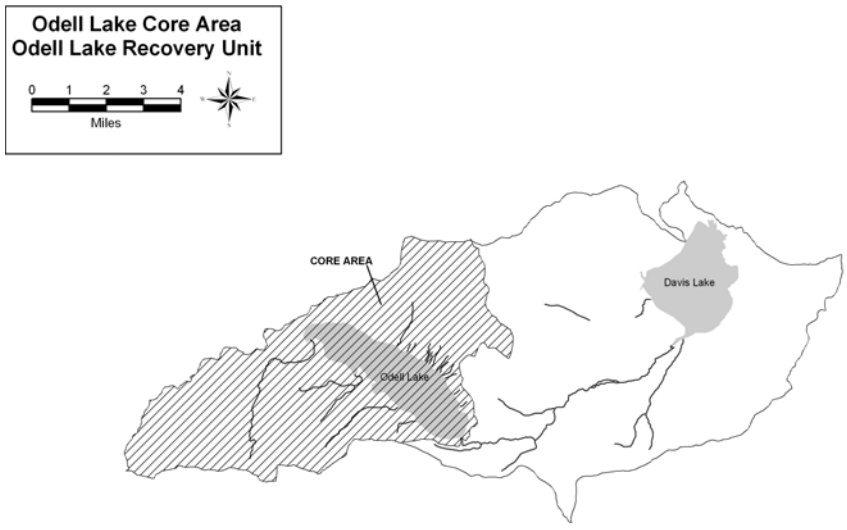
STRATEGY FOR RECOVERY

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 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.

Current distribution of bull trout in the Odell Lake Recovery Unit consists of spawning and juvenile rearing in Trapper Creek and subadult and adult rearing in Odell Lake. Some foraging activity may occur in Odell Creek and an occasional bull trout has been observed in Davis Lake.

For purposes of recovery, the Odell Lake Recovery Unit has a single core area encompassing Odell Lake and its tributaries (including Odell Creek and its tributaries) and Davis Lake and tributaries containing local populations (both current or potential as identified by the recovery unit team) (Figure 2).



Recovery goals and Objectives

The goal for bull trout recovery is to **ensure the long-term persistence of self-sustaining complex, interacting groups of bull trout distributed across the species native range, so that the species can be delisted.** To accomplish this goal the following four objectives were identified for bull trout in the Odell Lake Recovery Unit.

- Maintain current distribution of bull trout and restore distribution in previously occupied habitats within the Odell Lake Recovery Unit.

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

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

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

The Odell Lake 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 Odell Lake 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 Odell Lake 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). Multiple local populations distributed and interconnected throughout a watershed provide a mechanism for spreading risk from stochastic events. Distribution of local populations in such a manner is, in part, an indicator of a functioning core area. Based in part on guidance from Rieman and McIntyre (1993), bull trout core areas with less than five local populations are at increased risk; core areas with between 5-10 local populations are at intermediate risk; and core areas which have more than 10 interconnected local populations are at diminished risk. For the Odell Lake Core Area, there is currently one known local population. Based on the above guidance, bull trout in the Odell Lake Core Area are in an increased risk category.

Adult Abundance. The recovered abundance levels in the Odell Lake 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 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 Odell Lake Core Area was estimated (based on redd counts) at 100 adult spawners per year in the known local population. Based on the aforementioned abundance guidance, bull trout in the Odell Lake Core Area were considered at an increased risk of 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 risk of extinction. 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.

Based on the depressed and likely declining population trend and highly variable annual productivity, bull trout in the Odell Lake Core Area are currently at increased risk of extirpation.

Connectivity. The presence of the migratory life history form within the Odell Lake 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. Migratory bull trout still persist in the Odell Lake Core Area and are therefore considered at a diminished risk.

