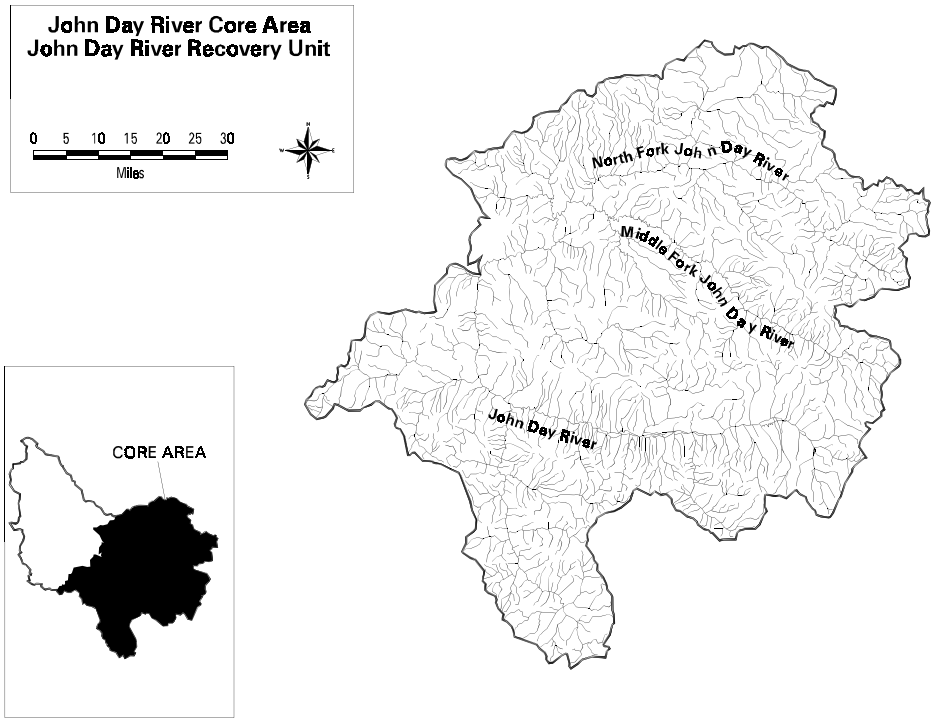
STRATEGY FOR RECOVERY

A core area represents the closest approximation of a biologically functioning unit for bull trout. The combination of core habitat (*i.e.*, habitat that could supply all the necessary elements for the long-term security of bull trout, including for both spawning and rearing, as well as for 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.

For purposes of recovery, the John Day River Recovery Unit contains one core area (John Day River Core Area) encompassing tributaries containing local populations (both current and potential as identified by the recovery unit team) and the foraging, migrating, and overwintering habitat in the mainstem John Day River from headwaters downstream to the confluence with the North Fork John Day River (Figure 2).

Understanding the contributions of the mainstem John Day River downstream of the North Fork confluence was defined as a research need. Migratory bull trout have recently been observed in the lower mainstem John Day River as far as the town of Spray. However, little is known about their use of the lower river and its relative importance to bull trout populations upstream. Additional information may indicate that the core area should extend further downstream. Streams with documented bull trout spawning, by subbasin, are Crane, Baldy, Bull Run, Trail, Middle, and South Trail creeks in the North Fork John Day River; Clear, Big Creek, Deadwood, Granite Boulder creeks in the Middle Fork John Day River; and John Day River, Call, Deardorff, Rail, Reynolds, Roberts creeks.

Figure 2. The map of the John Day River Recovery Unit of the Columbia River basin, Oregon, with the core area delineated.



Recovery Goals and Objectives

The goal of 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's native range, so that the species can be delisted.** To achieve this goal, the following objectives have been identified for bull trout in the John Day River Recovery Unit:

- Maintain current distribution of bull trout and restore distribution in previously occupied areas within the John Day River Recovery Unit.

- Maintain stable or increasing trends in abundance of bull trout.

- Restore and maintain suitable habitat conditions for all bull trout life history stages and strategies.

- Conserve genetic diversity and provide opportunity for genetic exchange.

Rieman and McIntyre (1993) and Rieman and Allendorf (2001) evaluated the bull trout population numbers and habitat thresholds necessary for long-term viability of the species. They identified four elements, and the characteristics of those elements, to consider when evaluating the viability of bull trout populations. These four elements are 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 John Day River Recovery Unit Team classified bull trout into relative risk categories based on the best available data and the professional judgment of the team.

