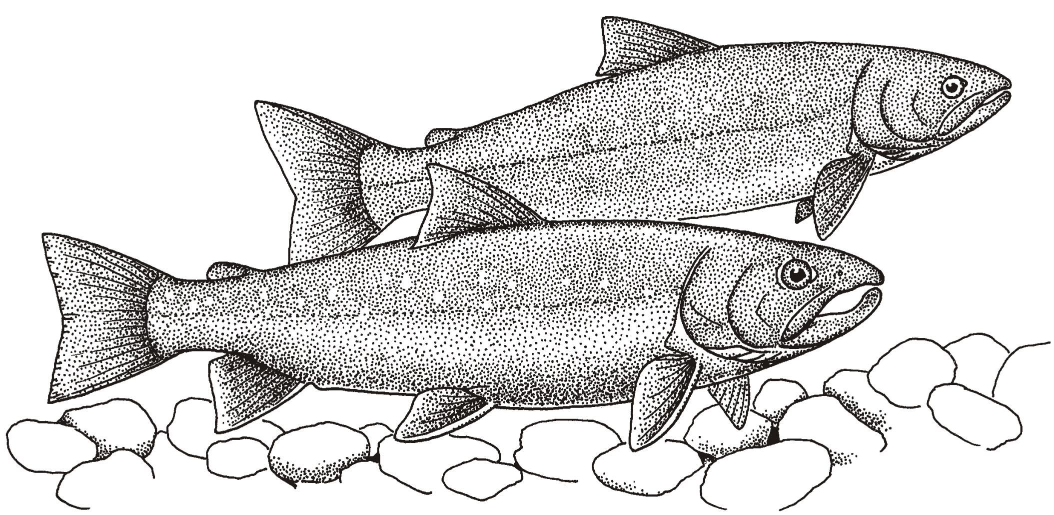
U.S. Fish & Wildlife Service

Draft Recovery Plan for the Jarbidge River Distinct Population Segment of Bull Trout (*Salvelinus confluentus*)



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Draft Recovery Plan for the Jarbidge River Distinct Population Segment of Bull Trout (*Salvelinus confluentus*)

(May 2004)

Region 1
U.S. Fish and Wildlife Service
Portland, Oregon

Approved: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Manager, California/Nevada Operations Office
U.S. Fish and Wildlife Service

Date: XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

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Recovery plans delineate reasonable actions which are believed to be required to recover and/or protect listed species. Plans are published by the U.S. Fish and Wildlife Service, and, in this case, with the assistance of recovery teams, State, Federal, and Tribal agencies, and others. Objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not necessarily represent the views or the official positions or approval of any individuals or agencies involved in the plan formulation, other than the U.S. Fish and Wildlife Service. Recovery plans represent the official position of the U.S. Fish and Wildlife Service *only* after they have been signed by the Director, Regional Director, or Manager, as *approved*. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery actions.

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Electronic copies of this recovery plan are available at:
<http://pacific.fws.gov/ecoservices/endangered/recovery/default.htm> and also at <http://endangered.fws.gov/recovery/index.html>.

Note to readers: A glossary of technical terms is provided in Appendix C of this plan. Terms provided in the glossary are denoted with a superscript symbol (†) the first time they appear in the plan.

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EXECUTIVE SUMMARY

Current Species Status

The Jarbidge River Distinct Population Segment[†] of bull trout (*Salvelinus confluentus*) was listed as threatened under the Endangered Species Act on April 8, 1999 (64 FR 17110). Bull trout are now listed throughout their range in the lower 48 states; however, as provided in the final listing rule, we are continuing to refer to the original distinct population segments for the purposes of recovery planning and consultation (64 FR 58910). The Jarbidge River Distinct Population Segment includes the Jarbidge River and Bruneau River watersheds[†], which are tributary to the Snake River. Bull trout occur in a single core area[†] within the Jarbidge River watershed. The Jarbidge River core area contains six local populations[†] of bull trout: East Fork Jarbidge River (including the East Fork headwaters[†] , Cougar Creek, and Fall Creek), West Fork Jarbidge River (including Sawmill Creek), Dave Creek, Jack Creek, Pine Creek, and Slide Creek. Bull trout in these local populations are primarily resident[†] fish, with relatively low numbers of migratory (fluvial[†]) fish present. The Jarbidge River Recovery Team[†] estimates that less than 500 resident and migratory adult bull trout, representing approximately 50 to 125 spawners, occur within the core area.

Habitat Requirements and Limiting Factors

The limiting factors for bull trout discussed here are specific to the Jarbidge River Distinct Population Segment and include a combination of historical and current human-induced and natural factors. These limiting factors include dams and diversions, increasing water temperatures, forest management practices, livestock grazing, transportation networks (road construction and maintenance), mining, residential development, fisheries management, isolation and habitat fragmentation, recreation, and random naturally-occurring events (*e.g.*, landslides and floods).

<u>Recovery Strategy</u>

Presently bull trout are listed as threatened across their range within the lower 48 states (64 FR 58910). Prior to the coterminous listing, five distinct population segments of bull trout were identified. Although these bull trout population segments are disjunct and geographically isolated from one another, they include the entire distribution of bull trout within the United States, therefore a coterminous listing was found to be appropriate in accordance with our policy on the designation of distinct population segments (61 FR 4722). As provided in the final listing rule, we are continuing to use the term “distinct population segments” for the purposes of recovery planning and consultation (64 FR 58910).

A delisting determination can only be made on a “listable entity” under the Endangered Species Act (Act). Listable entities include species, subspecies, or distinct population segments of vertebrate animals, as defined by the Act and U.S. Fish and Wildlife Service policy (61 FR 4722). Because bull trout were listed at the coterminous level in 1999, currently delisting can only occur at the coterminous level (64 FR 58910). In the future, if warranted by additional information, and if the Jarbidge River population is reconfirmed as meeting the definition of a distinct population segment under a regulatory rulemaking process, delisting may be considered separately for the Jarbidge River Distinct Population Segment of bull trout once it has achieved a recovered state (61 FR 4722).

For the purposes of recovery planning, here we have defined recovery criteria for the delisting of the Jarbidge River Distinct Population Segment as currently delineated. The recovery of bull trout is based on the concept of functional “core areas.” A core area represents the combination of both a core population[†] and core habitat[†], and constitutes the basic biological unit upon which to gauge recovery.

The Jarbidge River Distinct Population Segment will be considered recovered when the Jarbidge River core area is fully functional, as measured by parameters addressing the distribution, abundance, productivity (stable or increasing adult population trend), and connectivity between local populations of bull trout (including the potential for expression of migratory life history forms†). The conditions for recovery are identified in the criteria below.

Recovery Goal

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 their native range, so that the species can be delisted.**

Recovery Criteria for the Jarbidge River Distinct Population Segment

1. The biological and ecological function of the Jarbidge River core area for bull trout within the distinct population segment has been restored. The components of a fully functioning core area include:

a) **Habitat is sufficiently maintained or restored to provide for the persistence of broadly distributed local populations within the core area.** The term “broadly distributed” implies that local populations are able to access and are actively using habitat that fully provides for spawning, rearing,† foraging, migrating, and overwintering† needs at recovered abundance levels. An actual quantitative estimate of the amount of habitat that will be required to meet this criterion is unknown at this time; the adequacy of habitat restoration and management efforts must be measured indirectly by criteria 1b through 1d. The six currently identified local populations that will be used as a measure of broad distribution across the distinct population segment include: East Fork Jarbidge River (including the East Fork headwaters, Cougar Creek, and Fall Creek); West Fork Jarbidge River (including Sawmill Creek); Dave Creek; Jack Creek; Pine Creek; and Slide Creek. The current distribution of bull trout may be expanded within these local populations under recovered conditions.

b) **Adult bull trout are sufficiently abundant to provide for the persistence and viability of the core area and to support both**

resident and migratory adult bull trout. This level of abundance is estimated to be within a range of 270 to 1,000 spawning fish per year. This range was derived by the Jarbidge River Recovery Team using professional judgement to estimate the productive capacity of currently recognized local populations in a recovered condition and conservation biology theory. Productive capacity determinations incorporated analysis of existing bull trout population survey data and amounts of existing utilized habitat and underutilized or unutilized habitats perceived as recoverable within local populations. Resident and migratory life history forms are both included in this adult abundance range, but the relative proportion of each form required for recovery is considered a research need. As additional population data are collected, the recovered adult abundance range will be refined to be more precise and to reflect both the resident and migratory life history form components.

c) **Measures of bull trout abundance within all core areas show stable or increasing trends based on 10 to 15 years (representing at least 2 bull trout generations) of monitoring data.** In the Jarbidge River Distinct Population Segment, long-term, statistically-reliable bull trout population abundance data are not currently available to identify a trend in abundance. The development of a standardized monitoring and evaluation program to accurately describe trends in bull trout abundance is identified as a priority research need by the Jarbidge River Recovery Team. Achievement of this recovery criterion will be based on a minimum of 10 years of adequate population monitoring data.

d) **Habitat within the core area is connected so as to provide for the potential full expression of migratory behavior, allow for the refounding† of extirpated† populations, and provide for the potential of genetic exchange between populations.** The Jarbidge River Distinct Population Segment is a depleted, genetically-unique, physically-isolated population of bull trout on the margin of the species' range. It is the southernmost extant occurrence of the species. Therefore, this distinct population segment is a high conservation priority for maintaining the maximum genetic diversity and evolutionary potential of the species' range wide (Epifanio *et al.* 2003; Rieman, B., U.S. Forest Service, *in litt.*, 2003).

The Jarbidge River Recovery Team evaluated the physical isolation of bull trout with respect to recovery both within and outside of the Jarbidge River Distinct Population Segment. Addressing fish passage barriers outside of the Jarbidge River core area, as well as outside of this population segment, could physically reconnect it with bull trout in the Columbia River Distinct Population Segment. However, the Recovery Team strongly advises against removing existing outside barriers due to a substantial threat of nonnative[†] fish species invasions, which could cause adverse effects and prevent bull trout recovery.