Recovery Criteria

Recovery criteria for bull trout in the Odell Lake Recovery Unit are the following:

1. **Bull trout are distributed among one or more local populations in the recovery unit, depending on whether fish are found to exhibit homing fidelity to individual streams**. In a recovered condition the Odell Lake Recovery Unit would include Trapper Creek and at least one additional local population. Additional population studies and a better understanding of bull trout fidelity to their natal streams is needed to better define local populations in the recovery unit. Addition of at least one more local population would demonstrate that suitable habitat is being restored and maintained.

2. **Estimated abundance of adult bull trout is 200 or more adults distributed in one core area**. Increased abundance is expected to come from expansion of spawning and juvenile rearing habitat to the extent possible in Trapper Creek and re-establishment in historic habitat, *e.g.*, Crystal Creek. Recovered abundance was derived using the professional judgement of the Team and estimation of productive capacity of identified local populations. Increased abundance will reduce somewhat the risk of genetic complications in the Odell Lake population due to extremely small population size.

3. **Adult bull trout exhibit stable or increasing trends in abundance in the recovery unit, 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, with intact migratory corridors among all local populations in core areas providing opportunity for genetic exchange and diversity**. Barriers to connectivity within the Odell Lake Recovery Unit will be addressed by eliminating entrainment in diversions (Willamette Pass ski area) and providing passage at dams (Crystal Creek and Odell Creek). Maintaining access to Odell Lake for recovered local populations will ensure opportunities for exchange of genetic material (see tasks 1.2.1 and 1.2.2).

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 Odell Lake Recovery Unit. However, the team recognizes that many uncertainties exist regarding bull trout population abundance, distribution, and recovery actions needed. The Recovery Unit Team believes that if effective management and recovery are to occur, the recovery plan for the Odell Lake 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 Odell Lake Recovery Unit Team has identified essential research needs within the recovery unit.

Additional information is needed on bull trout life history and abundance to better estimate adult abundance, monitor genetic health, and assess population viability in the recovery unit. A preliminary list includes (1) annual abundance of breeders per local population and total for the recovery unit; (2) population structure and connectivity; (3) life history characteristics including age at first spawning, incidence, regularity and timing of repeat spawning, and total life span; (4) reproductive success in production of pre-adult offspring; (5) survival rates to

breeding adult; and (6) reproductive success in replacement of breeders (K. Kostow, ODFW, pers. comm. 2001).

The recovery unit team has identified the following additional research needs for bull trout in the Odell Lake Recovery Unit.

1. Analysis of factors limiting the abundance and distribution of bull in the Odell Lake Recovery Unit. This includes identifying sources of bull trout mortality by life stage.

2. Analysis of interactions among aquatic species in Odell Recovery Unit as they relate to bull trout. For example, assess competition between bull and lake trout in Odell Lake, competition and hybridization between bull and brook trout in Trapper Creek, food-web interactions with nonnative fishes, and Kokanee redd superimposition. Although Kokanee may be superimposing redds they add nutrients to the creek and their flesh and eggs are most likely a source of food for juvenile bull tout in Trapper Creek.

3. Assessment of feasibility of re-establishing bull trout to Crystal Creek, Odell Creek, or Davis Lake tributaries.

4. Determine how to effectively survey the bull trout in Odell Lake in order to establish abundance estimates for this segment of the bull trout population.

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 as methods that may be used for the conservation of listed species. While artificial propagation has played an important role in the recovery of other listed fish species, the overall recovery strategy for bull trout in the Odell Lake Recovery Unit will emphasize identifying and correcting threats affecting bull trout and bull trout habitats, where possible. If artificial propagation is determined to be necessary for bull trout recovery

within the Odell Lake Recovery Unit and if a feasibility study identifies a host of 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 must meet applicable State fish-handling and disease policies.

The findings of the Montana Bull Trout Scientific Group support the possible use of artificial propagation and transplantation. The group concluded that hatcheries are one of many potential tools that could be used in bull trout recovery and that hatcheries are appropriate for establishing genetic reserves for declining populations and some research strategies (MBTSG 1996). The Montana Bull Trout Scientific Group identified seven strategies for using artificially propagated fish, evaluated the strategies relative to recovery criteria and objectives, and provided recommendations. The group also concluded that transplantation into areas where bull trout have been extirpated should be considered only after the causes of extirpation have been identified and corrected.

