and the fishery on bull trout in Cracker Creek and Phillips Reservoir. About 8,000 legal-size and 100,000 fingerling rainbow trout are annually planted in Cracker Creek and Phillips Reservoir. Potential effects of stocked rainbow trout and angling for them on bull trout in the Cracker Creek watershed should be assessed and remedied, if necessary. Although bull trout are not presently known to occur in Phillips Reservoir, they may expand their distribution to the reservoir during recovery. The possible influence that stocked rainbow trout and the fishery has on the present and potential distribution of bull trout in the reservoir and upstream should be investigated.

3.4 *Evaluate effects of existing and proposed sport fishing regulations on bull trout.*

4 Characterize, conserve, and monitor genetic diversity and gene flow among local populations of bull trout.

4.1 Incorporate conservation of genetic and phenotypic attributes of bull trout into recovery and management plans.

4.1.1 Collect samples for genetic analysis to contribute to establishing a program to understand the genetic baseline and monitor genetic changes throughout the range of bull trout (see Chapter 1 narrative).

4.2 Maintain existing opportunities for gene flow among bull trout populations.

4.2.1 Prevent the establishment of barriers that may inhibit the movement of bull trout within the Hells Canyon Complex Recovery Unit. Activities that result in structural barriers or unsuitable habitat conditions should be modified or prohibited.

4.3 Develop genetic management plans and guidelines for appropriate use of transplantation and artificial propagation.

4.3.1 Develop protocols for and evaluate the feasibility of reintroducing bull trout into apparent historic or suitable habitat within the Hells Canyon Complex Recovery Unit. Transplanting bull trout in suitable unoccupied habitat may be necessary to achieve recovery at some time in the future. The feasibility of transplanting bull trout within the recovery unit needs to be assessed and appropriate protocols for specific areas need to be developed and evaluated. Protocols should address such issues as monitoring,

criteria for evaluating results, State and Federal guidelines for public process, donor stocks, disease factors, effects on other native species, and genetic concerns. Areas to consider as potential sites for transplanting bull trout include Eagle Creek and Fruit Creek, both in the Powder River basin.

5 Conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site-specific recovery tasks.

5.1 *Design and implement a standardized monitoring program to assess the effectiveness of recovery efforts affecting bull trout and their habitats.*

5.2 Conduct research evaluating relationships among bull trout distribution and abundance, bull trout habitat, and recovery tasks.

5.2.1 Evaluate historic and current conditions of all habitat types in each watershed within the Hells Canyon Recovery Unit. The evaluation will generate information useful for developing additional site-specific recovery tasks. For instance, the evaluation may identify site-specific threats to bull trout in currently occupied and possibly unoccupied areas for which recovery tasks should be developed and implemented. Evaluations have been performed in select portions of the recovery unit (*i.e.,* contained in biological and watershed assessments primarily conducted by natural resource agencies for public lands).

5.2.2 Review findings of continuing studies conducted by Idaho Power Company and others to develop additional recovery tasks for bull trout and other native fishes. As part of Federal Energy Regulatory Commission relicensing efforts, Idaho Power Company is studying fish habitat and populations in the Hell

Canyon Complex reservoirs, key tributaries, and the mainstem Snake River below Hells Canyon Dam. These data, in addition to those generated by resources agencies, should be used to develop and refine recovery tasks in the Hells Canyon Complex Recovery Unit.

5.3 *Conduct evaluations of the adequacy and effectiveness of current and past best management practices in maintaining or achieving habitat conditions conducive to bull trout recovery*.

5.4 Evaluate effects of diseases and parasites on bull trout, and develop and implement strategies to minimize negative effects.

5.5 Develop and conduct research and monitoring studies to improve information concerning the distribution and status of bull trout.

5.5.1 Evaluate the ability of Brownlee Reservoir to provide foraging, migrating, and overwintering habitat for bull trout. Establishing a local population in Eagle Creek is considered essential for recovery of bull trout in the Powder River Core Area; bull trout occurred in Eagle Creek during the past and establishing a local population there would contribute to achieving recovery criteria 2 and 3. Because Eagle Creek is a tributary to the lower Powder River, migratory bull trout that may become established in it could seasonally use Brownlee Reservoir as foraging, migrating, and overwintering habitat. Evaluating the ability of Brownlee Reservoir to provide bull trout habitat is the first step in developing recovery tasks that may lead to increasing the recovery potential of an Eagle Creek local population and the Powder River Core Area.

