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.

Two core areas were defined for the recovery unit, one for the Grande Ronde, one for the Little Minam (Figure 2). Whether bull trout exist in Wenatchee Creek was identified as a research need. If bull trout do exist in Wenatchee Creek, it would be a third core area in the recovery unit. The area above the barrier waterfall near the mouth of Wenatchee Creek is the area where research is needed.

Little Minam Core Area

This core area includes the local population complex defined as the Little Minam. Most, if not all, of the current spawning activity appears to occur in the mainstem of the Little Minam River above the barrier waterfall or in Dobbin Creek.

Grande Ronde Core Area

This core area includes eight extant, local populations: Upper Grande Ronde complex, Catherine Creek and tributaries, Indian Creek and tributaries, Minam River/Deer Creek complex, Lostine River/Bear Creek complex, Upper Hurricane Creek, Wenaha River, and Lookingglass Creek. This core area also includes Wallowa Lake and the Wallowa River above the lake where native bull trout are believed to have been extirpated. The Upper Grande Ronde, Minam River/Deer Creek, and Lostine River/Bear Creek populations may consist of more than one local population. For example, The Minam River/Deer Creek complex may have one local population in the Minam River and another local population in Deer Creek. For the present, or until research shows otherwise, they are

considered one local population, referred herein as various complexes. The Upper Grande Ronde, Catherine Creek and Indian Creek systems have the potential to become separate core areas if further research shows the local populations cannot or do not connect with the rest of the Grande Ronde local populations.

Current distribution of bull trout in the Grande Ronde River Recovery Unit includes the mainstem Grande Ronde River from its headwaters to the confluence with the Snake River; tributaries including Catherine Creek, Indian Creek, Lookingglass Creek, Wallowa River and its tributaries (Minam, Deer, Bear, Lostine, and Hurricane creeks), and the Wenaha River and its tributaries. To the best of our knowledge, with the exception of the Wallowa River above Wallowa Dam, historic distribution is closely reflected by the current distribution.

For purposes of recovery, the Grande Ronde River Recovery Unit contains two core areas: the Grande Ronde Core Area and the Little Minam Core Area (Figure 2). The Grande Ronde Core Area encompasses tributaries containing local populations (both current and potential as identified by the recovery unit team) and the mainstem Grande Ronde River from headwaters downstream to the Snake River. The Little Minam Core Area encompasses tributaries containing local populations and the mainstem above the barrier waterfall at approximately River kilometer 9 (River Mile 5.6). Wenatchee Creek has been defined as an area that needs to be surveyed for bull trout occurrence. It encompasses tributaries and the mainstem above the barrier waterfall at approximately River kilometer 4. It may not currently contain bull trout, but did historically. Additional assessment is needed to determine its suitability as a core area. The survey has been defined as a primary research need. Should surveys identify suitable habitat and the presence of bull trout, this recovery unit chapter will be revised to include Wenatchee Creek as a third core area.

Although we know Grande Ronde bull trout migrate to the Snake River and back, we do not have a clear understanding of the extent of their use and distribution in the Snake River mainstem. Once this information is available, the Grande Ronde Core Area may be extended to include portions of the Snake River

mainstem. Until then bull trout use patterns in the Snake River mainstem has been defined as a primary research need.

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 bull trout in the Grande Ronde River Recovery Unit:

5. The current number and distribution of bull trout populations within the Grande Ronde River Recovery Unit is maintained in the Little Minam and, potentially, Wenatchee core areas, as well as expanded in the Grande Ronde Core Area to suitable habitat (as noted in Table 2).

6. Stable or increasing trends in abundance of bull trout within the Grande Ronde River Recovery Unit are achieved.

7. Suitable habitat conditions for all bull trout life history stages and strategies are restored and maintained within the Grande Ronde River Recovery Unit.

8. Bull trout within the Grande Ronde River Recovery Unit are conserved by providing opportunities for genetic exchange between the local populations.

The current and recovered status of bull trout in the recovery unit were evaluated based on four population elements. These elements were derived from the best scientific information available concerning bull trout population dynamics and habitat requirements (Rieman and McIntyre 1993; Rieman and Allendorf 2001). The four elements were: 1) number of local populations, 2)

Table 2. Local populations and streams with potential to expand existing bull trout distribution in the Grande Ronde River Recovery Unit.

Core Area	Local Populations	Creeks with expansion potential
Grande Ronde	Upper Grande Ronde complex (upstream of La Grande)	Sheep Creek and East Fork Sheep Creek, Beaver Creek tributaries (below the dam); Five Points Cr; Lookout Cr (Little Fly system)
	Catherine Creek and tributaries	Little Catherine Creek
	Indian Creek and tributaries	Little Indian Creek
	Minam/Deer Creek complex	Sage Creek
	Lostine/Bear Creek complex	Mainstem Bear expand downstream; Little Bear Creek
	Upper Hurricane Creek	
	Wallowa Lake/River	
	Wenaha River	
	Lookingglass Creek	
Little Minam	Little Minam complex	

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).