Streams within the Jarbidge River core area need to be comprehensively surveyed for physical and thermal (*e.g.*, seasonally-elevated water temperatures) barriers to bull trout passage. If present, such barriers would limit habitat connectivity and genetic exchange among local populations and migratory individuals. Any barriers identified as preventing connectivity within the Jarbidge River core area must be addressed for bull trout recovery purposes.

2. A monitoring plan has been developed and is ready for implementation, to cover a minimum of 5 years post-delisting, to ensure the ongoing recovery of the species and the continuing effectiveness of management actions.

To achieve recovery of bull trout in the Jarbidge River Distinct Population Segment, all five recovery criteria (local populations, adult abundance, population trends, connectivity, and post-delisting monitoring plan) must be met. The Recovery Team expects that the recovery process will be dynamic. Recovery progress will be assessed as more information becomes available, and the Recovery Team will make changes in recovery planning, as necessary.

Recovery Actions

Recovery for bull trout will involve reducing threats to the long-term persistence of populations and their habitats, ensuring the security of multiple interacting groups of bull trout, and providing habitat conditions and access to them that allow for the expression of various life history forms. General recovery actions needed specific to the Jarbidge River Distinct Population Segment are as follows:

1. Protect, restore, and maintain suitable habitat conditions for bull trout.
2. Prevent negative effects of nonnative fishes on bull trout.
3. Establish fisheries management goals and objectives compatible with bull trout recovery, and implement practices to achieve goals.
4. Characterize, conserve, and monitor genetic diversity and gene flow among local populations of bull trout.
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 actions.
6. Use all available conservation programs and regulations to protect and conserve bull trout and bull trout habitats.
7. Assess the implementation of bull trout recovery, and revise the recovery plan based on evaluations, as necessary.

Total Estimated Cost of Recovery

The estimated cost of bull trout recovery in the Jarbidge River Distinct Population Segment is $6 million spread over a 25-year recovery period. If the time frame for recovery can be reduced, the estimated total cost would be lower. Total costs include estimates of expenditures by local, Tribal, State, and Federal governments and by private business and individuals. These costs are attributed to bull trout conservation, but other aquatic species will also benefit. Cost estimates are not provided for actions which are normal agency responsibilities.

Estimated Date of Recovery

Time required to achieve recovery depends on bull trout status, factors affecting bull trout, implementation and effectiveness of recovery actions, and population responses to recovery actions. A tremendous amount of work will be required to restore impaired habitats and eliminate or reduce threats. Three to 5 bull trout generations (15 to 25 years), or possibly longer, may be necessary before identified threats to the species can be significantly reduced or eliminated, population status improves, and recovery may be achieved.

TABLE OF CONTENTS

LIST OF FIGURES

JARBIDGE RIVER DISTINCT POPULATION SEGMENT OF BULL TROUT

INTRODUCTION AND OVERVIEW

Bull trout (*Salvelinus confluentus*), members of the family Salmonidae, are fish native to the Pacific Northwest and western Canada. Trout and salmon relatives in the genus *Salvelinus*, such as bull trout, are often generally referred to as "char[†] ." Bull trout occur in five identified distinct population segments[†] within the lower 48 states. In June 1998, we, the U.S. Fish and Wildlife Service, determined threatened status under the Endangered Species Act (16 United States Code [USC] 1531 *et seq*.) for bull trout in two distinct population segments in the Klamath River (Oregon) and Columbia River (Idaho, Montana, Oregon, and Washington) (63 FR 31647). In April 1999, the Jarbidge River Distinct Population Segment of bull trout (Idaho and Nevada) was also determined to be threatened (64 FR 17110). Two more distinct population segments of bull trout, the Coastal-Puget Sound (Washington) and St. Mary-Belly River (Montana), were also found to be threatened in November 1999 (64 FR 58910). This final listing resulted in all bull trout in the coterminous United States being listed as threatened. As provided in the final rule, however, we are continuing to refer to the original distinct population segments for the purposes of recovery planning and consultation (64 FR 58910). This recovery plan addresses the conservation actions deemed necessary for the recovery of the Jarbidge River Distinct Population Segment of bull trout in southwestern Idaho and northern Nevada. The location of the Jarbidge River Distinct Population Segment, and those of the other recovery areas delineated for bull trout throughout the coterminous United States, are provided in Figure 1.

Details regarding the ecology of bull trout and the threats faced by bull trout populations throughout their range in the United States are provided in the listing documents for the five distinct population segments and are only summarized here (63 FR 31647; 64 FR 17110; 64 FR 58910). A brief overview of bull trout life history, habitat needs, and reasons for decline is provided below.

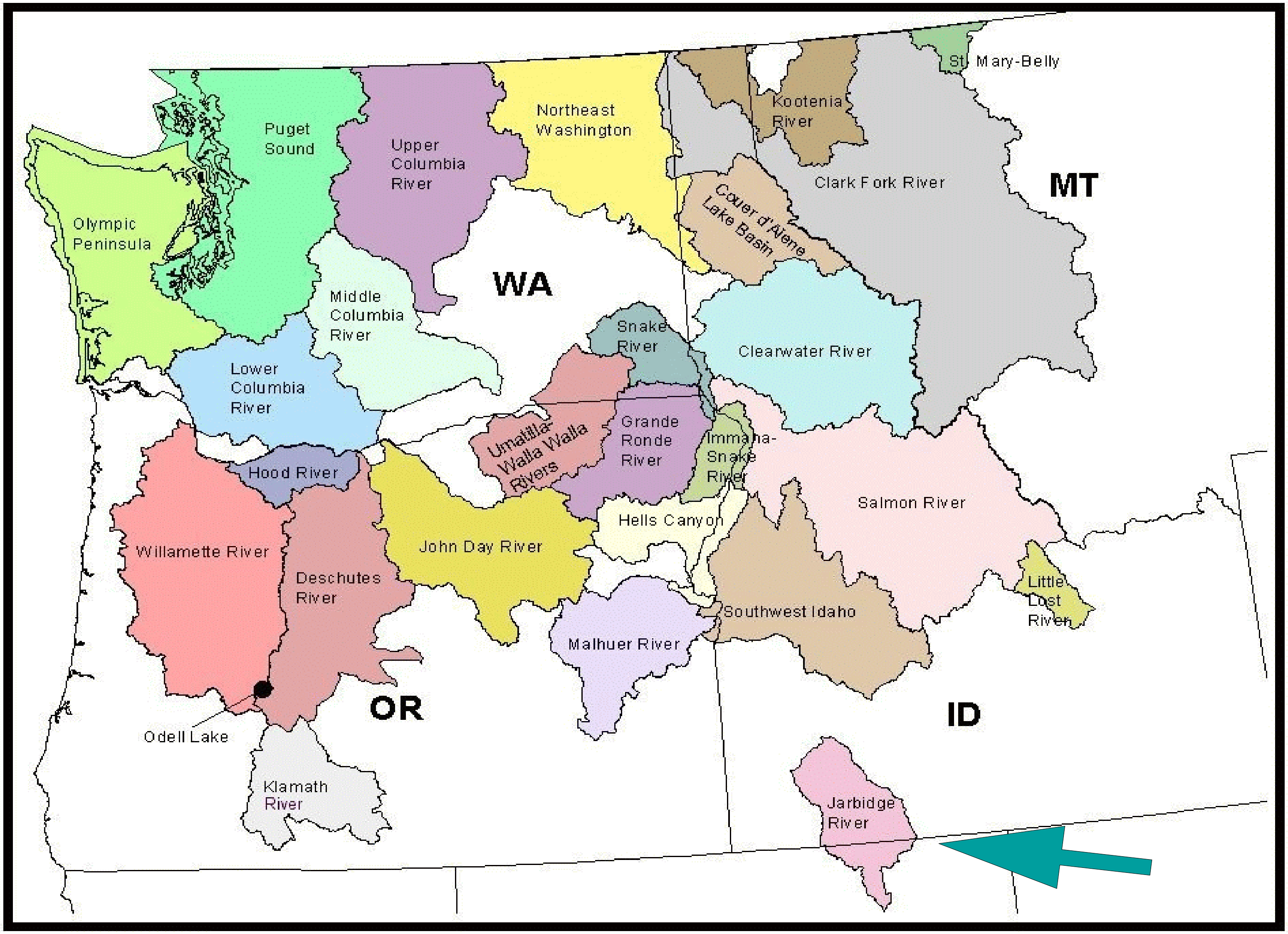

Figure 1. Jarbidge River Distinct Population Segment (arrow) and other population units of bull trout in the coterminous United States.

General Description and Life History

Bull trout exhibit both resident† and migratory life history strategies†. Both resident and migratory forms may be found together, and either form may produce offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993). Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. The resident form tends to be smaller than the migratory form at maturity and also produces fewer eggs (Fraley and Shepard 1989; Goetz 1989). Migratory bull trout spawn in tributary streams where juvenile fish rear 1 to 4 years before migrating to either a lake (adfluvial form†), river (fluvial form†) (Fraley and Shepard 1989; Goetz 1989), or in some cases to saltwater (anadromous†) to live as adults (Cavender 1978; McPhail and Baxter 1996). The resident and fluvial life history forms of bull trout are found in the Jarbidge River Distinct Population Segment.

Bull trout normally reach sexual maturity in 4 to 7 years and may live longer than 12 years. They are iteroparous (they spawn more than once in a lifetime), and both repeat- and alternate-year spawning has been reported, although repeat-spawning frequency and post-spawning mortality are not well documented (Leathe and Graham 1982; Fraley and Shepard 1989; Pratt 1992; Rieman and McIntyre 1996). Growth varies depending upon life-history strategy. Resident adults range from 150 to 300 millimeters (6 to 12 inches) total length, and migratory adults commonly reach 600 millimeters (24 inches) or more (Pratt 1985; Goetz 1989). The largest verified bull trout is a 14.6-kilogram (32-pound) specimen caught in Lake Pend Oreille, Idaho, in 1949 (Simpson and Wallace 1982).

