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. One core area was defined for the Willamette Recovery Unit: the Upper Willamette River core area. The Clackamas River is considered to represent core habitat because it currently does not contain any known local populations. The Santiam River basin may represent core habitat, but further analysis is needed to assess current habitat conditions.

To recover bull trout in the Willamette River Recovery Unit, securing the existing local populations in the McKenzie River and augmenting populations in the Middle Fork Willamette River will be necessary. As these populations become more secure, they are expected to expand their seasonal distribution farther into the mainstem Willamette River for foraging, migrating, and overwintering. As passage issues are resolved, migratory access may become possible between the Middle Fork Willamette and McKenzie Rivers.

Clackamas River Core Habitat. The Clackamas River basin has been identified as a potential area for reintroducing bull trout. Reestablishing bull trout in the Clackamas River core habitat will improve the long-term outlook for bull trout recovery in the Willamette Recovery Unit. As noted earlier, the two known spawning streams in the mainstem McKenzie River are very near one another, so another core area in the Clackamas River basin—one that is farther from the other two—would help safeguard bull trout persistence in the Willamette Recovery Unit by spreading potential extinction risks.

The Role of Artificial Propagation and Transplantation

As described in Chapter 1, section 3(3) of the Endangered Species Act lists artificial propagation and transplantation (or reintroduction) as methods that may be used for the conservation of listed species. While transplantation has played an important role in the recovery of other listed fish species, the overall recovery strategy for bull trout in the Willamette Recovery Unit, where possible, will emphasize identifying and correcting threats affecting bull trout and bull trout habitats. If transplantation is determined to be necessary for bull trout recovery within the Willamette Recovery Unit and if a feasibility study identifies streams capable of supporting bull trout, the joint policy of the U.S. Fish and Wildlife Service and the National Marine Fisheries Service regarding controlled propagation of listed species will be followed (65 FR 56916). Also, an appropriate plan would need to be approved to consider the effects of transplantation on other species, as well as on the donor bull trout populations. Transplanting listed species must be authorized by the U.S. Fish and Wildlife Service through a 10(a)(1)(A) recovery permit, and methods must meet applicable State fish-handling and disease policies.

In streams within the Clackamas River core habitat and the Santiam River basin, bull trout may or may not be present in habitat that historically contained reproducing populations. These streams are considered candidate locations for transplantation activities.

Though every effort should be made to recover a species in the wild before implementing transplantation, in the Clackamas River core habitat and the Santiam River basin, natural recolonization may not be a viable solution to enhance the existing abundance and distribution of bull trout. While bull trout may respond to habitat improvements in occupied and unoccupied streams, successful recovery will probably require a transplantation program.

Recent behavioral and genetic studies of bull trout support artificial propagation programs. These studies report that bull trout exhibit a high degree of fidelity to natal streams (James *et al.*, *in litt*., 1998; Spruell *et al.* 2000;

Hvenegaard and Thera 2001). Strong fidelity for natal streams does not mean that fish movement between adjacent populations or adjacent basins does not occur, but such fidelity may mean that gene flow and colonization or recolonization of unoccupied habitat may take more than several generations. Therefore, to achieve recovery in the time frame that is specified in Chapter 1 and in this Willamette Recovery Unit chapter, some form of reintroduction may be necessary. If the current Willamette River bull trout populations have been isolated and functioning at low abundance for a long period of time, such a program may be necessary to immediately increase the number of individual fish in the core area and to infuse new genetic material into existing populations to avoid loss of alleles and heterozygosity (Spruell *et al*. 1999). Before implementation of any reintroduction program, a feasibility study would be completed to identify streams with the greatest potential to support local populations of bull trout and to identify the best available source of genetic material.

The Willamette Recovery Unit Team recommends the following: (1) identify and correct threats in the upper Middle Fork Willamette River, the Clackamas River core habitat, and the Santiam River basin, if these areas are determined to contain adequate bull trout habitat, to increase bull trout densities and to allow natural population expansion to occur within streams that have evidence of recruitment; (2) consider a reintroduction program within the Upper Willamette River core area and the Clackamas River core habitat if a feasibility study indicates that this option is the best option for recovery; and (3) recognize that, even if threats are identified and corrected in the Upper Willamette River core area and the Clackamas River core habitat, natural recolonization of bull trout in streams that once supported a local population may take an extended amount of time. In this case, supplementation or transplantation may be the best option. For this option, a feasibility study would need to be completed to identify streams with the greatest potential to support local populations. Supplementation or transplantation would then occur concurrently with other restoration and recovery activities

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' native range so that the species can be delisted.** To achieve this goal, the following objectives have been identified for the Willamette Recovery Unit:

- Maintain current distribution of bull trout within the Willamette Recovery Unit and reestablish bull trout in previously occupied habitats.