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 Grande Ronde 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. In the Grande Ronde Core Area, there are currently eight known local populations (although additional information is needed to better characterize local populations in the core area); the Little Minam Core Area currently contains one local population. Based on the above guidance, bull trout in the Grande Ronde Core Area are at an intermediate risk category, and bull trout in the Little Minam Core Area are at an increasing risk. Additional local populations may be needed in the Grande Ronde Core Area, and are needed in the Little Minam Core Area, to reduce the risk from deterministic or stochastic events which may threaten bull trout.

Evaluation of the status of bull trout in Wenatchee Creek was identified as a research need. If a population of bull trout exists in Wenatchee Creek, this population would be in a similar situation to that in the Little Minam Core Area. The level of extinction risk and threats are currently unknown.

Adult Abundance

The recovered abundance levels in the Grande Ronde 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.

Bull trout in the Grande Ronde River Recovery Unit persist at moderate numbers. In the Grande Ronde Core Area the best estimates are that approximately 4,000 bull trout spawned in each of the past few years. The majority of spawning likely occurs in the Wenaha River and Minam River/Deer Creek complex, both which exists primarily in wilderness areas. In the Little Minam Core Area the best estimates are that approximately 750 bull trout spawned in each of the past few years. All of this spawning occurred in a wilderness area above the barrier waterfall in the Little Minam River. Based on

the aforementioned guidance, bull trout in the Grande Ronde and Little Minam Core Areas are at a diminished 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 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.

Given the overall lack of long-term population census information in the Grande Ronde and Little Minam Core Areas (trend information in both is based on less than 5 years of data), and the variability in abundance estimates, bull trout in the Lower Columbia Recovery Unit were classified at increased risk.

Connectivity

The presence of the migratory life history form within the Grande Ronde River Recovery Unit was used as an indicator of the functional connectivity of the recovery unit and both core areas. 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.

There are few physical or thermal barriers obstructing connectivity and migratory forms are present in many local populations within the Grande Ronde Core Area. Assuming all of the local populations in the Grande Ronde Core Area are connected, bull trout in this core area are currently at an intermediate threat level. If bull trout from (for example) Catherine Creek are not connected to those in the rest of the core area, the level of threat would increase accordingly. In contrast, the local population in the Little Minam Core Area contains resident life history forms only as they are isolated from other bull trout populations in the Minam River by a barrier waterfall. Although this local population currently contains relatively high numbers of spawners, this population is not connected with other local populations and is at increased risk.

Recovery Criteria

Recovery criteria for bull trout in the Grande Ronde River Recovery Unit are the following:

1. **Bull trout are distributed among nine local populations in the recovery unit, eight in the Grande Ronde Core Area and one in the Little Minam Core Area.** In a recovered condition the recovery unit would include nine local populations. In the Grande Ronde Core Area local populations would include the Upper Grande Ronde complex, Catherine Creek, Indian Creek, the Minam River/Deer Creek complex, The Lostine River/Bear Creek complex, Hurricane Creek, Lookingglass Creek, and the Wenaha River. In the Little Minam Core Area a local population of resident bull trout would exist in the Little Minam River above the barrier waterfall. Native bull trout are believed to have been extirpated above the dam at Wallowa Lake and bull trout distribution above this point would not be considered necessary for recovery. Additional research is needed in the Wenatchee Creek Core Area. If resident bull trout currently exist above the barrier waterfall in Wenatchee Creek, then a recovered condition would also include a local population of resident bull trout in Wenatchee Creek, or a total of 10 local populations. 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. There is potential to further separate the population within the Upper Grande Ronde complex into multiple local populations, the Minam River/Deer Creek complex into two local populations, and the Lostine River/Bear Creek complex into two local populations.

2. **Estimated abundance of adult bull trout is at least 6,000 adults in the recovery unit distributed in each core area as follows: Grande Ronde Core Area (5,000), Little Minam Core Area (1,000).** Recovered abundance was derived using the professional judgement of the recovery unit team, an estimation of productive capacity of identified local populations, and conservation biology theory. Estimates of the resident and fluvial life history component within the recovery unit are considered a research need. Recovered abundance levels do not include estimates for the Wenatchee Creek Core Area, which are considered a research need. These goals may be refined as more information becomes available, through monitoring and research.