Habitat Characteristics

Bull trout have more specific habitat requirements than most other salmonids† (Rieman and McIntyre 1993). Habitat components that influence bull trout distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrate, and migratory corridors† (Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989;

Sedell and Everest 1991; Howell and Buchanan 1992; Pratt 1992; Rieman and McIntyre 1993, 1995; Rich 1996; Watson and Hillman 1997). Watson and Hillman (1997) concluded that watersheds† must have specific physical characteristics to provide the habitat requirements necessary for bull trout to successfully spawn and rear and that these specific characteristics are not necessarily present throughout these watersheds. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993), fish should not be expected to simultaneously occupy all available habitats (Rieman *et al*.1997).

Cold water temperatures play an important role in determining bull trout habitat, as these fish are primarily found in colder streams (below 15 degrees Celsius [59 degrees Fahrenheit]), and spawning habitats are generally characterized by temperatures that drop below 9 degrees Celsius (48 degrees Fahrenheit) in the fall (Fraley and Shepard 1989; Pratt 1992; Rieman and McIntyre 1993).

All life history stages of bull trout are associated with complex forms of cover, including large woody debris†, undercut banks, boulders, and pools (Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Pratt 1992; Thomas 1992; Rich 1996; Sexauer and James 1997; Watson and Hillman 1997). Maintaining bull trout habitat requires stability of stream channels and of flow stability (Rieman and McIntyre 1993). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997). These areas are sensitive to activities that directly or indirectly affect stream channel stability† and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel from winter through spring (Fraley and Shepard 1989; Pratt 1992; Pratt and Huston 1993). Pratt (1992) indicated that increases in fine sediment† reduce egg survival and emergence.

Bull trout typically spawn from August to November during periods of decreasing water temperatures. Preferred spawning habitat consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989). Redds[†] are often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989; Pratt 1992; Rieman and McIntyre 1996). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992), and after hatching, juveniles remain in the substrate. Time from egg deposition to emergence of fry[†] may surpass 200 days. Fry normally emerge from early April through May, depending on water temperatures and increasing stream flows (Pratt 1992; Ratliff and Howell 1992).

The ability to migrate is important to the persistence of local bull trout populations (Rieman and McIntyre 1993; Rieman *et al.* 1997). Migratory forms of bull trout appear to develop when habitat conditions allow movement between spawning and rearing[†] streams and larger rivers or lakes where foraging opportunities may be enhanced (Frissell 1993). For example, multiple life history forms (*e.g.*, resident and fluvial) and multiple migration patterns have been noted in the Grande Ronde River (Baxter 2002). Parts of this river system have retained habitat conditions that allow free movement between spawning and rearing areas and the mainstem Snake River. Such multiple life history strategies help to maintain the stability and persistence of bull trout populations to environmental changes. Benefits to migratory bull trout include greater growth in the more productive waters of larger streams and lakes, greater fecundity resulting in increased reproductive potential, and dispersing the population across space and time so that spawning streams may be recolonized should local populations[†] suffer a catastrophic loss (Rieman and McIntyre 1993; MBTSG 1998; Frissell 1999). In the absence of the migratory bull trout life form, isolated populations cannot be replenished when disturbance makes local habitats temporarily unsuitable, the range of the species is diminished, and the potential for enhanced reproductive capabilities are lost (Rieman and McIntyre 1993).

<u>Diet</u>

Bull trout are opportunistic feeders, with food habits primarily a function of size and life history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macrozooplankton, and small fish (Boag 1987;

Goetz 1989; Donald and Alger 1993). Adult migratory bull trout are primarily piscivorous (fish eating) and are known to feed on various trout and salmon (*Oncorhynchus* spp.), whitefish (*Prosopium* spp.), yellow perch (*Perca flavescens*), and sculpin (*Cottus* spp.) (Fraley and Shepard 1989; Donald and Alger 1993).

<u>Reasons for Decline Across the Range</u>

Throughout their range in the lower 48 states, bull trout have been negatively impacted by the combined effects of a variety of factors, including habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, entrainment (being pulled through a diversion or other device), and the introduction of nonnative species[†]. Habitat alteration, primarily through the construction of impoundments, dams, and water diversions, has fragmented habitats, eliminated migratory corridors, and isolated bull trout in the headwaters[†] of tributaries (Rieman *et al.* 1997; Dunham and Rieman 1999; Spruell *et al.* 1999; Rieman and Dunham 2000). For example, although many dams have fish ladders[†], most such passageways were designed specifically for anadromous salmonids migrating upstream to spawn, not for resident fish such as bull trout. These designs therefore address the migration needs of primarily semelparous fishes (those that spawn only once in a lifetime, and therefore only require one-way passage) as opposed to iteroparous fishes such as bull trout (which require two-way passage) or fish that may merely wander both upstream and downstream as adults to forage. Therefore even dams with fish passage facilities may be a factor in isolating bull trout populations if they do not provide a downstream passage route. The combination of such factors has resulted in rangewide declines in bull trout distribution, abundance, and habitat quality, as well as the reduction or elimination of migratory bull trout.

Although isolation and habitat fragmentation contributed to the initial declines of bull trout in the Jarbidge River system, this population segment is now in a somewhat unusual position relative to the other population segments of bull trout, in that the current isolation of this population due to dams and diversions is not considered a significant threat to recovery. In fact, in this instance the isolation of this population from the Snake River may be beneficial, because this population is presently protected from the adverse impacts of nonnative fishes present in the Snake River system that would become predators, competitors, or possibly hybridize† with bull trout should connectivity† be restored. Their isolation from other populations of bull trout also serves to maintain the particular genetic characteristics of the Jarbidge River population segment. Other threats to this population include habitat degradation, interactions with nonnative fishes, and incidental angler harvest. Further details specific to the threats faced by bull trout within the Jarbidge River Distinct Population Segment are discussed in detail in the Reasons for Decline section beginning on page 35 of this plan.

SIGNIFICANCE OF THE JARBIDGE RIVER DISTINCT POPULATION SEGMENT

The Jarbidge River in southwest Idaho and northern Nevada is a tributary in the Snake River basin and contains the southernmost habitat currently occupied by bull trout. This population segment is geographically segregated from other bull trout in the Snake River basin by more than 240 kilometers (150 miles) of unsuitable habitat and several impassable dams on the mainstem Snake River and the lower Bruneau River. The occurrence of a species at the periphery of its range is not necessarily sufficient evidence of significance to the species as a whole. However, since the Jarbidge River possesses bull trout habitat that is disjunct from other suitable patches of habitat, the population segment is considered significant because it occupies a unique or unusual ecological setting, and its loss would result in a substantial modification of the species' range (64 FR 17110). Furthermore, the genetic uniqueness of bull trout in the Jarbidge River, in association with their physical isolation, makes this distinct population segment a high conservation priority for maintaining the maximum genetic diversity and evolutionary potential of the species across its range (Epifanio *et al.* 2003; B. Rieman, U.S. Forest Service, *in litt*. 2003).

Since the original listing, mitochondrial DNA data has revealed genetic differences between coastal populations of bull trout, including the lower Columbia and Fraser Rivers, and inland populations in the upper Columbia and

Fraser River drainages east of the Cascade and Coast Mountains (Williams *et al.* 1997; Taylor *et al.* 1999). This divergence is likely based on recolonization patterns associated with glacial refugia 10,000 to 15,000 years ago (Haas and McPhail 2001; Costello *et al.* 2003; Spruell *et al.* 2003), and suggests the existence of two or more genetically differentiated lineages of bull trout, each with a unique evolutionary legacy. Furthermore, analyses of nuclear DNA at microsatellite loci reveal an apparent differentiation between inland populations within the Columbia River basin, suggesting that bull trout populations in the Jarbidge River have a shared evolutionary history with populations in the upper Columbia River and upper Snake River (Spruell *et al.* 2003). However, despite the evidence that historically there was some level of gene flow between the Jarbidge River population segment and bull trout in the Columbia River basin, bull trout in the Jarbidge River population segment have now been artificially isolated from other populations for over 100 years (since the late 1800's; Gilbert and Evermann 1894). Furthermore, the recovery team for the Jarbidge River Distinct Population Segment has advised us that the isolation of this population due to dams and diversions is not currently a limiting factor, and that restoration of passage, allowing connectivity with other populations, may actually hinder recovery efforts by allowing nonnative fishes access to this core area† for bull trout. These considerations – genetic and physical isolation – in conjunction with the unique ecological setting of the Jarbidge River population segment at the southernmost extension of the species' range, suggest that it is appropriate to continue to focus our recovery efforts on this population segment as we evaluate the potential implications of recent genetic analyses on the organization of bull trout recovery efforts.

RECOVERY PLAN TERMINOLOGY AND STRUCTURE

The bull trout is a wide-ranging species with multiple life history forms and a complex population structure reflecting a high degree of local site fidelity (Kanda and Allendorf 2001) and substantial genetic divergence between breeding populations (Dunham and Rieman 1999; Spruell *et al.* 2003). Furthermore, it has been suggested that maintaining variablity in life history strategies and dispersal over many habitats may be as important to bull trout conservation as maintaining genetic variability (Rieman and Allendorf 2001). In order to preserve the diverse array of life histories and genetic variability exhibited by bull trout across their range, we have utilized the concept of "core areas" in recovery planning for bull trout. A **core area** represents a combination of suitable habitat and one or more **local populations** (the smallest group of fish that are known to represent an interacting reproductive unit) that function as one demographic unit due to occasional gene flow between them; essentially, most core areas function as metapopulations[†] (Meffe and Carroll 1994; Hanski and Gilpin 1997; Dunham and Rieman 1999). A **metapopulation** can be defined as a collection of relatively isolated, spatially distributed local populations bound together by occasional dispersal between them. Metapopulations provide a mechanism for reducing risk because the simultaneous loss of all local populations is unlikely. Although local populations may become extinct, they can be reestablished by individuals from other local populations. In general, the characteristics of most bull trout populations appear to be consistent with the metapopulation concept, although the exact structure of metapopulation dynamics for bull trout is not well understood (Rieman and McIntyre 1993).

Recovery planning for bull trout across their range in the coterminous United States also utilized the concept of "potential local populations." A **potential local population** is a population that does not currently exist, but that could exist, if spawning and rearing habitat or connectivity were restored in that area, and contribute to recovery in a known or suspected unoccupied area.