To achieve the time frame for recovery as specified in Chapter 1 and in this Odell Lake Recovery Unit chapter, some form of artificial propagation or transplantation may be anticipated in the Odell Lake Recovery Unit. Such strategies may also be necessary to establish a genetic refugia since the population within this recovery unit is seriously imperiled. Before the implementation of any artificial propagation or transplant program, a feasibility study would be completed to identify streams (either the priority streams or any new streams) having the greatest potential to support local populations of bull trout.

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

The Odell Lake Recovery Unit chapter should be updated as recovery tasks are accomplished, or revised as environmental conditions change, and monitoring results or additional information become available. The Odell Lake 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 general sediment sources. Stabilize roads, crossings, and other sources of sediment delivery, *e.g.*, railroad crossing on Crystal Creek. Use U.S. Forest Service road assessments in watershed analyses for a list of sediment sources. Review, prioritize and take necessary action.

1.1.2 Assess water quality in Odell Lake. Assess water quality in Odell Lake and tributaries and mitigate where limiting to bull trout. Investigate possible impacts from Willamette Pass ski area maintenance operations, road maintenance operations, and residential septic systems. Coordinate water quality studies with bull trout lake life history studies to target life stages that may be affected.

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

1.2.1 Eliminate entrainment in diversions . Determine if water diversion for the Willamette Pass ski area intake entrains juvenile bull trout and screen, if necessary. Inventory residential pumps and install screens where needed.

1.2.2 Provide passage at dams. Evaluate effects of the railroad dam on Crystal Creek on potential bull trout habitat and take action as necessary. Investigate the rock weir at outlet of Odell Creek to determine if it is a passage barrier to bull trout.

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

1.3.1 Restore riparian habitat. Revegetate to restore shade and canopy, riparian cover, and native vegetation along Trapper

Creek and Odell Lake lakeshore camp sites in areas that adversely impact bull trout recovery.

1.3.2 Restore stream channels. Implement the Trapper Creek channel restoration project.

1.3.3. Assess stream habitat restoration potential. Assess other areas of the recovery unit for stream restoration potential and implement restoration where needed, *e.g.*, Crystal Creek, Odell Creek, Davis Lake and tributaries.

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

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

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 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 Implement management actions wherever feasible and biologically supportable to control nonnative fishes. Continue removing brook trout from Trapper Creek and other creeks where brook trout populations pose a risk to bull trout. Evaluate effectiveness of removal program.

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 Incorporate bull trout recovery actions into existing plans. Incorporate bull trout recovery plans into Oregon Department of Fish and Wildlife Deschutes Basin Fish Management Plans and the Oregon Plan for Salmon and Watersheds.

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

3.2.1 Increase angler education and outreach efforts. Provide educational material to anglers on bull trout identification, habitat needs, special regulations, methods to reduce hooking mortality of bull trout caught incidentally, and the value of bull trout and their habitat. Utilize kiosks at campground, posters, camp host, creel surveyor when available to distribute information.

3.2.2 Develop fish management strategies to achieve a sustainable Odell Lake adfluvial bull trout population. The working group will review current fish management (*e.g.*, angling regulations, enforcement, etc.), when the opportunity or need arises and provide input when needed.

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 site-specific conflicts with introduced sport fish. Determine site-specific level of competition and hybridization with introduced sport fish and assess impacts of those interactions; especially lake trout, brook trout, and largemouth bass (Davis Lake). For example, assess competition between bull and lake trout in Odell Lake, competition and hybridization between bull and brook trout in Trapper Creek, impacts of superimposition of Kokanee salmon redds on bull trout production, and food-web interactions with nonnative fishes. Take action based on findings.