In the Grande Ronde Core Area, increased population abundance is expected to occur by securing the distribution in Hurricane and Lookingglass creeks as well as the Wenaha River, and by securing and expanding seasonal distribution in the Upper Grande Ronde, Minam/Deer, and Lostine/Bear complexes as well as in Catherine and Indian creeks. Spawning habitat in the Wenaha River needs to be protected, and in the other local populations it needs to be protected and expanded. There are opportunities to protect and expand rearing and migration habitat in the Upper Grande Ronde complex and Catherine Creek on private, Tribal and public lands. To insure that fish from the Upper Grande Ronde complex, Catherine Creek, and the lower Grande Ronde River populations are connected, it will be necessary to monitor and possibly improve the migration of fluvial fish through the Grande Ronde River valley.

In the Little Minam Core Area, increased population abundance is expected to occur within the existing population complex. The recovery unit team estimated that 750 adult bull trout occur in this core area. However, the only information we have to make this estimate is from spawning ground surveys for resident fish. These surveys can yield highly variable results.

3. **Adult bull trout exhibit stable or increasing trends in abundance in the recovery unit, at the recovered abundance level, for at least two generations.** In the Grande Ronde River Recovery Unit, long-term, reliable information is not available on the trends in bull trout population abundance. In addition, for bull trout in general, current methods to assess the population status of bull trout are often inadequate. Existing monitoring efforts should continue and new methods should be developed and implemented. Trends in abundance should be evaluated over at least a 10 year period.

4. **Specific barriers inhibiting recovery have been addressed.** Passage barriers within the Grande Ronde Core Area need to be addressed, ensuring opportunities for connectivity among local populations within the core area. In the Grande Ronde Core Area this includes evaluating and

addressing dams (*e.g.,* Wallowa River Dam and Beaver Creek Dam) and diversions for irrigation and channelization (*e.g.,* upper Alder Slope/Moonshine ditch in Hurricane Creek, South Fork Catherine Creek, upper Wallowa River near Joseph) as well as culverts which are potential passage barriers to bull trout throughout the core area (*e.g.,* Sage Creek, Sand Pass Creek, and near the Indian Creek hydropower facility). This also includes addressing potential impacts from weirs (*e.g.*, upper Grande Ronde River, Catherine Creek, Lookingglass Creek, and Lostine River) and hatchery intakes (*e.g.,* Wallowa and Lookingglass fish hatcheries, Big Canyon satellite facility, and satellite facilities in the Lostine River, Upper Grande Ronde River, and Catherine Creek). This also includes assessments of the impacts of Lower Granite Dam and Hells Canyon Dam, both in the mainstem of the Snake River. This also includes evaluating possible thermal barriers from warm water temperatures (*e.g.,* upper Grande Ronde River, Bear Creek watershed, Lostine River, and Hurricane Creek below the upper Alder Slope irrigation ditch). In particular, connectivity between local populations via the Grande Ronde River where it flows through the Grande Ronde valley (between the towns of La Grande and Elgin) may become an important factor in bull trout recovery. Additional monitoring and research is needed to assess whether this section of river functions as a passage barrier and its relative importance.

Most likely, there are additional barriers that have not yet been identified and are important to recovery of bull trout. A list of all barriers should be developed in the first 5 years of implementation of this recovery plan. Substantial progress must be made in providing passage over the majority of these sites, consistent with the protection of other native fishes, in order to meet the bull trout recovery criteria for connectivity.

Identification of these 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 Grande Ronde River Recovery Unit, all four recovery criteria (local populations, abundance, population trends, and barrier removal)

must be achieved. It is likely that meeting all four recovery criteria will not be accomplished by addressing these barriers.

The Grande Ronde Recovery Unit Team expects that the recovery process will be dynamic and will be refined as more information becomes available. Future adaptive management will play a major role in recovery implementation and refinement of recovery criteria. While removal of bull trout as a species under the Act (*i.e.*, delisting) can only occur for the entity that was listed (Columbia River Distinct Population Segment), the recovery unit criteria listed above will be used to determine when the Grande Ronde 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 Grande Ronde 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 Grande Ronde 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 Grande Ronde River Recovery Unit Team has identified essential research needs within the recovery unit.

General Information Needs

The Snake River

A primary research need is a complete understanding of the current, and future, role that the Snake River should play in the recovery of bull trout. It is likely that fluvial bull trout life histories involved, at the very least, seasonal use of the mainstem Snake River. Bull trout from the Grande Ronde River Recovery Unit are known to use the Snake River for part of their life history. It is essential to establish with greater certainty the current bull trout distribution and seasonal use areas of the Snake River by bull trout from the Grande Ronde 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 the present distribution of bull trout. Application of such a protocol will improve the recovery team's ability to identify additional core areas, or revise the current classification. Specifically, tributaries from which there are isolated or anecdotal reports of bull trout using the mainstem of the Snake River should be targeted to clarify bull trout distribution within the recovery unit. This includes, but is not limited to the Wenaha River.