The John Day River Recovery Unit Team also evaluated each element under a potential recovered condition to produce recovery criteria. Evaluation of these elements under a recovered condition assumed that actions identified within this chapter had been implemented. Recovery criteria for the John Day River Recovery Unit reflect 1) the stated objectives for the recovery unit, 2) evaluation of each population element in both current and recovered conditions, and 3) consideration of current and recovered habitat characteristics within the recovery unit. Recovery criteria will be revised in the future as more detailed information on bull trout population dynamics becomes available. Given the limited information on bull trout, both the level of adult abundance and the number of local populations needed to lessen the risk of extinction should be viewed as a best estimate.

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 John Day River Recovery Unit, the recovery unit team relied heavily on the professional judgment of its members.

Local Populations. Metapopulation theory is important to consider 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, there are 12 local populations of bull trout in the John Day River Recovery Unit: 1) upper North Fork John Day River (Crawfish, Baldy, Cunningham, Trail, Onion, Crane creeks as well as the North Fork upstream of Granite Creek), 2) upper Granite Creek including Bull Run, Deep, Boundary creeks and the upper mainstem Granite Creek), 3) Boulder Creek, 4) Clear/Lightning creeks including Salmon Creek, 5) Clear Creek below ditch (including Lightning Creek below ditch), 6) Desolation Creek (includes South Fork Desolation Creek below falls and North Fork Desolation Creek), 7) South Fork Desolation Creek above the falls, 8) Clear Creek, 9) Granite Boulder Creek, 10) Big Creek, 11) upper John Day River (including Deardorff Creek, Reynolds Creek, Rail Creek, Roberts Creek, and Call Creek), and 12) Indian Creek above the flow barrier. Based on the aforementioned guidance, bull trout in the John Day River Recovery Unit are considered at diminished risk.

Adult Abundance. The recovered abundance levels in the John Day River 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 is needed to minimize potential inbreeding effects within local populations. In addition, a population size of between 500 and 1,000 adults in a core area is needed to minimize the deleterious effects of genetic variation from 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.

Overall, bull trout in the John Day River Recovery Unit persist at low abundance. While both the migratory and resident life history forms persist in the core area, only the migratory form was evaluated relative to aforementioned effective population size guidance. Comprehensive adult population estimates for the John Day River Recovery Unit are not available during the preparation of this draft. Given the lack of specific information, the John Day River Recovery Unit Team assumed that abundance levels for migratory bull trout in individual local populations was below 100 spawners per year, and therefore are at risk of inbreeding depression. Similarly, the John Day River Recovery Unit Team concluded that the

core area currently supported less than 1,000 migratory adults per year and consequently was 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, indicate 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 which is below recovered abundance levels but moving toward recovery would be expected to exhibit an increasing trend in the indicator.

The population growth rate is an indicator of extinction probability. The probability of going extinct cannot be measured directly; it can, however, 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 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. In the John Day River Recovery Unit, bull trout were classified at an increased risk, due to either the short duration of population census information, or the incomplete record of the redd count surveys within each core area.

Connectivity. The presence of the migratory life history form within the John Day River Recovery Unit was used as an indicator of the functional connectivity of the system. If the migratory life form was absent from core area, 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. While the migratory form persists within the John Day River core area, local populations are fragmented by habitat degradation, and the core area is considered at increased risk.

Recovery Criteria

Recovery criteria for the John Day River Recovery Unit are the following:

1. **Bull Trout are distributed among 12 or more local populations in the John Day River Recovery Unit.** The team identified 12 current and 12 potential local bull trout populations in the John Day River Recovery Unit (Table 2). This recovery criterion recognizes the uncertainty in clearly defining local populations and the possibility that some local populations isolated by human-caused barriers may, in a recovered state, become part of another local population (*e.g.,* Boulder Creek in the Granite Creek Watershed). In addition, there is potential to further refine the local populations within the several identified population complexes in the recovery unit, if additional information indicates the need to do so. Better understanding of bull trout movement patterns in the drainage is needed to more accurately define local populations in the recovery unit. There is also a potential need to expand into historic habitat and establish new local populations.

Table 2. List of current and potential local bull trout populations in the John Day River Recovery Unit.