DESIGNATION AND DESCRIPTION OF THE JARBIDGE RIVER DISTINCT POPULATION SEGMENT

The Jarbidge River Distinct Population Segment encompasses the entire Bruneau River Subbasin[†] 4th-field hydrologic unit of the U.S. Geological Survey (Hydrologic Unit Code 17050102), which covers 8,547 square kilometers (3,300 square miles). This hydrologic unit includes both the Jarbidge River and Bruneau River watersheds in southwest Idaho and northern Nevada (see Figure 1).

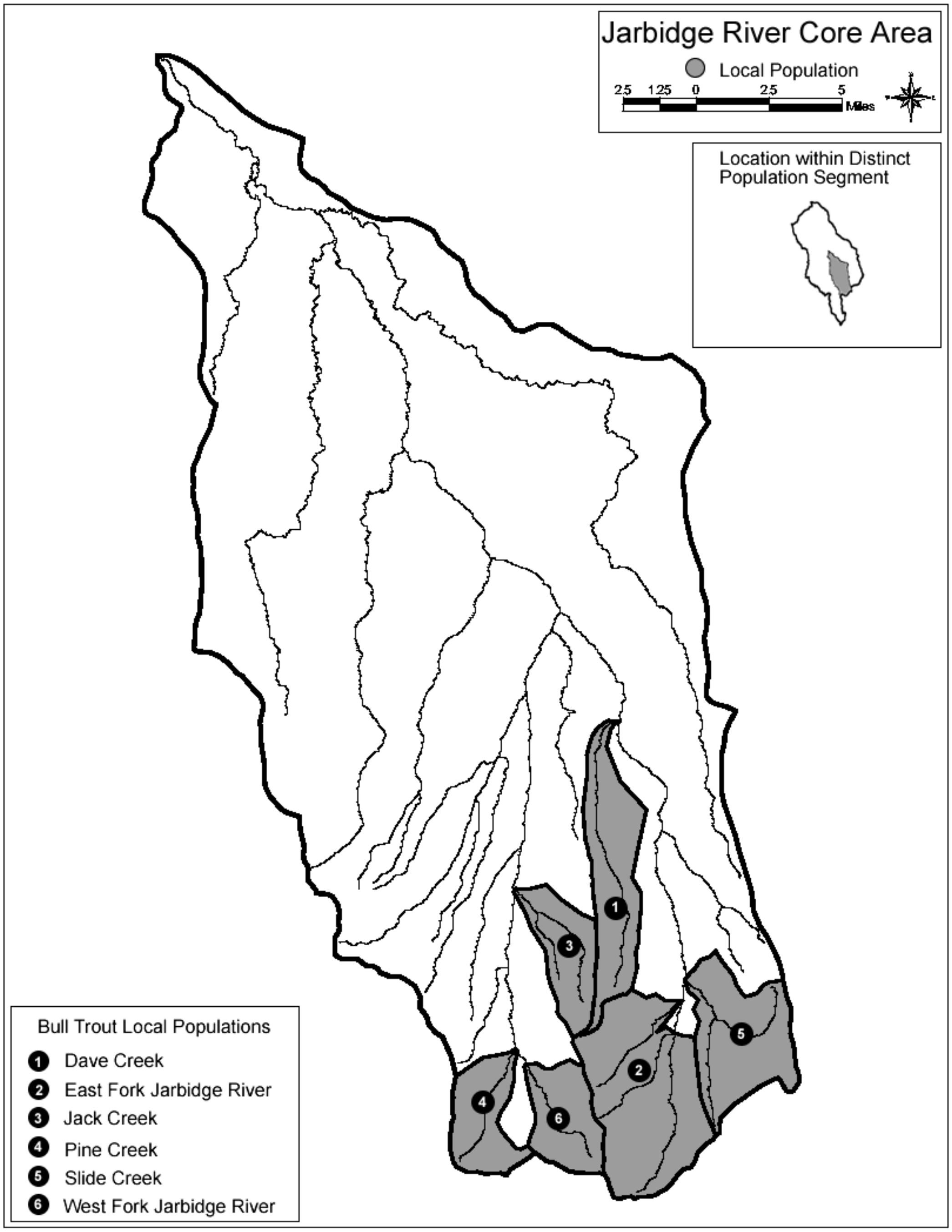

Figure 2. Local populations of bull trout within the Jarbidge River core area of the Jarbidge River Distinct Population Segment.

The Jarbidge River Recovery Team identified one core area with six local populations in the Jarbidge River watershed (Figure 2); no core areas or local populations were identified elsewhere in the Bruneau River watershed. The Jarbidge River core area consists of the entire mainstem Jarbidge River and the East and West Forks of the Jarbidge River and their tributaries (Hydrologic Unit Codes 1705010210 to 1705010215). Local populations present within the Jarbidge River core area are the East Fork Jarbidge River (including the East Fork headwaters, Cougar Creek, and Fall Creek), West Fork Jarbidge River (including Sawmill Creek), Dave Creek, Jack Creek, Pine Creek, and Slide Creek.

Geographic Description

The Jarbidge River originates in the Jarbidge Mountains of northeastern Nevada, which form a portion of the north rim of the Great Basin. The watershed is characterized by an elevated volcanic plateau that gradually slopes downward to the Snake River Plain (Schrader 1923), draining approximately 1,264 square kilometers (488 square miles) (Frederick and Klott 1999). The upper watershed is divided by a north-south crest with eight mountain peaks over 3,050 meters (10,000 feet) in elevation; Matterhorn Peak is the highest at 3,306 meters (10,839 feet). The steep slopes in the upper watershed (22 to 46 percent gradient) regularly experience large-scale erosional processes which impact streams such as mass-wasting events (*e.g.*, earth slumps, debris avalanches, and debris torrents from rain-on-snow events) (McNeill *et al.* 1997; Lay 2000).

The Jarbidge River and several tributaries have carved narrow canyons up to 180 meters (600 feet) deep into the surrounding plateau. Many of the canyons have reaches with vertical volcanic rock (rhyolite) walls or steep lower slopes with rim rock above. The East and West Forks of the Jarbidge River flow northward for approximately 36 and 32 kilometers (22.4 and 19.9 miles), respectively, and merge approximately 6.4 kilometers (4 miles) downstream of the Idaho-Nevada border. The mainstem Jarbidge River extends another 45 kilometers (28 miles) to the northwest, and at its confluence with the Bruneau River has dropped to 1,128 meters (3,701 feet) in elevation. The Bruneau River then flows northward for approximately 80 kilometers (50 miles) downstream from the Jarbidge River confluence to enter C.J. Strike Reservoir on the Snake River.

Vegetation cover types in the upper Jarbidge River watershed are primarily mountain sagebrush (*Artemisia* spp.), aspen (*Populus tremuloides*), mountain shrub (*e.g.*, bitterbrush [*Purshia* spp.], serviceberry [*Amelanchier* spp.], etc.), subalpine fir (*Abies lasiocarpa*), and Great Basin subalpine pine (*e.g.*, limber [*Pinus flexilis*] and whitebark [*P. albicaulis*]) pine) (McNeill *et al.* 1997). Riparian[†] vegetation in the watershed primarily consists of juniper (*Juniperus* spp.), black cottonwood (*Populus balsamifera*), subalpine fir, aspen, and various forbs, grasses, and sedges (McNeill *et al.* 1997). The upland plateau is dominated by shrub steppe community species.

Although located in a semi-arid region, the Jarbidge Mountains have a subalpine climate and capture substantial amounts of precipitation, primarily in the form of snow. The higher elevations typically accumulate a snow pack of 2.1 to 2.4 meters (7 to 8 feet) each year, which is the major water source for streams in the watershed. Additional precipitation falls as rain during thunderstorms. The upper East and West Forks of the Jarbidge River are subject to occasional rain-on-snow events, which reduce the snow pack and cause localized flooding. Because there are no storage reservoirs or diversions on the East Fork, West Fork, or mainstem Jarbidge River, runoff follows the natural hydrograph with high spring and early summer flows and greatly reduced flows in late summer, fall, and winter (Figure 3). There are no gaging stations on the mainstem Jarbidge River, but peak flows[†] could reach as high as 42,475 liters per second (1,500 cubic feet per second) or more with flow contributions from lower tributaries. Most existing consumptive surface and groundwater use in the Jarbidge River watershed is for livestock watering and domestic purposes.

The only operational stream gaging station in the Jarbidge River watershed is located on the West Fork of the Jarbidge River downstream of Jarbidge, Nevada (U.S. Geological Survey [USGS] Station Number 13162225).

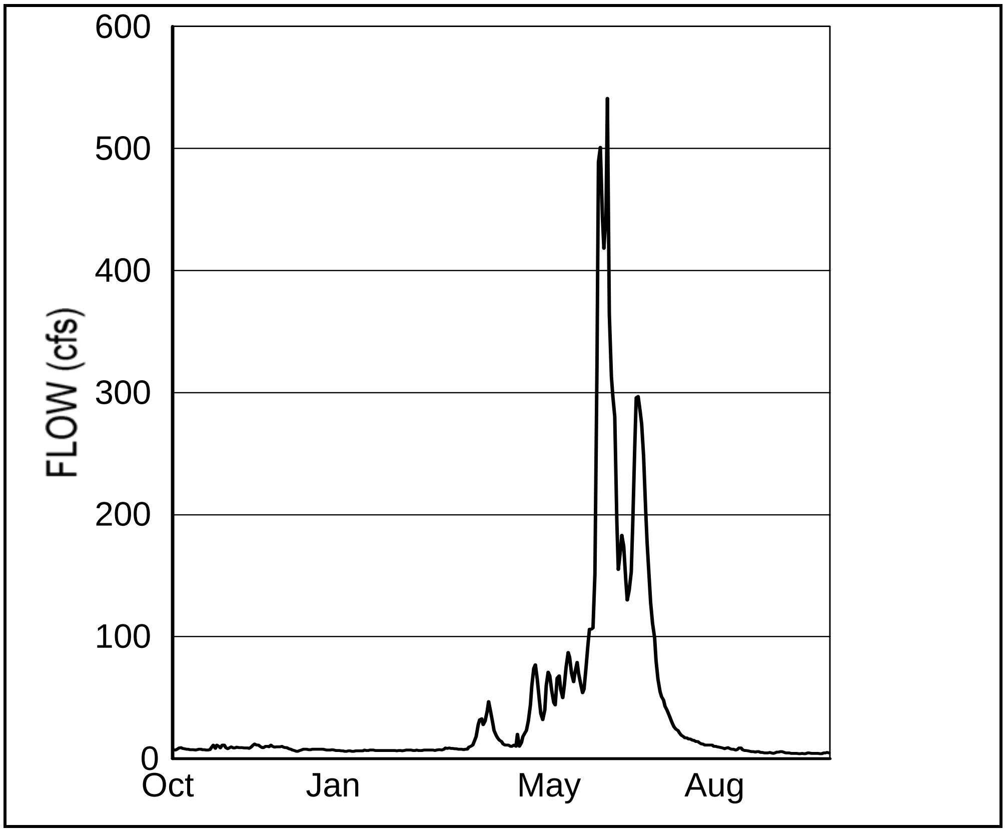

Figure 3. Hydrograph for the West Fork of the Jarbidge River downstream of Jarbidge, Nevada (October 1, 1998 to September 30, 1999). Flow is shown in cubic feet per second (cfs).