The Grande Ronde River flows into the Snake River between Lower Granite and Hells Canyon dams. Both of these dams could be a barrier to bull trout as could the reservoir created by Lower Granite Dam. Although Lower Granite Dam has a ladder for passage of anadromous species, Hells Canyon Dam does not provide for fish passage. Hells Canyon Dam is an Idaho Power facility that is a terminal barrier to upstream movement. Whether bull trout are attempting to move upstream in the Snake River and being blocked by Hells Canyon Dam needs to be further evaluated. Lower Granite Dam is part of the Federal Columbia River Power System. Incidental catch of bull trout at Federal Columbia River Power System facilities has only been recorded in the Fish Passage Center database since 1997. Prior to 1997, a bull trout sighting could have been noted as a "comment", but would not have been recorded in the database. Records prior to 1997 need to be examined for any documentation of bull trout in the comments. Passage facilities and reservoir operations at Lower Granite Dam need to be evaluated as to their suitability for bull trout.

Distribution and Abundance

The Grande Ronde River Recovery Unit Team based estimates of recovered abundance levels and number of local populations on the best available information and professional judgement. Information about historic abundance levels and distribution of spawning populations is very limited. The recovery unit team realizes that recovery criteria will most likely be revised as recovery actions are implemented and bull trout populations begin to respond. The recovery unit team will rely on adaptive management to better refine both abundance and distribution criteria. Adaptive management is a continuing process of planning,

monitoring, evaluating management actions, and research. This adaptive management approach will identify actions that maximize the ability to achieve recovery objectives. In addition, this approach will provide a better understanding of key uncertainties, crucial to long term management actions.

The Grande Ronde River Recovery Unit Team has identified an urgent need for the development of a standardized monitoring and assessment program that would more accurately describe current status of bull trout within the recovery unit, as well as identify improvements in current sampling protocols that would allow for monitoring the effectiveness of recovery actions. This recovery unit chapter is the first step in the planning process for bull trout recovery in the Grande Ronde River subbasin. Monitoring and evaluation of population levels and distribution will be an important component of any adaptive management approach. The U.S. Fish and Wildlife Service will take the lead in developing a comprehensive monitoring approach that will provide guidance and consistency in evaluating bull trout populations. An important component in recovery implementation and the use of adaptive management will be the evaluation of recommended actions. Development and application of models that assess population trend and extinction risk will be useful in refining recovery criteria as the recovery process proceeds.

Specific Information Needs

There are a number of research needs regarding the use of the mainstem Snake River by Grande Ronde bull trout and its importance in their life history. One such research need is data on the movement and seasonality of use of different habitat types in the Snake River by adult and subadult bull trout. For fluvial bull trout using the mainstem of the Snake, the timing of use (arrival and departure), the habitat conditions in the mainstem associated with these movements, the manner in which fish use the mainstem (including the reservoir behind Lower Granite Dam), the frequency with which fish enter or leave the mainstem, and the fidelity that fish have to a particular tributary all need to be determined. In addition, the impact of hydropower facilities on the mainstem Snake River on bull trout and their habitat should be evaluated. These studies should be done in conjunction with studies on bull trout from adjacent recovery units, *e.g.*, Imnaha-Snake, Clearwater, etc. to determine areas of overlapping use and possible interactions. Studies are also

also be evaluated. Additional data is needed on the impacts of diversions (low, warm water) on migrations of fluvial fish (for example, in the Lostine River and Hurricane Creek).

Food webs in drainages occupied by bull trout should be evaluated to determine whether introduced species are impacting bull trout and to assess whether the prey base necessary for increased bull trout abundance is available.

An additional research need is to determine the effects of whirling disease on bull trout. If it is a concern, monitoring for presence of whirling disease in important bull trout spawning and rearing areas is needed. Screening should also be conducted in potential habitat prior to reestablishment of any local populations. General fish health screening and transplant protocols should be maintained to reduce the chance of disease transmission.

ACTIONS NEEDED

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

The Grande Ronde River Recovery Unit chapter should be updated or revised as recovery tasks are accomplished, environmental conditions change, or monitoring results or other new information becomes available. Revisions to the Grande Ronde 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 Grande Ronde 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 **Identify and reduce sources of excessive fine sediment delivery.** Roads, grazing, agricultural practices, and urban development are main sources of excessive fine sediment in the Grande Ronde River Recovery Unit. Use existing Oregon Department of Transportation as well as proposed U.S. Forest Service and Boise Cascade road assessments to identify areas where action is necessary to correct problems associated with roads.