Subbasin	Local Population	Life History Forms Present
North Fork John Day River	Upper North Fork John Day River (includes Crawfish, Baldy, Cunningham,Trail, Onion and Crane creeks, as well as mainstem North Fork John Day River upstream of Granite Creek)	Fluvial and Resident
	upper Granite (includes Bull Run, Deep and Boundary creeks, and upper mainstem Granite Creek)	Fluvial and Resident
	Boulder Creek in Granite Creek subwatershed	Resident
	Clear/Lightning creeks above the ditch (includes Salmon Creek)	Resident
	Clear Creek below the ditch (includes Lightning Creek below ditch)	Resident
	Desolation Creek (includes South Fork Desolation Creek below waterfall and North Fork Desolation Creek)	Fluvial and Resident
	South Fork Desolation Creek above waterfall	Resident
	Winom Creek above falls (potential)	
	Hidaway Creek (potential)	
	Cable Creek (potential)	
Middle Fork John Day River	Clear Creek	Resident
	Granite Boulder Creek	Resident and Fluvial
	Big Creek and tributaries	Resident and Fluvial
	Vinegar Creek (potential)	
	Big Boulder Creek (potential)	
	Indian Creek (potential)	
	Butte Creek (potential)	
	Davis Creek (potential)	

Table 2. List of current and potential local bull trout populations in the John Day River Recovery Unit.

Subbasin	Local Population	Life History Forms Present
	upper Middle Fork John Day River (mainstem and tributaries above Clear Creek) (potential)	
Upper Mainstem John Day River	upper John Day River (includes mainstem John Day River, and Call, Reynolds, Deardorff, and Rail creeks)	Resident and Fluvial
	Indian Creek above flow barrier	Resident
	Pine Creek (potential)	
	Canyon Creek (potential)	
	Strawberry Creek (potential)	

2. **Estimated abundance of adult bull trout is at least 5,000 individuals distributed within the John Day River Recovery Unit.** Recovered abundance range was derived using the professional judgement of the recovery unit team and estimated productive capacity of identified local populations in a recovered condition. The estimate includes resident fish where connectivity between populations exists or could be restored. Population estimates have not been made for local populations isolated above natural barriers, although partial (one-way) connectivity may exist. Population estimates may be refined as more information becomes available, through monitoring and research. Increased abundance in the recovery unit is expected to occur by securing and expanding seasonal distribution of current local populations and expanding or restoring local populations into historic habitat.

3. **Adult bull trout exhibit stable or increasing trends in abundance over a period of at least 10 years in the recovery unit, as determine through contemporary and accepted abundance trend data analyses.** Developing a standardized monitoring and evaluation program to accurately describe trends in bull trout abundance is identified as a priority research need. As

4. 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 necessary to evaluate trends in bull trout populations.

4. **Specific barriers inhibiting recovery as listed in this recovery unit chapter must be addressed.** Functional migration corridors for bull trout between the North Fork John Day River and the mainstem John Day River, and between the North Fork John Day River and the Middle Fork John Day River must be established and the following priority one barriers must be addressed: restoring flow in Boulder Creek (tributary to Granite Creek - North Fork John Day River) and Indian Creek (mainstem John Day River, connected seasonally), assessing connectivity between West Fork, Clear, Salmon, Lightning, and the Mainstem of Clear Creek (North Fork John Day River), and addressing barriers associated with roads, (*e.g.,* culverts barriers or roads without culverts).

Recovery criteria for the John Day River Recovery Unit were established to assess whether recovery actions have resulted in the recovery of bull trout. The John Day River 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 John Day River Recovery Unit is fully contributing to recovery of the population segment.

Research Needs

Based on the best scientific information available, the recovery unit team has identified recovery criteria and actions necessary for recovery of bull trout within the John Day River Recovery Unit. However, the recovery unit team recognizes that many uncertainties exist regarding bull trout population abundance, distribution, and recovery actions needed. The recovery unit team feels that if effective management and recovery are to occur, the recovery plan for the John Day River Recovery Unit should be viewed as a "living" document, to be updated as

new information becomes available. As part of this adaptive management approach, the John Day River Recovery Unit Team has identified essential research needs within the recovery unit.

Columbia River. There is little information available on the role and importance of the Columbia River mainstem to local bull trout populations in the John Day River basin. Bull trout have now been documented in the mainstem John Day River near the town of Spray, Oregon, providing an indication that seasonal migration to the Columbia River may have been an important life history component in the past, when river conditions were more conducive to successful migration. As recovery proceeds, it is important to research the dynamics between the health of local populations and their pattern of use of the mainstem Columbia River.