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

3.4.1 Determine effects of existing sport fishing regulations in Odell lake on bull trout. Assess effectiveness of existing sport angling regulations that minimize incidental mortality of bull trout. For example, determine the effectiveness of the closure of angling of bull trout in Trapper Creek and compliance with no harvest in the Odell Lake fishery. Develop a compliance index of angling regulations specific to 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 Determine factors limiting bull trout recovery in the Odell Lake Recovery Unit. Identify habitat factors limiting bull trout use in Crystal Creek. Assess habitat potential in Odell Creek and tributaries to support spawning and rearing bull trout.

5.2.2 Protect and restore habitat in the Odell Lake Recovery Unit. Identify essential areas and insure they are adequately protected, and implement strategies to restore and protect habitat in the recovery unit. Ensure that human use in the recovery unit, *e.g.*, Trapper Creek Campground, is compatible with bull trout recovery.

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.

5.4.1 Monitor for fish pathogens. Continue to monitor for effects of fish pathogens on Oregon bull trout populations. Follow department protocols (in development) for handling and disposition of bull trout mortalities, *e.g.*, submission to Oregon Department of Fish and Wildlife fish pathology laboratories for disease assessment.

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

5.5.1 Survey for bull trout presence/absence. Conduct regular, every five years for example, surveys in potential habitat where bull trout status is unknown or re-colonization is anticipated. For example, Odell Creek, Crystal Creek, Odell Lake, and spring areas.

5.5.2 Identify and map bull trout spawning habitat. Identify and map bull trout spawning habitat, present and potential, within the Recovery Unit. Explore Odell Lake Recovery Unit for all available and potential spawning areas, *e.g.*, lakeshore spawning by bull trout. Use information in feasibility analysis for reintroducing bull trout into potential habitat.

5.5.3 Establish abundance estimates. Establish abundance estimates for existing population (age class, composition, condition). Determine how to best survey the bull trout in Odell Lake and expand creel effort to establish an index of abundance.

5.5.4 Determine juvenile life history of bull trout in the Odell Lake Recovery Unit. Continue snorkel surveys on Trapper and Crystal Creeks and explore other areas, *e.g.*, shoreline near Trapper Creek. Explore feasibility of using screw traps to determine juvenile timing and abundance. Have bull trout scales read.

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 watershed group restoration efforts. Promote and support collaborative efforts to establish or support existing local watershed groups to accomplish site specific protection/restoration activities. Integrate watershed analyses and restoration activities on public lands in Odell Lake Recovery Unit.

6.1.2 Develop an outreach program to share information. Disseminate information to a wide variety of interest groups and educational institutions via publications, world wide web, and presentations. Present papers at professional meetings, *e.g.*, American Fisheries Society, *Salvelinus confluentus* Curiosity Society meetings. Provide a mechanism, *e.g.*, working group, to facilitate consultation among state, federal, and private entities on habitat issues. Develop a public information program with broad emphasis on bull trout identification and life history requirements and more specific focus on regionally or locally important recovery. For example, continue the census as an education effort; enlist the aid of volunteers (*e.g.*, Oregon State Police volunteers), provide bull trout, lake trout and brook trout identification cards to anglers, and develop and distribute educational materials on bull trout and their habitat needs (*e.g.*, watershed form and function, riparian and side channel restoration, large wood placement). Maintain a database of affected interests.

6.1.3 Secure funding and cooperation to implement recovery strategies. Obtain financial and personnel support from management agencies; pursue cooperative funding, partnerships, challenge cost share opportunities, and other private and governmental grants; and utilize mitigation and natural resource damage settlement funds as available. Seek funding solutions to address Road 5810 and railroad bridge work.

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

6.3 Enforce 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.

7.3.1 Periodically review progress towards recovery goals and assess recovery task priorities. Annually review progress toward population and adult abundance criteria and recommend changes, as needed, to the Odell Lake Recovery Unit chapter. In addition, review tasks, task priorities, completed tasks, budget, time frames, particular successes, and feasibility within the Odell Lake Recovery Unit.