1.1.2 **Assess effects on bull trout from nonpoint source pollution.** Impacts to bull trout in terms of nutrients (winter feeding of livestock in valley bottoms in Wallowa Valley) and chemicals (agricultural use in Grande Ronde Valley in summer) are unknown. At least in part, they could be determined through the total maximum daily load or SB1010 processes.

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

1.2.1 **Assess whether tributary diversions act as migration barriers and restore passage where necessary.** Numerous irrigation diversions in the Wallowa River watershed need to be assessed for their effects on bull trout movement. An assessment of diversions in the Lostine watershed has been funded through the Grande Ronde Model Watershed Program. Diversions which are currently considered migration barriers include the upper Alder Slope/Moonshine Ditch diversion on Hurricane Creek.

1.2.2 **Assess whether tributary diversions and irrigation ditches are screened appropriately and remediate where necessary.** Assess diversions and irrigation ditches above anadromous fish distribution for screening needs to protect bull trout. For example, South Fork Catherine Creek ditch may be a problem, and diversions in the upper Wallowa River near Joseph have not been assessed. Screen needs in upper Hurricane Creek are currently being assessed by Oregon Department of Fish and Wildlife.

1.2.3 **Evaluate, and where necessary, reduce impacts of hatchery weirs on bull trout.** Hatchery weirs in Lookingglass Creek (Oregon Department of Fish and Wildlife), the Upper Grande Ronde River and Catherine Creek (Confederated Tribes of the Umatilla Indian Reservation), and the Lostine River (Nez Perce Tribe) acting as passage barriers may be influencing the spawning distribution and spawning time of bull trout. This potential impact should be evaluated and remediated where necessary.

1.2.4 **Ensure that hatchery intakes are not impacting bull trout.** Assess the impacts to bull trout of operating hatchery intakes at Lookingglass Fish Hatchery, Wallowa Fish Hatchery, the Big Canyon satellite facility, and satellite facilities in the Lostine River, Upper Grande Ronde River, and Catherine Creek. Insure that these intakes are screened properly.

1.2.5 **Assess whether road and trail crossings are acting as barriers to bull trout movement and provide passage wherever feasible.** Assess structures associated with road and trail crossings in tributaries in the Grande Ronde River Recovery Unit. For example, tributaries of the lower Grande Ronde need to be assessed, as well as the culvert on Sage Creek

(Deer Creek) and on Sand Pass Creek (Catherine Creek). Use the Oregon Department of Transportation culvert inventory on State and county roads, as well as the U.S. Forest Service culvert inventory and the Boise Cascade Corporation road assessment. Provide passage where feasible.

1.2.6 **Salvage stranded bull trout.** In areas where fish become stranded because of low water conditions (*e.g.,* Moonshine Ditch), conduct salvage operations.

1.2.7 **Secure appropriate instream flows.** Work with landowners on a voluntary basis to secure more instream water rights for fish use. Securing instream flows and water rights will help restore connectivity and opportunities for migration.

1.2.8. **Monitor the effects of diversions and withdrawals on stream temperature and bull trout migration, and modify as necessary**. For example, manage the Lostine River to provide flows and water temperatures necessary for the upstream migration of bull trout from July through September.

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

1.3.1 **Restore riparian zones associated with bull trout habitat.** Revegetate to restore shade and canopy, riparian cover, and native vegetation *(e.g.*, in the Wallowa subbasin, Little Bear Creek from mouth to Allen Canyon ditch, Bear Creek downstream of mouth of Little Bear Creek, Catherine Creek between Union and the State Park, Indian Creek below the forest boundary, and Lookingglass Creek as well as those areas included in the total maximum daily load report).

1.3.2. **Maintain riparian zones associated with bull trout habitat.** Manage streams (*i.e.* Bear Creek and Deer Creek) in a manner designed to maintain existing riparian growth and function.

1.3.3. **Reduce grazing impacts.** Management alternatives exist (*e.g.*, fencing, changes in timing and use of riparian pastures, off site watering and salting) which have been proven to reduce grazing impacts. These should be employed in (for example) Little Bear Creek from mouth to Allen Canyon ditch, Bear Creek downstream of mouth of Little Bear Creek, the Wallowa River upstream of Enterprise, South Fork Catherine Creek, and Indian Creek below the forest boundary.

1.3.4. **Assess the need for stream channel restoration activities and implement where necessary.** National Forest lands and private lands need to be assessed for areas that are potential bull trout habitat. Some action has already been taken on National Forest lands in bull trout occupied habitat. Stream channel restoration would include recruitment of large wood to improve stream hydraulics and fish habitat where warranted and cost-effective.