Mainstem John Day River. It is essential to establish with greater certainty the current bull trout distribution and seasonal use areas within the John Day River Recovery Unit. To this end, the Recovery Unit Team recommends the development and application of a scientifically accepted, statistically rigorous, standardized protocol for determining present distribution of bull trout. Application of such a protocol will improve the team's ability to identify additional core areas, or revise the current classification.

Isolated tributaries, or other sites where anecdotal reports of bull trout capture have occurred, should be targeted to clarify bull trout distribution within the recovery unit. These areas include, but are not limited to Winom Creek, Phipps Creek, Hidaway and Cable creeks in the Camas Creek drainage.

Resident/Migratory Relationship. Many areas in the John Day River basin have both resident and migratory local populations. The relationships between these two life history types is not known. For instance, there is uncertainty whether migratory fish can produce resident progeny, and vice versa; what proportion of progeny switch life history types; whether adults can switch from resident to

migratory lifestyles; and whether environmental factors determine the proportion and extent of life history type. Since, in general, the migratory life history type is more robust to environmental and biological challenges, these relationships become very important to bull trout recovery.

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 John Day River Recovery Unit. They appear in the implementation schedule that follows this section and are identified by three numerals separated by periods.

The John Day River Recovery Unit Chapter should be updated or revised as recovery tasks are accomplished, environmental conditions change, or monitoring results or other new information become available. Revisions to the John Day River 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 John Day River 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 inputs. Stabilize roads, crossings, and other sources of sediment delivery; remove and vegetatively restore unneeded roads. For example, the Galena and upper Middle Fork Watershed Assessments identify some specific problem roads.

1.1.2 Control agricultural and sewage effluent (nutrients and chemicals). Site-specific sewage problems were identified at the town of Prairie City. Agricultural effluent is a localized problem throughout the basin.

1.1.3 Assess and mitigate effects of nonpoint source pollution. Major mainstem and tributaries across the entire John Day River basin are identified as water quality limited, primarily for high summer temperature. This condition is a result of the widespread and cumulative impact from a variety of nonpoint sources, such as, road building, timber harvest, present and past livestock grazing, and present and past mining impacts.

1.1.4 Reduce mining runoff. Remove sources and/or stabilize effluent from mine shafts in the Granite/Clear Creek system (upper North Fork John Day River). Require and evaluate mitigation for mining activities.

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

1.2.1 Screen water diversions and irrigation ditches. For example, address problems with an old fish screen on Indian Creek (upper

mainstem John Day River) at the Strawberry Wilderness Area boundary.

1.2.2 Install appropriate fish passage structures around diversions and/or remove related migration barriers. Ensure all diversions are "fish friendly" including combining diversions, converting to a pump/infiltration gallery, and installing adjustable headgates, water measuring devices, and efficient ditches (low flow loss via seepage or breaching). Maintain and monitor the improved fish passage structures.

1.2.3 Secure instream flows. Restore connectivity and opportunities for migration by securing instream flows and/or water rights. Priority areas include Pete Mann ditch, which intercepts Lightning Creek, upper Clear Creek flows; reduce winter stock water runs, etc.

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

1.3.1 Revegetate to restore shade and canopy, riparian cover, and native vegetation. Priority sites include Cable, Oriental and Hidaway creeks within the Tower Fire area; South Fork Desolation Creek within the Summit Fire Area; migratory habitat on Federal and private lands of the middle fork and private checkerboard lands in the upper mainstem; private land along the upper mainstem between the headwaters and town of John Day; and portions of the North Fork John Day River watershed. Plant (conifers, hardwoods, shrubs) in riparian zone of areas burned in the 1996 Tower, Summit and Bull fires.

1.3.2 Reduce grazing impacts. Fencing, changes in timing and use of riparian pastures, off site watering and salting, and other

measures can be used to minimize grazing impacts. Priority sites include Reynold Creek allotment in upper mainstem and Sullens in the upper Middle Fork John Day River, Camp Creek and Bear Creek allotments are Federal allotments in the Middle Fork John Day River that have some riparian habitat problems. North Fork John Day River lands (Prineville Bureau of Land Management on lower North Fork John Day River) have poor woody riparian component and problems with unauthorized use. Migratory habitat on Federal and private lands of the Middle Fork is degraded from livestock grazing. This task will depend, in part on findings from implementing 5.2.1, but in addition, should consider lower Camas and Owens creeks.