The West Fork of the Jarbidge River had an annual mean streamflow of 1,085 liters per second (38.3 cubic feet per second) in water year 1999 (October 1998 to September 1999) (USGS 1999). The instantaneous peak flow over 4 water years of record (1998 to 2001) was 23,333 liters per second (824 cubic feet per second), but daily mean streamflow dropped as low as 70.8 liters per second (2.5 cubic feet per second) (USGS 1999, 2002). Annual discharge[†] for the West Fork during water year 1999 was 34.9 million cubic meters (28,320 acre feet) based on a drainage area of 79.2 square kilometers (30.6 square miles) (USGS 1999).

Flows in the East Fork of the Jarbidge River were gaged downstream of Murphy Hot Springs, Idaho (USGS Station Number 13162500), from September

1, 1928 to October 31, 1933, and from August 1, 1953 to January 31, 1972. The peak daily mean stream flow during the entire period of record was 21,634 liters per second (764 cubic feet per second) in 1971 (USGS 2002). Annual mean streamflow for the East Fork ranged from 779 to 2,557 liters per second (27.5 to 90.3 cubic feet per second) (USGS 2002). The drainage area for this gaging station (219 square kilometers, 84.6 square miles) was much larger than for the West Fork station, and there are no overlapping years of record, so flow data are not directly comparable.

The Jarbidge River canyon has been seasonally occupied by humans since around 8000 B.C., with use by Shoshone tribal members dating from 1150 A.D. until the mid-1800's when the Ruby Valley Treaty was signed (18 Statutes at Large 689; Mathias and Berry 1997; McNeill *et al.* 1997). Use of the Jarbidge River watershed in the late 1800's was primarily for sheep, cattle, and horse grazing. Gold was discovered in 1909 with subsequent gold and silver mining and milling, timber harvest, and road construction (Mathias and Berry 1997; McNeill *et al.* 1997).

The headwaters area of the Jarbidge River in Nevada was designated as a Forest Reserve in 1909 (McNeill *et al.* 1997). A portion of the Forest was designated as a Wild Area in 1958 and converted into the Jarbidge Wilderness in 1964 (USFS 1999). The Jarbidge Wilderness was expanded in 1989 to a total of 45,900 hectares (113,330 acres). The U.S. Forest Service currently manages approximately 25 percent (31,668 hectares, 78,192 acres) of the land in the Jarbidge River watershed as part of the Humboldt-Toiyabe National Forest, including the portion of the Jarbidge Wilderness located in this watershed. The Bureau of Land Management administers approximately 64 percent (81,070 hectares, 200,172 acres) of the watershed. With the exception of a portion of a 16,200-hectare (40,000-acre) area closed to grazing within the Jarbidge Wilderness, these public lands are managed for multiple uses, primarily livestock grazing and various recreational activities. Water developments, commercial outfitting and guiding, and mineral development and production on existing valid claims are still allowed in the Jarbidge Wilderness.

Additional public land representing State endowment lands (sections 16 and 36) in Idaho make up 3 percent (3,800 hectares, 9,383 acres) of the Jarbidge River watershed. Approximately 8 percent (10,134 hectares, 25,022 acres) of the Jarbidge River watershed is private land. Private lands are generally located along streams and in canyon or valley bottoms, and include the communities of Jarbidge, Nevada, and Murphy Hot Springs, Idaho. Seasonal recreation use of the surrounding public lands is economically important to communities in the watershed. The primary uses of private land are for livestock grazing and seasonal residences.

DISTRIBUTION AND ABUNDANCE

Status of Bull Trout at the Time of Listing

At the time of listing, we identified a single subpopulation[†] of bull trout within the Jarbidge River watershed (64 FR 17110). This subpopulation included both resident and migratory fish. The status of this subpopulation was considered depressed based on low numbers and disjunct distribution. Bull trout were known to be present in the East Fork, West Fork, and mainstem Jarbidge River, and six headwater tributaries (Cougar, Dave, Fall, Pine, Sawmill, and Slide Creeks). Habitat degradation and fragmentation from past and ongoing land management activities such as road construction and maintenance, mining, and grazing; natural events; and past fisheries management practices were identified as the primary threats to this subpopulation (63 FR 31693; 63 FR 42757; 64 FR 17110). The single subpopulation identified in the original listing document is now referred to as the Jarbidge River core area which is composed of six identified local populations of bull trout.

Current Distribution and Abundance

All bull trout in the Jarbidge River watershed are native fish sustained by natural reproduction. Although bull trout were likely never as abundant as other native salmonids (*e.g.*, interior redband trout, *Oncorhynchus mykiss gairdneri*) in the watershed, the Jarbidge River Recovery Team believes bull trout were more abundant and more widely distributed historically than they are today. Currently, the recovery team estimates that fewer than 500 resident and migratory (fluvial) bull trout occupy the Jarbidge River core area, representing approximately 50 to 125 spawning adults.

The recovery team used professional judgement to designate six local populations of bull trout in the Jarbidge River watershed based upon available survey data, including observations of juveniles, documentation of suitable habitat for bull trout spawning and rearing, redd observations, or the presence of adults during the spawning season, as well as geographical isolation and limited genetic data. These six local populations are: 1) Dave Creek; 2) East Fork Jarbidge River (including the East Fork headwaters, Cougar Creek, and Fall Creek); 3) Jack Creek[1]; 4) Pine Creek; 5) Slide Creek; and 6) West Fork Jarbidge River (including Sawmill Creek) (see Figure 2).

There is preliminary genetic information indicating that bull trout in at least two of the designated local populations (West Fork Jarbidge River and Dave Creek) are genetically differentiated from one another (P. Spruell, University of Montana, *in litt.*, 1998; Spruell *et al.* 2003). Additional genetic samples of bull trout from each occupied stream are needed to complete the genetic analysis and ensure these six designations accurately represent local population structure. However, these findings are consistent with those for bull trout in other regions, which generally exhibit low levels genetic variation within a population, but high levels between populations (Williams *et al.* 1995; Spruell *et al.* 1999; Taylor *et al.* 1999; Kanda and Allendorf 2001; Neraas and Spruell 2001; Costello *et al.* 2003; Whiteley *et al.* 2003). Such genetic differentiation has been found in cases where bull trout are connected by suitable habitat in adjacent drainages (Kanda and Allendorf 2001) and even within the same tributary (Spruell *et al.* 1999). This evidence suggests that all local populations within the core area may be important for the conservation of the full range of genetic variability present within the distinct population segment, even if those populations are relatively small.

[1] Bull trout were rediscovered in Jack Creek during 1999 surveys (Johnson and Haskins 2000).

Population data for bull trout in the Jarbidge River Distinct Population Segment are primarily limited to data obtained during informal surveys by various State and Federal agencies and other anecdotal reports (*e.g.*, creel surveys), as opposed to systematic surveys for bull trout. Summaries of available population data by stream are provided below; local populations are identified by number to correspond with Figure 2. These combined data represent the best information currently available on bull trout population distribution and relative abundance, but they are inadequate to determine statistically-defensible population trends. The Jarbidge River Recovery Team has identified the development of standardized population monitoring protocols and the implementation of systematic bull trout surveys as research needs to resolve this issue.

Occupied Habitats in the Jarbidge River Core Area

Dave Creek - Local Population 1

Dave Creek is a major western tributary to the East Fork of the Jarbidge River. The creek originates on public land managed by the U.S. Forest Service, but then flows through private property and finally through Bureau of Land Management-managed public land. Dave Creek contains a local population of resident bull trout and likely provides spawning and rearing habitat for fluvial bull trout. This creek supports the most extensive known and potentially suitable bull trout spawning and rearing habitat in the Jarbidge River watershed, primarily due to its lower gradient and the relative abundance of spawning gravels. The Jarbidge River Recovery Team believes that the Dave Creek local population of bull trout will be a significant factor in bull trout recovery, potentially throughout the entire watershed, because of its future reproductive contributions and subsequent fish dispersal.

The first recorded documentation of bull trout anywhere in the Jarbidge River watershed was the collection of two fish (169 and 105 millimeters, 6.6 and 4.1 inches standard length) from Dave Creek on August 27, 1934, approximately 6.4 kilometers (4 miles) upstream of its confluence with the East Fork (Miller and Morton 1952). No bull trout were collected at two access sites on lower Dave

Creek in August 1957 (Johnson 1995b; Johnson, *in litt.*, 2003a). In August 1993, five bull trout (122 to 231 millimeters, 4.8 to 9.1 inches fork length) were captured from two sites within 4.4 kilometers (2.75 miles) upstream of the Humboldt-Toiyabe National Forest boundary (NDOW 1993; Johnson and Weller 1994; Johnson 1995b). Another site was also sampled in August 1993 on a small unnamed tributary, but no bull trout were collected (Johnson 1995b). No bull trout were observed in a July 1994 survey of approximately 4 kilometers (2.5 miles) of lower Dave Creek (Zoellick 1994; Zoellick *et al.* 1996).