1.3.5 **Protect, maintain, and enhance anadromous fish habitat to increase available forage species for bull trout.** Juvenile salmonids are considered to have been a primary food source of bull trout. This reduction in prey base has contributed to the decline of bull trout in the Grande Ronde River Recovery Unit and is of particular concern in the Upper Grande Ronde River, Catherine Creek and Indian Creek watersheds.

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

1.4.1. **Evaluate the impacts of Lower Granite Dam and Hells Canyon Dam.** Bull trout from the Grande Ronde River Recovery Unit

enter the mainstem of the Snake River. However, how bull trout use the mainstem of the Snake River, whether they attempt to pass either dam has not been determined, and impacts of hydropower facility operation has not been well defined.

1.4.2. **Review reservoir operations at Federal Columbia River power system facilities, and revise as necessary.** The impacts to bull trout of (for example) water level manipulation, physical entrainment, and gas entrainment resulting from reservoir operations need to be thoroughly investigated. The results of these studies should be incorporated in operational recommendations provided through the Federal Energy Regulatory Commission, State relicensing processes, and Federal consultations. For examples, the operations of Lower Granite Dam and the East Fork Wallowa hydropower project should be assessed for impacts to bull trout.

1.4.3. **Evaluate and reduce the impacts of tributary dams.** Evaluate current conditions above the dam in the Wallowa River and the dam in Beaver Creek. Assess the benefits and detriments of connecting bull trout local populations in these areas and determine whether such a connection is essential for recovery. Reduce adverse impacts of tributary dams wherever feasible.

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

1.5.1 **Assess current risk of catastrophic fire to bull trout populations and reduce where necessary.**

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

2.2.1 **Review efficacy of and compliance with fish stocking regulations.** Improve enforcement of laws governing illegal transport and introduction of live fish. For example, in Oregon illegal transport of live fish is a priority for the Coordinated Enforcement Program. Develop standard and effective procedures for responding to illegal introductions 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 **Assess the interactions between bull trout and introduced fishes.** Determine site-specific levels of competition and hybridization of bull trout with introduced fish and assess impacts of those interactions; especially lake trout, rainbow trout, brook trout, brown trout, northern pike, largemouth and smallmouth bass, and walleye.

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

2.6.1 **Where necessary, implement management actions to reduce the distribution and abundance of nonnative species where bull**

trout are likely to benefit. Task 2.5.1 will provide information to determine locations in which actions to reduce the distribution/abundance of nonnative species are necessary.

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 **Coordinate plans associated with fish management.** Incorporate bull trout recovery actions and adaptively integrate research results into The Oregon Plan for Salmon and Watersheds, the Northwest Power Planning Council's subbasin plans, Federal land management plans, the Wallowa County and Nez Perce multi-species plan, local watershed council action plans, and other relevant fish and habitat management plans. Request assistance with implementation of recovery strategies for bull trout through all relevant plans.

3.1.2 **Coordinate recovery efforts on bull trout, salmon, and steelhead.** Coordinate bull trout recovery with recovery efforts being developed for other listed species (*e.g.,* Snake River Spring/Summer chinook salmon). Implement recovery plans for other listed species.

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

3.2.1 **Evaluate the impact of current sport angling regulations on bull trout.** These regulations should attempt to minimize the effects of incidental mortality on recovery of bull trout in fisheries closed to bull trout harvest. For example, implement management

actions to reduce angler pressure in areas where incidental mortality continues to be detrimental to recovery.

3.2.2 **Enforce sport angling regulations.** Ensure compliance with regulations and policies and target problem areas for enforcement. Work with Oregon State Police through the Coordinated Enforcement Program to determine enforcement priorities and needs.

3.2.3 **Provide information to the public about low-impact angling.** Provide information to anglers about bull trout identification, special regulations, how to reduce hooking mortality of bull trout caught incidentally, and the value of bull trout and their habitat and their place in the ecosystem.

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.

4.1.1 **Document and monitor genetic baselines for each local population.** Assess the population structure and relatedness of bull trout form various watersheds and tributaries withing the recovery unit.

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

4.2.1 **Manage local populations (numbers and life forms) to maintain long-term viability.** Once local populations are identified, they should be managed as specific units.

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

4.3.1 **Assess the potential for re-establishment of local populations in Wenatchee Creek and above the Wallowa Lake Dam.** Assess the feasibility and appropriateness of reestablishing local populations in previously occupied habitat.

4.3.2 **Reestablish bull trout in Wenatchee Creek and above the Wallowa Lake Dam if feasible.** If appropriate and feasible, propose and gain approval for specific reintroductions. Monitoring and criteria for evaluating results should follow State and Federal guidelines for public process, donor stocks, disease factors, impacts on other native species, and genetic concerns. Proceed with reintroductions after obtaining State and Federal approval and funding.