1.3.3 Conduct stream channel restoration activities where warranted and cost-effective. Continue redistribution of dredge tailing piles in parts of the North Fork John Day River and the Clear Creek system to restore a more natural stream channel morphology and flood plain access for the stream. Restore stream channel to eliminate head cuts in Desolation Meadow (North Fork Desolation Creek) and Owens Creek.

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

1.4.1 Integrate watershed analyses and restoration activities on public lands. A potential way to integrate identified activities is through the Northwest Power Planning Council's subbasin planning process.

1.4.2 Assess current and historic effects of upland management on changes to the hydrograph. For example, timing and magnitude of peak flows. Priority areas include: the public/private checkerboard lands in the upper mainstem John Day River;

private ranches along upper mainstem John Day River between the checkerboard and the town of John Day, and the Malheur National Forest's historically heavy timber harvest activities in the Middle Fork John Day River subbasin.

1.4.3 Plant site appropriate vegetation in the Tower, Summit, and Bull fire areas, focusing on nearby existing seed sources to speed natural recovery.

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

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

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

2.3 Provide public information about ecosystem concerns of illegal introductions of 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 presence/absence of introduced fishes in bull trout habitat and determine site specific biological, economic, and social impacts. For example, brook trout in Desolation Creek; North Fork John Day River, and upper mainstem John Day River; smallmouth bass in the lower mainstem John Day River.

2.5.2 Assess severity of threat due to hybridization with brook trout where the two species co-occur in the North Fork John Day River and upper mainstem John Day River.

2.5.3 Implement nonnative species removal efforts wherever feasible and biologically supportable. Investigate the feasibility of removing brook trout from the Desolation Creek system, where the population is still relatively small. Consider Big, Winom, Cable, and Hideaway creeks for brook trout reduction via liberal harvest regulations.

2.6 Develop tasks to reduce negative effects of nonnative taxa on 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 Integrate multiple planning processes, incorporating bull trout recovery actions into *The Oregon Plan for Salmon and Watersheds* and the Pacific Northwest Power Planning Council Subbasin plans. Request assistance with implementation of recovery strategies for bull trout through both planning processes.

3.1.2 Coordinate monitoring with Oregon Salmon Plan. Coordinate bull trout recovery monitoring with the *Oregon Plan for Salmon and Watersheds* monitoring program.

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

3.2.1 Ensure compliance with angling regulations and policies and target problem areas for enforcement. Unauthorized harvest associated with hunting season activities near the North Fork Wilderness, for example.

3.2.2 Reduce angler pressure in key areas where incidental mortality is evaluated as detrimental to recovery. In areas with documented problems, use techniques to limit access (such as seasonal or permanent road restrictions) and consider establishment of conservative regulations for other fisheries whose popularity may result in increased bull trout bycatch.

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.

3.4 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.

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

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

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 Further define bull trout distribution and habitat use in the John Day River Recovery Unit. For example, identify existing spawning habitat for bull trout populations in Desolation Creek (North Fork John Day River) and tributaries, South Fork Desolation, and upper Clear Creek and tributaries (Middle Fork John Day River), and determine movement of fluvial bull trout in the Middle Fork John Day River.

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 Conduct bull trout spawning ground surveys in Desolation and Clear creeks. See task #5.2.1. Document historic distribution and design and implement monitoring program.

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

5.6.1 Evaluate food web interactions in drainages most affected by introduced fishes, such as the North Fork John Day River and upper mainstem John Day River.

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 Provide long-term habitat protection through purchase from willing sellers, conservation easements, management plans, land exchanges, etc. Potential candidates include lower Desolation Creek; the privately-held Crown Pacific "Checkerboard Lands" of the upper mainstem John Day River; and the four or five remaining privately-held parcels in the Middle Fork John Day River corridor above Big Creek. Recovery tasks should emphasize private lands. Federal land management should already be protective of the majority of resident spawning habitat

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

6.3 Evaluate enforcement of existing Federal and State 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 generate progress reports on implementation of the recovery plan for the U. S. Fish and Wildlife Service.

7.2 Develop and implement a standardized monitoring program to evaluate the effectiveness of recovery efforts.

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