- Maintain stable or increasing trends in abundance of bull trout in the Willamette Recovery Unit.

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

- Conserve genetically diverse populations of bull trout populations within the Willamette Recovery Unit.

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 Willamette Recovery Unit Team classified bull trout into relative risk categories based on the best available data and the professional judgment of the team.

The Willamette 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 Willamette 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 probably 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 Willamette 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. For the upper Willamette River core area, there are currently 3 known local populations. Based on the above guidance, bull trout in the Upper Willamette River core area is at an increasing risk category.

Adult Abundance. The recovered abundance levels in the Willamette 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.

Adult abundance in the upper Willamette River core area was estimated at 300 adult spawners per year in the three known local populations. Based on

the aforementioned abundance guidance, bull trout in the upper Willamette River core area were considered at increasing risk of inbreeding depression.

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 risk of extinction. Therefore, the reproductive rate should indicate that 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.

Based on the depressed and probably declining population trend and the loss of range within the Willamette River basin, bull trout in the Upper Willamette River core area are considered to be at intermediate risk due to an apparent population trend that is not declining and that has low to moderate annual variability (based on five years of data).

Connectivity. The presence of the migratory life history form within the Willamette 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 was present but local populations lacked connectivity, the core area was considered to be at increased risk. If the migratory life form persisted 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. Or, 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.

Migratory bull trout may persist in some local populations in the Upper Willamette River core area and are, therefore, considered to be at an intermediate risk.

Recovery Criteria

Recovery criteria for bull trout in the Willamette Recovery Unit are the following:

1. **Distribution criteria will be met when bull trout are distributed among five or more local populations in the recovery unit: four in the Upper Willamette River core area and one in the Clackamas River core habitat area.** In a recovered condition, the Upper Willamette River core area would include local populations in the mainstem McKenzie River (connectivity with Trail Bridge population would be reestablished), South Fork McKenzie River, upper Middle Fork Willamette River, and the Salt Creek/Salmon Creek/North Fork

Middle Fork Willamette River complex. The Clackamas River core habitat area would also contain one or more local populations as yet to be identified. Feasibility analyses are needed to assess the potential for reintroducing bull trout into historic habitat in the Middle Fork Willamette River subbasin (Salt Creek, Salmon Creek, and North Fork Middle Fork Willamette River watersheds) and into the Clackamas River core habitat area. Additional population studies and a better understanding of bull trout fidelity to natal streams are needed to further define local populations in the recovery unit.

2. **Abundance criteria will be met when the Willamette Recovery Unit supports an estimated 900 to 1,500 adult bull trout, distributed in each core area or core habitat as follows: 600 to 1,000 in the Upper Willamette River core area and 300 to 500 in the Clackamas River core habitat.** The recovered abundance range was derived from the professional judgment of the recovery unit team in estimating the productive capacity of identified local populations and potential habitat. These abundance goals may be refined as more information becomes available through monitoring and research.

   Increased population abundance in the Upper Willamette River core area is expected to occur through expanding of seasonal distribution in the Upper Willamette River core area and through expanding of populations to additional basins, for example, the Clackamas and Santiam River basins.

   Opportunities to protect spawning and rearing habitat on private lands through purchase, conservation easement, land exchange, or other means should be pursued. Habitat restoration efforts to improve anadromous salmonid production in the recovery unit can be expected to benefit existing and potential migration corridors and overwintering habitat for bull trout, as well as improve the prey base for bull trout.

3. **Trend criteria will be met when adult bull trout exhibit stable or increasing trends in abundance in the recovery unit.** Achievement of this recovery criterion will be based on a minimum of 10 years of monitoring data.

4. **Connectivity criteria will be met when migratory forms are present in all local populations and when intact migratory corridors among all local populations in the Willamette Recovery Unit provide an opportunity for genetic exchange and diversity.** Addressing passage barriers within the Willamette Recovery Unit would ensure opportunities for connectivity among local populations within each core area. In the Upper Willamette River core area, addressing fish passage at Cougar, Trail Bridge, Dexter, Lookout Point, and Hills Creek Dams would ensure opportunities for exchange of genetic material among bull trout populations in the core area. In the future, addressing fish passage at dams in the Clackamas and Santiam River basins may be necessary, but there is insufficient information at this time to make that determination.

   Connectivity between core areas via the Willamette River may become a factor in achieving recovery. However, additional monitoring and research is needed to assess this connectivity.