In August 1998, 13 bull trout (140 to 213 millimeters, 5.5 to 8.4 inches fork length) were collected from three upstream sites and expanded sampling in the Forest (J. Frederick, U.S. Forest Service, pers. comm. 1998; Johnson 1999). On the private land reach of Dave Creek within approximately 3.2 kilometers (2 miles) downstream of the National Forest boundary, three adult bull trout were observed in late June 1999, and one additional adult was observed in late August 1999 (Werdon 2000a). Approximately six redds were observed with spawning bull trout (200 to 350 millimeters, 8 to 14 inches) in this same reach in mid-September 2001 (Burton *et al.* 2001).

East Fork Jarbidge River - Local Population 2

The upper half of the East Fork of the Jarbidge River is located in the Jarbidge Wilderness. Lower reaches flow through public lands managed by the U.S. Forest Service and Bureau of Land Management and limited (less than 2.4 kilometers, 1.5 miles) private lands at Robinson Hole and Murphy Hot Springs, Idaho. The East Fork Jarbidge River local population of bull trout consists of both fluvial and resident fish. The Jarbidge River Recovery Team has also combined bull trout using Cougar and Fall Creeks into this headwaters local population.

Bull trout were first documented in the East Fork in July 1951 when three male specimens (168 to 193 millimeters [6.6 to 7.6 inches] standard length) were collected (Miller and Morton 1952). In August 1957, one bull trout was collected 2 kilometers (1.2 miles) downstream of the headwater forks and another was collected just downstream of Slide Creek (Johnson 1993a). The Nevada State record bull trout from the East Fork was a 406-millimeter (16-inch) fish weighing 595 grams (1 pound, 5 ounces) caught on July 15, 1976 (NDOW 1998). In October 1984, a 266-millimeter (10.5-inch) bull trout was collected from the East Fork at Robinson Hole (Johnson 1995a; G. Johnson, NDOW, pers. comm. 2001a).

In the early summer of 1992, a single bull trout was observed moving upstream near Murphy Hot Springs, Idaho (M. Vinson, Bureau of Land Management, pers. comm., as cited in Zoellick *et al.* 1996). However, no bull trout were collected at five sites on the lower 6.6 kilometers (4.1 miles) of the East Fork in July and August 1992 (Warren and Partridge 1993). In September 1993, four bull trout (103 to 203 millimeters, 4 to 8 inches) were collected and three others were observed in the East Fork at two sites with elevations of 2,220 meters (7,280 feet) and above (Johnson 1993a; NDOW 1993; Johnson 1999). No bull trout were observed during March 1994 or August 1995 surveys on the lower East Fork in Idaho or upstream to the Forest boundary in July 1994 (Zoellick 1994; BLM and USFWS 1995; Zoellick *et al.* 1996).

No bull trout were collected at a fish weir on the lower East Fork in Idaho during trapping efforts from August 27 through October 17, 1997 (Partridge and Warren 1998). During early August 1998, two bull trout (142 and 262 millimeters, 5.6 and 10.3 inches) were collected from the western headwater branch of the East Fork; six other bull trout (97 to 258 millimeters, 3.8 to 10.2 inches) were collected just downstream of the confluence of the two headwater streams (Johnson 1999). Electrofishing of several pools on the lower East Fork upstream to the Idaho-Nevada border for 1 day in October 1998 also did not produce any bull trout (Partridge and Warren 1998).

Two bull trout were reported as caught and released by anglers in early September 1999 (Partridge and Warren 2000), but it is unclear whether both of the fish were from either the East Fork or West Fork, or if one fish may have come from each of the forks. In late September 1999, a total of seven bull trout (55 to 195 millimeters, 2.2 to 7.7 inches total length) were collected or observed in the upper East Fork less than 1.6 kilometers (1 mile) downstream of the confluence of the two headwater branches (Johnson and Haskins 2000). The fish weir on the lower East Fork was operated again from September 7 to November 30, 1999, resulting in the capture of two bull trout (280 and 315 millimeters, 11 and 12.4 inches) in late October (Partridge and Warren 2000). On October 14, 1999, two deer hunters reported observing a number of large “brook trout” holding in pools on the East Fork between Slide Creek and Robinson Hole; these fish were most likely bull trout based on their description (noticeable white on fins) and the absence of brook trout (*Salvelinus fontinalis)* in the East Fork (S. Werdon, U.S. Fish and Wildlife Service, *in litt.*, 1999).

In early April 2001, an angler reportedly caught an adult bull trout from the East Fork at Murphy Hot Springs, Idaho (D. Parrish, Idaho Department of Fish and Game [IDFG], *in litt.*, 2001). In mid-October 2001, snorkel surveys of the East Fork documented a total of 12 bull trout (51 to 250 millimeters, 2 to 10 inches) at 7 of 26 survey sites distributed over 21 kilometers (13 miles) of stream (Parametrix 2002). These bull trout were all observed upstream of the confluence with Slide Creek, with most occurring upstream of the Cougar Creek confluence above an elevation of 2,100 meters (6,900 feet) (Parametrix 2002).

Cougar Creek

Cougar Creek is a western tributary to the East Fork of the Jarbidge River in the Jarbidge Wilderness. Five sites on the lower 6.3 kilometers (3.9 miles) of Cougar Creek were surveyed during late August 1993, but no bull trout were collected (NDOW 1993; Johnson and Weller 1994; Johnson 1996a; Johnson 1999). No fish species were collected at the upper three sites, indicating perhaps that access is restricted to the lower 2.4 kilometers (1.5 miles) of the stream by either stream gradient or some other physical barrier. Bull trout were discovered in lower Cougar Creek in late August 1998 when two young-of-the-year (45 and 49 millimeters, 1.8 and 1.9 inches total length) and one adult (180 millimeters, 7.1 inches total length) were collected (Johnson 1999). The Jarbidge River Recovery Team has designated a single local population containing bull trout in Cougar Creek, the headwaters of the East Fork of the Jarbidge River, and Fall Creek.

Bull trout in Cougar Creek appear to be resident fish, but population data are limited.

Fall Creek and Tributaries

Fall Creek is a western tributary to the East Fork of the Jarbidge River within the Jarbidge Wilderness. The Jarbidge River Recovery Team has designated a single local population for bull trout occurring in Fall Creek and its two unnamed tributaries, Cougar Creek, and the headwaters of the East Fork of the Jarbidge River. This local population likely contains both resident and migratory bull trout, with Fall Creek supporting resident fish.

Fall Creek is estimated to have 2.4 kilometers (1.5 miles) of accessible habitat for bull trout, and its two tributaries together provide less than 1.6 kilometers (1 mile) of habitat (Johnson 1999). In August 1993, two potential adult bull trout were observed in lower Fall Creek, but none were found in the tributaries (NDOW 1993; Johnson and Weller 1994; Johnson 1996b). In August 1998, a total of five bull trout were captured in this drainage, one fish (134 millimeters, 5.3 inches) from Fall Creek, three fish (135 to 155 millimeters, 5.3 to 6.1 inches) from the upper tributary, and one fish (98 millimeters, 3.9 inches) from the lower tributary (Johnson 1999).

Jack Creek and Tributaries – Local Population 3

Jack Creek is a major eastern tributary to the West Fork of the Jarbidge River and is located on public lands managed primarily by the U.S. Forest Service. Jack Creek currently contains a local population of resident bull trout and likely provides spawning and rearing habitat for fluvial bull trout. The one major tributary to Jack Creek is Jenny Creek; other smaller tributaries include Little Jack Creek in the headwaters and an unnamed northern tributary entering upstream of Jenny Creek. None of the tributaries are known to support bull trout, although Jenny Creek and the unnamed tributary have redband trout (Johnson 1995c; S. Werdon, U.S. Fish and Wildlife Service, *in litt.*, 2001).

No bull trout were collected in an August 1957 survey of one reach on Jack Creek (Johnson 1995d). A single bull trout was sampled in Jack Creek near the Jarbidge Canyon road crossing during August 1974 (Johnson 1993a, 1995d). In September 1992, one bull trout (135 millimeters, 5.3 inches) was observed within 0.4 kilometer (0.25 mile) of the 1974 collection site during a survey of four 30-meter (100-foot) transects in lower Jack Creek (Johnson 1993a; Johnson 1995d; G. Johnson, NDOW, pers. comm. 1998; Johnson and Haskins 2000). In July 1994, five or six bull trout (175 to 225 millimeters, 6.9 to 8.9 inches) were observed in a large plunge pool in lower Jack Creek (Zoellick 1994; Zoellick *et al.* 1996); the pool was created by an impassable road culvert near the confluence with the West Fork of the Jarbidge River. In addition, one bull trout (225 millimeters, 8.9 inches) was observed in the same pool in August 1995 (BLM and USFWS 1995; Zoellick *et al.* 1996). A barrier to fish migration is believed to have existed at this road crossing at least periodically since July 1981 (Johnson and Haskins 2000). The culvert barrier was removed and replaced with a bridge in November 1997.

Bull trout were considered as likely extirpated[†] in Jack Creek after 2 years of unsuccessful surveys in August and September 1997 and 1998 below approximately 2,135 meters (7,000 feet) elevation (Johnson 1997b, 1999; G. Johnson, NDOW, pers. comm. 1998; Johnson and Haskins 2000). More intensive fish surveys during August 16 to 29, 1999, collected a total of 14 bull trout (95 to 229 millimeters, 3.7 to 9 inches) in Jack Creek upstream of the Jenny Creek confluence, and additional bull trout were also observed (Johnson and Haskins 2000). Two bull trout (250 to 300 millimeters, 9.9 to 11.8 inches) were observed in the lower 0.8 kilometer (0.5 mile) of Jack Creek in late June 2000 (NDOW 2001). An additional two adult bull trout (203 to 229 millimeters, 8 to 9 inch) were observed in July 2000 (NDOW 2001). In September 2001, two adult bull trout and a potential bull trout redd were observed upstream of the Jenny Creek confluence in lower Jack Creek (Werdon, *in litt.*, 2001).