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.

5.1.1 **Design and implement a standardized, statistically sound bull trout population monitoring program.**

5.1.2 **Assess habitat restoration techniques.** Evaluate effectiveness of different active and passive habitat restoration techniques in restoring watershed function and local bull trout populations. For example, Bonneville Power Administration and U.S. Forest Service fencing and grazing management projects.

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

5.2.1 **Conduct further sampling in the mainstem Indian Creek to identify lower distribution limits of spawning and rearing habitat.**

5.2.2. **Evaluate habitat condition and determine bull trout use of the Grande Ronde valley.** Assess habitat conditions in the Grande Ronde River between La Grande and Elgin. Determine how, when and in what capacity bull trout use this portion of the river. Determine if conditions (*i.e.* thermal) in this area prevent or inhibit the migration of fluvial bull trout. Determine if bull trout from the Upper Grande Ronde River and Catherine Creek are connected to each other as well as to other local populations within the recovery unit.

5.2.3. **Assess habitat potential for expanding local populations.** As identified in Table 2, bull trout have the potential to expand into various areas within the Grande Ronde River Recovery Unit. This is particularly true in Little Catherine Creek and Indian Creek as well as on lands owned by Boise Cascade.

5.2.4. **Conduct watershed assessments.** Evaluate historic and present conditions in each habitat type by watershed. This has been completed for the Grande Ronde and Lostine watersheds but needs

to be done for Bear Creek, Deer Creek, and Wallowa River watersheds.

5.2.5. **Determine range of temperature tolerances for bull trout life stages in different habitats.** Use the results of ongoing temperature studies to address the adequacy of existing regulations. The recovery unit team identified this as a need rangewide.

5.2.6. **Determine the seasonal movement patterns of adult and subadult migratory bull trout.** This action would include bull trout which use different habitat types, including the mainstem Snake River. This information is necessary to determine how bull trout from the Grande Ronde River Recovery Unit are related to each other as well as other bull trout populations in Snake River watershed *(e.g.*, Imnaha, Clearwater, and Salmon Rivers), and the extent of their habitat requirements.

5.2.7. **Evaluate food web interactions.** This action is particularly relevant in drainages most affected by introduced fishes, *Mysis* shrimp, and reservoir operations. For example, food web interactions with *Mysis* shrimp and lake trout in Wallowa Lake.

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

5.3.1 **Develop, implement, and evaluate basin management plans.** These would address a variety of unregulated activities that can be detrimental to bull trout recovery. For example, an inventory of dispersed recreation in the National Forests has been scheduled.

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

5.4.1 **Research effects of whirling disease on bull trout.** If it is a concern, monitor for presence of whirling disease in important bull trout spawning and rearing areas. Currently the Grande Ronde River subbasin is quarantined. The recovery unit team identified this as a need rangewide.

5.4.2 **Maintain fish health screening and transplant protocols.** This will help reduce risk of disease transmission. Include discussion of fish health in the terms and conditions in section 10 permits for hatchery operations for guidance.

5.4.3 **Provide information to the public about fish disease issues.** Produce a whirling disease informational pamphlet for public distribution. This would contain current information of this parasite's distribution in Oregon and Washington and list precautions that should be taken by the fishing public to help prevent its spread to other watersheds.

5.4.4 **Survey for whirling disease.** Continue Oregon's Statewide survey of hatchery and wild fish populations for the presence of *Myxobolus cerebralis*, agent of whirling disease. Periodic planned surveys should be conducted in watersheds where past known exposure of infected fish occurred, *e.g.*, Grande Ronde Basin.

5.4.5 **Monitor for effects of fish pathogens on Oregon bull trout populations.** Follow Oregon Department of Fish and Wildlife 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 **Determine life history requirements.** Local, resident and migratory bull trout populations both exist in the recovery unit and may have different requirements. The recovery unit team identified this as a need rangewide.

5.5.2. **Investigate the relationship between bull trout and anadromous species.** This relationship is particularly important relative to predator-prey interactions. Evaluate the dependence of bull trout on anadromous prey.

5.5.3. **Continue to survey for bull trout.** Periodically monitor for presence/absence of bull trout in potential habitat where their status is unknown or recolonization is anticipated.

5.5.4 **Maintain a central database.** Identify funding and personnel to develop and centralize all distribution and monitoring data for bull trout in the recovery unit. Review and periodically update databases for bull trout distribution records.

5.5.5 **Compare characteristics of weak and strong populations of bull trout.** The characteristics of relatively strong and relatively weak but otherwise similar populations (for example, the Wenaha River and Lookingglass Creek) may be very different. This information is necessary to understand the factors limiting bull trout populations.