   Identifying barriers does not imply that other actions associated with passage and habitat degradation are not crucial for recovery to occur. To achieve recovery in the Willamette Recovery Unit, all four recovery criteria (distribution of local populations, abundance, population trends, and connectivity) must be achieved. Meeting all four recovery criteria will probably not be accomplished by only removing barriers.

Recovery criteria for the Willamette Recovery Unit were established to assess whether recovery actions are resulting in the recovery of bull trout. The Willamette 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 listed 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 Willamette Recovery Unit is fully contributing to recovery of the population segment.

Research Needs

Using the best scientific information available, the Willamette Recovery Unit Team has identified recovery criteria and actions necessary for recovery of bull trout. However, the Willamette Recovery Unit Team recognizes that many uncertainties exist regarding bull trout population abundance and distribution and about actions needed to recover bull trout in the Willamette Recovery Unit. The Willamette Recovery Unit Team believes that if effective management and recovery are to occur, the recovery plan for the Willamette 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 Willamette Recovery Unit Team has identified essential research needs within the recovery unit.

Primary research needs throughout the recovery unit include evaluating food web interactions, especially where introduced nonnative fish are present; evaluating the response of different bull trout life stages and population productivity to environmental variables such as stream temperature, introduced fine sediments, and changing habitat conditions; documenting and describing habitat use, especially of the reservoir environments, by different bull trout life stages and rearing use of the mainstem McKenzie River; evaluating predator–prey relationships, and potential disease and pathogen relationships, between bull trout and other fish species present in the recovery unit; and attempting to document or quantify the relative response or effectiveness of the full range of management, recovery, and conservation actions within the recovery unit.

Santiam River Basin. The North Santiam River has the most potential in the Santiam River basin for supporting the reintroduction of bull trout. Historically, bull trout were probably present throughout the North Santiam and Breitenbush River systems. Spawning and early rearing probably took place primarily in the upper parts of the Breitenbush and North Santiam Rivers, including suitable tributaries such as the North and South Forks of the Breitenbush River and the larger, colder tributaries of the upper North Santiam River that flow in from the Mount Jefferson Wilderness Area. The Little North Santiam River probably did not support a population of bull trout because Salmon Falls would have been impassable and would not have allowed access to potential spawning habitat upstream. Salmon Falls has since been laddered, and bull trout could potentially make it almost up to Opal Creek (Somes, pers. comm., 1999). An assessment of the potential of the Santiam River subbasin to support bull trout is needed.

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 either programmatic activities that are applicable across the species' range and 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 and appear in *a shaded italic type (as seen here)*. These tasks are included to preserve consistency in numbering tasks among recovery unit chapters and are intended to assist in generating information during the comment period for the draft recovery plan, a period during which additional tasks may be developed. Third-tier entries are tasks specific to the Willamette Recovery Unit. They appear in the Implementation Schedule that follows this section and are identified by three numerals separated by periods.

The Willamette Recovery Unit chapter should be updated or revised when recovery tasks are accomplished, environmental conditions change, or monitoring results or other new information becomes available. Revisions to the Willamette Recovery Unit chapter will probably focus on priority streams or stream segments within core areas where restoration activities occurred and where habitat or bull trout populations have shown a positive response. The Willamette Recovery Unit Team should meet annually to review annual monitoring reports and summaries and to 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 Complete an access and travel management plan for Federal lands in the upper Middle Fork Willamette River. U.S. Forest Service roads that have been identified in current watershed analyses as needing decommissioning include 2100392, 2100390, 2100391, 2100401, 21004023, and 2100273 along the upper Middle Fork Willamette River.

1.1.2 Assess turbidity from operation of Blue River project for impacts on bull trout. Take corrective action if turbidity is a problem.

1.1.3 Identify and eliminate industrial, agricultural, residential and sewage effluent runoff (nutrients and chemicals) that impact bull trout habitat in the mainstem Middle Fork Willamette River and the lower mainstem McKenzie River.

1.1.4 Investigate the effects on bull trout of thermal effluent discharged into the McKenzie River.

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

1.2.1 Assess feasibility of restoring fish passage at dams to reconnect fragmented bull trout populations in the Upper Willamette River core area. Dams include Cougar, Trail Bridge, Hills Creek, Lookout Point, and Dexter Dams. Analysis should include cost/benefits, potential quality and quantity, and relative importance of habitat that could be newly accessed.

1.2.2 Prioritize and then implement fish passage at dams to reconnect fragmented bull trout populations in the Upper Willamette River core area. Base prioritization on analyses of feasibility and potential benefit.

1.2.3 Document, enumerate, and evaluate entrainment at Cougar Dam as a factor influencing bull trout status in the South Fork McKenzie River.