Pine Creek and Tributaries – Local Population 4

Pine Creek is a western tributary to the West Fork of the Jarbidge River. It is located within the Jarbidge Wilderness except for a short reach including the mouth. The Pine Creek drainage contains a local population of resident bull trout and potentially provides spawning and rearing habitat for fluvial bull trout. In August 1992, a single adult bull trout (167 millimeters, 6.6 inches) was captured in upper Pine Creek (Johnson 1993a, 1995e; Johnson and Weller 1994). On September 29, 1997, a juvenile bull trout was collected in upper Pine Creek (Johnson and Haskins 2000). One juvenile bull trout (110 millimeters, 4.3 inches total length) was captured in a small tributary to Pine Creek in August 1998 (Johnson 1999; Johnson and Haskins 2000). During August 31 to September 2, 1999, a total of 14 bull trout (total lengths of approximately 106 to 296 millimeters, 4.2 to 11.7 inches) were collected or observed at six stations located in the upper half of Pine Creek (Johnson and Haskins 2000). On June 19, 2000, a juvenile bull trout (85 millimeters, 3.3 inches) was collected near the mouth of Pine Creek (Werdon 2000b). A survey of 7.6 kilometers (4.7 miles) of Pine Creek produced one bull trout (100 to 159 millimeters, 4 to 6 inches) observation at an elevation of approximately 2,225 meters (7,300 feet) (Parametrix 2002).

Slide Creek and Tributaries - Local Population 5

Slide Creek is one of two major eastern tributaries to the East Fork of the Jarbidge River. Tributaries to Slide Creek include two unnamed streams and God’s Pocket Creek. Except for the uppermost headwater reach of Slide Creek, the entire drainage is within the Jarbidge Wilderness. The Slide Creek drainage contains a local population of resident bull trout and may also be used by migratory individuals.

A single adult bull trout (153 millimeters, 6 inches) was collected in Slide Creek in late July 1993 just upstream of the mouth of God’s Pocket Creek, while a total of nine juvenile bull trout (107 to 124 millimeters, 4.2 to 4.9 inches) were collected and three others were observed in the lower reaches (1.9 to 2.4 kilometers, 1.2 to 1.5 miles) of the two unnamed tributaries to Slide Creek in

August 1993 (Johnson 1993a; NDOW 1993; Johnson and Weller 1994; Johnson 1996d; Johnson 1999). In August 1998, two juvenile bull trout (101 and 112 millimeters, 4 and 4.4 inches) were collected in Slide Creek just upstream of the lower unnamed tributary (Johnson 1999). In late June 1999, a single juvenile (89 millimeters, 3.5 inches) bull trout was also observed in this same area of Slide Creek; and two juvenile (102 millimeters, 4 inches) bull trout were observed in the lower unnamed tributary itself (Werdon 2000a). However, no fish were observed in the lower 150 meters (492 feet) of God's Pocket Creek at that time. On August 24, 1999, a single bull trout was observed at each of nine sample stations on Slide Creek; approximate total lengths of these fish were 127 to 190 millimeters (5 to 7.5 inches) (Werdon 2000a).

West Fork of the Jarbidge River - Local Population 6

The West Fork of the Jarbidge River originates in the Jarbidge Wilderness, but remains in the Wilderness for only approximately 4.8 kilometers (3 miles). Outside the Wilderness, the West Fork flows primarily through public lands managed by the U.S. Forest Service and Bureau of Land Management, but a total of approximately 4.8 kilometers (3 miles) also flows through private land and Idaho State land. The West Fork Jarbidge River local population of bull trout consists of both fluvial and resident fish. Bull trout from this local population also occasionally use Sawmill Creek (see below), a headwater tributary. Preliminary genetic analysis of bull trout from the West Fork indicates these fish are distinct from bull trout in Dave Creek, a tributary to the East Fork (Spruell, *in litt*., 1998; Spruell *et al.* 2003).

The upper 8 kilometers (5 miles) of the West Fork were first scientifically sampled between June 1 and August 30, 1934 (Durrant 1935). Starting 3.2 kilometers (2 miles) upstream of Jarbidge, Nevada, the river downstream was considered too polluted from mining to support fish (Durrant 1935). Durrant (1935) did not report finding bull trout in the upper watershed, instead reporting cutthroat trout (*Oncorhynchus clarki*) (stocked) as rare and rainbow (native redband) trout (*Oncorhynchus mykiss*) as common.

Bull trout were first documented in the West Fork in August 1954 when two fish (102 to 203 millimeters, 4 to 8 inches) were caught between the confluences of Sawmill Creek and Dry Gulch (NDOW 1954; Johnson 1999). Seven bull trout (51 to 150 millimeters, 2 to 6 inches) were collected just upstream of Sawmill Creek again during surveys in early October 1961 (NDOW 1961; Johnson 1999). A total of nine bull trout (average length 196 millimeters, 7.7 inches) were reported caught from the West Fork in June and August 1962 (NDOW 1963).

In August 1972, one bull trout (165 millimeters, 6.5 inches) was collected at the West Fork confluence with Jack Creek (NDOW 1972). No bull trout were captured in November 1974 or September 1975 surveys of six and seven sites, respectively, located between the Nevada-Idaho border and Snowslide Gulch (NDOW 1974, 1975). However, anglers reported catching several bull trout, including one measuring 432 millimeters (17 inches) in 1975 (NDOW 1975). Two bull trout (150 to 175 millimeters, 6 to 7 inches) were collected in October 1979; one in the vicinity of the town of Jarbidge and one between Bonanza Gulch and Pine Creek (NDOW 1979).

Three bull trout were captured at two sites on the West Fork between the U.S. Forest Service's Mahoney Administrative Site and Pine Creek Campground in October 1980 (NDOW 1981; G. Johnson, NDOW, *in litt.*, 2003a). The Nevada State record bull trout from the West Fork is a 559-millimeter (22-inch) fish weighing 1,984 grams (4 pounds, 6 ounces) caught by an angler near Sawmill Creek on July 9, 1985 (Johnson 1990; NDOW 1998). In late September 1985, a 266-millimeter (10.5-inch) bull trout was captured between Bourne and Bonanza Gulches (NDOW 1985). During early October 1985, a total of 10 bull trout (73 to 153 millimeters, 2 to 6 inches) were collected in the West Fork between Snowslide Gulch and Sawmill Creek; another larger bull trout (255 to 305 millimeters, 10 to 12 inches) was also observed near Sawmill Creek (NDOW 1985; Johnson 1999).

No bull trout were sampled or observed at three sites on the lower 5.5 kilometers (3.4 miles) of the West Fork in 1992 or March 1994 (Warren and Partridge 1993; Zoellick 1994; Zoellick *et al.* 1996). A single bull trout (175 millimeters, 6.9 inches) was observed in the West Fork 2.4 kilometers (1.5 miles) downstream of the Idaho-Nevada border in July 1994 (Zoellick 1994; Zoellick *et al.* 1996). No bull trout were observed during an August 1995 snorkel survey on the West Fork downstream of the Jack Creek and Buck Creek confluences (BLM and USFWS 1995). Four bull trout (175 to 300 millimeters, 7 to 12 inches) were observed upstream of Dry Gulch in October 1996 (Ramsey 1997).

A total of three potential resident bull trout redds were observed in the upper West Fork during surveys in 1995 (one redd) and 1997 (two redds) (Ramsey 1997). A fish weir (operated August 27 to October 17, 1997) on the lower West Fork trapped one bull trout (141 millimeters, 5.6 inches) on August 28 (Partridge and Warren 1998). Electrofishing and snorkeling surveys conducted from the weir upstream to the Idaho-Nevada border in October 1997 did not record any bull trout (Johnson 1997a; Partridge and Warren 1998). However, three bull trout (175 to 225 millimeters, 7 to 9 inches) were observed upstream of Dry Gulch in early October 1997 (K. Ramsey, U.S. Forest Service, *in litt.*, 1997). On August 5, 1998, one bull trout (210 millimeters, 8.3 inches) was collected 3.2 kilometers (2 miles) upstream of the State line; three bull trout (172 to 176 millimeters, 6.8 to 6.9 inches) were located 1.6 kilometers (1 mile) upstream of the mouth of Jack Creek; and a total of 20 bull trout (95 to 225 millimeters, 3.7 to 8.9 inches) were caught at three sites upstream of Snowslide Gulch (Johnson 1999).

A total of eight bull trout (127 to 305 millimeters, 5 to 12 inches) were observed in snorkel surveys of the West Fork upstream of Pine Creek in late June and August 1999 (Werdon 2000a). The West Fork fish weir was operated again from September 8 to November 30, 1999, resulting in the capture of two bull trout (250 and 260 millimeters; 9.9 and 10.2 inches) in late September and a larger bull trout (355 millimeters, 14 inches) in mid-November (Partridge and Warren 2000). Two other bull trout were reported as caught and released by anglers in early September 1999 (Partridge and Warren 2000), but it is unclear whether both fish were caught downstream of the East Fork or West Fork weir, or if one fish came from each of the forks.

A total of seven bull trout were observed in the West Fork from the confluence with Gorge Gulch upstream in late June 2000 (Werdon 2000b). Additional surveys in late June 2000 located a total of 16 bull trout (175 to 350 millimeters, 7 to 14 inches); with two adults near the Jack Creek confluence, two sub-adults near the Jarbidge Cemetery bridge, and 12 between Jarbidge and Pine Creek Campground (NDOW 2001). Another survey of the same sites in July 2000 found one additional bull trout (305 to 330 millimeters, 12 to 13 inches) at the confluence of Jack Creek (NDOW 2001). Surveys of the West Fork in Nevada during late June 2001 documented bull trout primarily between the confluences of Pine Creek and Fox Creek (Johnson, pers. comm. 2001a). However, no bull trout were observed in mid-October 2001 during snorkel surveys of 11 sites on the West Fork, located over a total distance of 14.2 kilometers (8.8 miles; excluding the Jarbidge vicinity) upstream of the Forest boundary near the Jack Creek confluence (Parametrix 2002).