5.5.2 Conduct a comprehensive survey to evaluate bull trout presence and potentially suitable habitat in the Burnt River basin.

Although bull trout have not been observed in the Burnt River basin, the basin has not been intensively surveyed specifically to investigate the presence of bull trout. Because bull trout occur in basins adjacent to the Burnt River basin and the Burnt River basin historically supported anadromous salmonids, it is plausible that bull trout presently occur or historically occurred in some portions of the basin. Habitat suitable for bull trout may exist in headwater tributaries of the Burnt River. Determining bull trout presence and the potential of the Burnt River basin to support bull trout is a primary research need.

5.5.3 Conduct studies of bull trout distribution, abundance, and life history characteristics in the Wildhorse River watershed and continue studies in the Indian Creek watershed. Bull trout presence in the upper Wildhorse River basin has only recently been documented and appears to be limited to two tributaries, Bear Creek and Crooked River. Bull trout in Indian Creek were thought to consist only of resident fish in the upper portion of the watershed; however, relatively large bull trout leaving the stream were recently collected in a weir in the lower portion of the stream, suggesting that migratory fish may occur in the drainage. Expanding ongoing studies in these basins will improve our understanding of bull trout there and contribute information to developing additional recovery tasks.

5.5.4 Conduct regular surveys in areas where bull trout status is unknown and those identified as having potential spawning and rearing habitat. Insufficient information is available to confidently describe the status (*e.g.,* abundance, distribution) and life history characteristics of bull trout in some areas of the Hells Canyon Complex Recovery Unit. Regular surveys should be conducted in these areas, as well as in areas considered as having potential spawning and rearing habitat, to generate information on

bull trout status and the establishment of additional local populations.

5.5.5 Develop a process to disseminate all information collected within the Hells Canyon Complex Recovery Unit. Several agencies and groups are generating information on various aspects of the recovery unit. A process to provide the information to interested parties is necessary to ensure that the data are distributed in a timely manner to improve coordination. The process should include reviewing and updating databases for bull trout distribution records.

5.6 Identify evaluations needed to improve understanding of relationships among genetic characteristics, phenotypic traits, and local populations of bull trout.

6 Use all available conservation programs and regulations to protect and conserve bull trout and bull trout habitats.

6.1 Use partnerships and collaborative processes to protect, maintain, and restore functioning core areas for bull trout.

6.1.1 Support collaborative efforts by local watershed groups to implement site- specific protection and restoration activities to benefit bull trout. Various local watershed groups occur within the Hells Canyon Complex Recovery Unit and are involved in activities affecting bull trout conservation (*e.g.,* completing watershed assessments and implementing recommendations in assessments). Collaborative approaches (*e.g.,* conservation agreements, habitat conservation plans, easements, land purchases and leases from willing sellers) should be pursued with the groups and landowners to protect and improve bull trout habitat.

6.1.2 Continue cooperative efforts between states and among government agencies to implement recovery actions. The Hells Canyon Complex Recovery Unit occupies portions of both Idaho and Oregon. Agencies in both states should coordinate activities in implementing recovery tasks to improve efficiency (*e.g.,* common data collection methods, evaluation of responses to recovery tasks).

6.1.3 Develop educational materials on bull trout and their habitat needs. Educational materials addressing bull trout habitat and activities affecting it (*e.g.,* watershed form and function, riparian and side channel restoration, large wood placement, marking storm drains in urban areas) would contribute to informing landowners and the public at large about bull trout and recovery tasks.

6.2 *Use existing Federal authorities to conserve and restore bull trout.*

6.3 Evaluate enforcement of existing Federal, State, and Tribal habitat protection standards and regulations and evaluate their effectiveness for bull trout conservation.

7 Assess the implementation of bull trout recovery by recovery units, and revise recovery unit plans based on evaluations.

7.1 Convene annual meetings of each recovery unit team to review progress on recovery plan implementation.

7.1.1 Develop a participation plan to support implementation of recovery tasks in the Hells Canyon Complex Recovery Unit. A plan formalizing the participation of all interested parties in recovery of bull trout in the Hells Canyon Complex Recovery Unit should be developed. The plan should address such issues as

assessing appropriate changes in the recovery plan, task implementation and priority, and treatment of new information.

7.2 Assess effectiveness of recovery efforts.

7.3 *Revise scope of recovery as suggested by new information.*