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

5.6.1 **Determine the mechanism by which migratory life forms undergo transition to resident forms.** The recovery unit team identified this as a need rangewide.

5.6.2 **Evaluate the relationship between life history forms.** Specifically, address whether resident adults produce migratory (fluvial) progeny and whether migratory (fluvial) adults produce resident progeny.

5.6.3 **Determine the consequences of genetic fragmentation and isolation.** This isolation may be due to human-made or natural barriers (*e.g.*, Little Minam River). The recovery unit team identified this as a need rangewide.

5.6.4 **Investigate use of the mainstem Snake River by bull trout from the Grande Ronde River subbasin.** It is essential to understand how important this area is in the life history of bull trout from this recovery unit. This should be done in conjunction with studies on bull trout from adjacent recovery units, *e.g.*, Imnaha-Snake, Clearwater, to determine areas of overlapping use and possible interactions.

5.6.5 **Evaluate the population structure of bull trout in the recovery unit.** Assess whether the recovery unit consists of one large population or multiple populations and whether there appears to be any metapopulation structuring.

5.6.6 **Evaluate basic life history characteristics.** Determine the age- and size- specific fecundity of fluvial and resident bull trout. For both fluvial and resident bull trout, determine the age at first spawning, size at first spawning, longevity, and the number of spawns during a life time.

5.6.7 **Evaluate survival rates by life stage.** Determine the embryo to fry, fry to age 'X', and age 'X' to first spawn survival rates as well as parent to progeny ratios. Generate a life table. Identify which life stages have the greatest mortality and what factors may be associated with that mortality.

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

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

6.1.1 **Support collaborative efforts by local watershed groups.** These groups often accomplish site specific protection/restoration activities.

6.1.2 **Provide long-term habitat protection.** This may be accomplished through purchase, conservation easements, management plans, and land exchanges. Specifically, explore whether these opportunities exist in the Lookingglass Creek drainage.

6.1.3 **Work cooperatively with neighboring States and governments to implement recovery actions.** Many of these watersheds span interstate and Tribal boundaries; such cooperation is necessary to implement recovery actions.

6.1.4 **Provide educational and outreach opportunities to the public about bull trout habitat needs.** Develop educational materials on bull trout and their habitat needs, *e.g.*, watershed form and function, riparian and side channel restoration, large wood placement, and marking storm drains in urban areas.

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

6.3 *Enforce 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.

needed to determine the migration timing and pathways in and between tributaries within the Grande Ronde Recovery Unit.

As discussed in Chapter 1, a standardized, statistically sound bull trout population monitoring program should be designed and implemented. Methods should include techniques appropriate for monitoring the abundance of fluvial, resident, and mixed local populations. Monitoring should include potential habitat (core habitat) where the status of bull trout is unknown or recolonization is anticipated.

A centralized database repository should be developed and maintained for all bull trout distribution and monitoring data. This activity needs to be supported directly and should include data from Tribal, State and Federal activities.

Research should be conducted to determine life histories of both local resident and migratory bull trout (including limiting factors), and to evaluate relationships among bull trout distribution and abundance, bull trout habitat, and recovery tasks. To assess progress and response of habitat/local populations to implementation of recovery tasks, baseline data on historic and present conditions in each habitat type should be gathered for each watershed (particularly Bear Creek, Deer Creek, and Wallowa River watersheds). Studies should include assessment of habitat potential for expanding or reestablishing local populations (*i.e.* Little Catherine Creek, Indian Creek and Little Indian Creek), evaluation of population structure (life table) of existing local populations, and evaluation of the relationship between life history forms. Additional information is needed on the distribution and abundance of bull trout in the Upper Grande Ronde, Indian Creek, and Wenatchee Creek. Further sampling in the mainstem Indian Creek is needed to identify lower distribution limits of spawning and rearing habitat.

Another research need is to evaluate connectivity of local populations, especially in Catherine Creek, the Upper Grande Ronde River, and the lower Grande Ronde River, and to determine whether this connectivity is essential for recovery. The consequences of genetic fragmentation/population isolation due to human-made barriers, or from natural barriers (*i.e.* Little Minam River) should

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.

7.1.1 **Develop a Participation Plan to support implementation in the recovery unit.** Consider a combined coordination meeting for the Grande Ronde and Imnaha-Snake recovery units. Share results and data, check progress toward recovery, and coordinate work for coming field season.

7.2 *Develop and implement a standardized monitoring program to evaluate the effectiveness of recovery efforts (coordinate with 5.1).*

7.3 Revise scope of recovery as suggested by new information.

7.3.1 **Periodically assess progress and determine needs for changes in recovery unit plan.**

7.3.2 **Periodically assess the priority of actions in the context of how to emphasize actions in core areas.**