1.2.4 Provide fish protection at water diversions and associated structures. Examples include the Walterville Canal powerhouse, Leaburg Dam roll gates, and Bigelow powerhouse.

1.2.5 Correct manmade barriers that impede bull trout access to suitable habitat. Examples include road culverts on Echo Creek Road 325, Swift Creek Road 2300422, and Road 2300 and barriers in the upper Middle Fork Willamette River at Coal Creek Road 2133 and Road 2133228.

1.2.6 Identify and evaluate opportunities for improving passage through dams to increase survival rates. Dams include Trail Bridge, Leaburg-Walterville, and U.S. Army Corps of Engineers Projects at turbine intakes, regulating outlets, and spillways.

1.2.7 Improve survival below the regulating outlet at Hills Creek Dam by addressing inadequate plunge pool at low or moderate flows.

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

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

1.4.1 Review and evaluate reservoir operations and provide recommendations through Federal Energy Regulatory Commission relicensing process and/or Federal consultation. Reservoir operations include water level manipulation, flows downstream from reservoirs, and others.

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

1.5.1 Identify existing road systems that have a high risk of adversely affecting bull trout streams. Negative changes include sediment delivery and natural drainage networks, interception of groundwater, and interruption of delivery of woody material. Road management plans should be developed to modify, reduce, or eliminate such roads.

1.5.2 Update the watershed analysis for the upper Middle Fork Willamette River. This task is necessary to determine appropriate U.S. Forest Service management activities and to help establish short- and long-term goals and actions compatible with bull trout recovery.

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 of policies for preventing illegal transport and introduction of nonnative fishes.

2.3 Provide information to the public 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 feasible and appropriate.

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

3 Establish fisheries management goals and objectives that are 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 Continue reestablishment of bull trout into the upper Middle Fork Willamette River. Identify conflicts with the reestablishment program such as road management, cumulative impacts from timber harvest, and impacts of and access to recreation sites.

3.1.2 Incorporate bull trout recovery actions into the Oregon Department of Fish and Wildlife's Willamette River basin fish management plans.

3.1.3 Coordinate bull trout recovery with management plans and with recovery and other efforts for other species, such as chinook salmon and steelhead trout.

3.1.4 Coordinate bull trout recovery monitoring in the Willamette River basin with the monitoring program for the Oregon Plan for Salmon and Watersheds.

3.1.5 Restore historic prey base by reestablishing spring chinook salmon into habitats occupied by bull trout. Priority areas remaining in the Willamette River basin include Salt Creek and Salmon Creek.

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

3.2.1 Conduct a creel census at Trail Bridge Reservoir to document angling pressure and mortality.

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 Assess habitat conditions and capacity in tributaries with historic or potential habitat in the Upper Willamette River core area. For example, assess conditions in Salmon Creek, Salt Creek, and the North Fork Middle Fork Willamette River.

5.2.2 Assess capacity of habitat in the Santiam and Clackamas River basins to support self-sustaining populations of bull trout.

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 Assess feasibility of reestablishing bull trout in the Clackamas and Santiam River basins. Include task numbers 5.2.2 and 5.5.2 as part of the analysis.

5.5.2 Conduct additional field sampling to determine presence/absence of bull trout in the Clackamas and Santiam River basins.

5.5.3 Conduct physical and biological surveys in the Upper Willamette River core area to determine current abundance of populations and factors preventing or limiting productivity. Eugene Water and Electric Board is proposing in the draft biological assessment to assess population status of bull trout and brook trout in Trail Bridge Reservoir.

5.6 Identify actions 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 Participate in efforts by local and regional (basinwide) watershed groups and others to accomplish site-specific protection and restoration activities. Examples of groups and others include watershed councils (McKenzie Trust) and the Willamette Restoration Initiative.

6.1.2 Coordinate with other agencies, research scientists, and conservation organizations. Efforts include 1) identifying and facilitating activities necessary to accomplish tasks at basin and subbasin levels, 2) implementing prioritization and scheduling of projects (such as surveys, habitat restoration, reintroductions), and 3) soliciting

participation of organizations. Coordinate recovery actions with recommendations for watershed improvements developed by the McKenzie Watershed Council.

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

6.2.1 Identify opportunities to incorporate bull trout recovery actions into the relicensing process for hydroelectric projects in the Willamette Recovery Unit. Examples of projects include the Carmen-Smith Project in the McKenzie River basin and Portland General Electric projects in the Clackamas River basin.

6.2.2 Identify and develop opportunities for collaboration between total maximum daily load planning (Clean Water Act) and bull trout recovery unit planning and implementation in the Willamette Recovery Unit.

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.

7.2 Assess effectiveness of recovery efforts.

7.3 Revise scope of recovery as suggested by new information.