Sawmill Creek

Sawmill Creek is a western tributary to the headwaters of the West Fork of the Jarbidge River within the Jarbidge Wilderness. Available habitat for bull trout in Sawmill Creek is limited by the steep channel gradient. The lower reach of this stream is likely utilized occasionally by resident bull trout in the West Fork Jarbidge River local population. No bull trout were collected in a 1954 survey of Sawmill Creek at one site near the mouth or at two sites in a 1992 survey (NDOW 1954, 1992; Johnson 1995f). However, bull trout were collected by spot shocking in the West Fork of the Jarbidge River just upstream from the mouth of Sawmill Creek at the time of the 1992 survey (Johnson 1995f). In 1998, a single juvenile bull trout (120 millimeters, 4.7 inches) was collected in lower Sawmill Creek (Johnson 1999).

Deer Creek

Deer Creek is a western tributary to the West Fork of the Jarbidge River, located primarily on public land managed by the U.S. Forest Service and Bureau of Land Management, with less than 1.6 kilometers (1 mile) on private land.

There are no historical records of bull trout from Deer Creek, and no bull trout were observed at five sites on Deer Creek in 1992 (NDOW 1992; Johnson 1993c). However, there was an anecdotal report of bull trout presence in 1993 (J. Klott, Bureau of Land Management, *in litt.*, 1994). No bull trout were observed in an August 1995 survey from the mouth upstream to the National Forest boundary (BLM and USFWS 1995; Zoellick *et al.* 1996). A single adult bull trout (220 millimeters, 8.7 inches) was collected upstream of the Forest boundary (Township 46 North, Range 58 East, Section 17) in July 2000 (G. Johnson, NDOW, pers. comm. 2001b; NDOW 2001). However, an additional limited survey of Deer Creek in July 2001 failed to collect any bull trout (K. Amy, U.S. Forest Service, pers. comm. 2001).

The Jarbidge River Recovery Team believes that the existing six local populations in the Jarbidge River core area are sufficient for bull trout recovery purposes. Therefore, the recovery team has not targeted Deer Creek for establishing a potential local population of bull trout. Also, water temperatures in Deer Creek may limit spawning and rearing habitat for bull trout (NDOW 2001), except near cold spring flows. The recovery team does support performing comprehensive surveys of Deer Creek to determine the extent of current use by migratory bull trout, as well as surveys of existing habitat conditions. Habitat suitability may be improved through implementation of recovery actions, which may increase the likelihood of migratory bull trout using this stream for foraging or other purposes.

Mainstem Jarbidge and Bruneau Rivers

Jarbidge River - Mainstem

Fluvial bull trout are present in the mainstem Jarbidge River in low numbers, migrating between the mainstem and the East Fork and West Fork of the Jarbidge River, and possibly some of their tributaries (*e.g.*, Dave, Jack, and Pine Creeks). Migrations are likely related to seasonally-elevated water temperatures in the mainstem and lower East and West Forks, and spawning, overwintering, and foraging activities. The downstream extent of movement by these fluvial fish is unknown, but there are no known physical barriers in the mainstem Jarbidge River preventing them from moving between the Jarbidge and Bruneau Rivers.

Any historical bull trout collections in the mainstem Jarbidge River are unrecorded, and contemporary collections are exceedingly rare. The general lack of bull trout observations and collections in the mainstem Jarbidge River has been attributed to sampling when water temperatures are too high, flows are too low, and/or after bull trout would have seasonally migrated upstream (Warren and Partridge 1993; Zoellick *et al.* 1996). Extensive reaches of the mainstem have no road access and are otherwise relatively inaccessible due to steep canyon walls; some mainstem areas have not been surveyed.

In 1991, a single bull trout was caught during several days of angling effort on the mainstem Jarbidge River (Warren and Partridge 1993). No bull trout were observed at 11 snorkel survey sites on the Jarbidge River in August and early September 1992 (Warren and Partridge 1993). Also, no bull trout were observed in July 1994 or August 1995 at five snorkel survey sites within 2 kilometers (1.2 miles) downstream of the confluence of the East and West Forks (Zoellick *et al.* 1996). A single bull trout was observed at the confluence of the East and West Forks in October 1994 (Zoellick *et al.* 1996). The mainstem Jarbidge River was sampled just upstream from the mouth in October 1995, but no bull trout were collected even though the water temperature was 10 degrees Celsius (50 degrees Fahrenheit), within their preferred temperature range (Allen *et al.* 1996).

A research need identified by the Jarbidge River Recovery Team is to determine the abundance, downstream distribution, seasonal movement patterns, and habitat use of migratory bull trout in the mainstem Jarbidge River. This research would also determine whether or not these fluvial bull trout use foraging, migration, and overwintering habitat[†] outside of the Jarbidge River core area in the mainstem Bruneau River.

Bruneau River - Mainstem

The headwaters of the Bruneau River were reportedly used for spawning by fall run chinook salmon (*Oncorhynchus tshawytscha*) (Gilbert and Evermann 1894). It is unclear what fish species besides salmon historically migrated from the Snake River into the Bruneau River because of few historical survey records. However, the Bruneau River is considered historical habitat for bull trout (Conley 1993). It is likely that fluvial adult bull trout utilized this migratory corridor along with other fluvial and anadromous salmonids as occurs in other Snake River tributary systems.

Fluvial bull trout using the mainstem Jarbidge River may also use the Bruneau River for foraging, migration, and overwintering habitat, although this has not been documented. There are no known physical barriers preventing fish movement between the Jarbidge and Bruneau Rivers. Once in the Bruneau River, fish passage is physically unrestricted for approximately 64 kilometers (40 miles) downstream to Hot Springs, Idaho. However, thermal outflow from Indian Hot Springs, located less than 1.6 kilometers (1 mile) downstream of the mouth of the Jarbidge River, might influence bull trout movements. The thermal waters may be a deterrent to bull trout passage during warm seasons, but may also provide additional foraging opportunities for bull trout at other times of the year. The Jarbidge River Recovery Team has identified a research need to determine whether or not fluvial bull trout use foraging, migration, and overwintering habitat outside of the Jarbidge River core area in the mainstem Bruneau River.

<u>Currently or Potentially Suitable but Presently Unoccupied Habitats</u>

Bear Creek

Bear Creek is a western tributary to the West Fork of the Jarbidge River. It is located almost entirely on land managed by the U.S. Forest Service just outside the Jarbidge Wilderness boundary, but enters the West Fork on private land in Jarbidge, Nevada. Bear Creek was historically identified as the only uncontaminated water source for the community. In July 1916, a 14.2 liter per second (0.5 cubic foot per second) water right† application was filed on Bear Creek for municipal use in Jarbidge (Mathias and Berry 1997). Construction of the water system began in 1917, and included a concrete diversion dam approximately 1.2 meters (4 feet) high across Bear Creek located 610 meters (2,000 feet) upstream from the mouth, which blocked upstream fish passage. Water pipelines provided fire protection and domestic water for a portion of the community, as well as supplying water to the Elkoro Mill and another mine camp. By 1922, Bear Creek water was also being stored in an 80,000-gallon tank using this diversion (Mathias and Berry 1997).

There are no records of bull trout presence in Bear Creek historically or in a limited August 1963 survey (Johnson 1993b). Seven sites on 6.9 kilometers (4.3 miles) of Bear Creek were surveyed in June 1992 and no bull trout were collected, although habitat in Bear Creek Meadows was considered potentially suitable for bull trout (NDOW 1992; Johnson 1993b).

The concrete diversion structure for the Jarbidge water system was reconstructed 61 meters (200 feet) further upstream in 1994 to improve water quality. The new dam is also approximately 1.2 meters (4 feet) high and is a fish passage barrier. Other improvements to the water system included adding a 567,750-liter (150,000-gallon) water storage tank in 1993. The lower reach of Bear Creek is occasionally completely dewatered by the diversion during low flow periods. Flows in Bear Creek are frequently as low as 1.9 liters per second (0.07 cubic feet per second) (Stantec Consulting 2002). Further modifications to the water system are underway to comply with State and Federal regulations for public drinking water quality and fire protection, including installing an additional 567,750-liter (150,000-gallon) storage tank.

The Jarbidge River Recovery Team has not targeted Bear Creek for establishing a potential local population† of bull trout. The recovery team believes that the existing six local populations in the Jarbidge River core area are sufficient for recovery purposes. Potentially suitable habitat conditions for bull trout may exist in Bear Creek, but there are no records of bull trout in this drainage and there is no access to allow for natural population expansion into this drainage. Also, a nonnative brook trout population in Bear Creek upstream of the barrier is considered a threat to bull trout recovery in the Jarbidge River Distinct Population Segment.

Buck Creek and Tributaries

Buck Creek is a western tributary to the lower West Fork of the Jarbidge River; Corral Creek is tributary to Buck Creek. Brook trout were present in lower Buck Creek as of 1969, and cutthroat trout were stocked back in 1936 (Johnson 1993d). Neither of these nonnative species are believed to still exist in the Buck Creek drainage. No bull trout were collected in either Buck Creek or Corral Creek during a July 1992 survey at unusually low flows (Johnson 1993d, 1993e) or in a 2002 survey (G. Johnson, NDOW, pers. comm. 2003a). Habitat conditions in the headwaters of Buck Creek were relatively poor in the 1990's due to hot season livestock grazing (Johnson 1993d, 1993e). However, recent habitat data collected by the Bureau of Land Management indicate that the lower portion of Buck Creek could potentially support bull trout at least seasonally (Klott and Burton 2003a).

The Jarbidge River Recovery Team has not targeted the Buck Creek drainage for establishing a potential local population of bull trout. There are no records of bull trout in this drainage, and the recovery team believes that the existing six local populations in the Jarbidge River core area are sufficient for recovery purposes. However, the recovery team supports performing future surveys in the Buck Creek drainage to detect any possible seasonal use by bull trout given the potentially suitable habitat conditions identified. Habitat conditions may be further improved through implementation of recovery actions, which may increase the likelihood of bull trout using these streams for foraging or other purposes.

Fox Creek

Fox Creek is a western tributary to the West Fork of the Jarbidge River. There are no historical records of bull trout in Fox Creek. Surveys in 1992, September 1998, and July 2000 also did not collect any bull trout (NDOW 1992, 2001; Johnson 1999). Habitat conditions in Fox Creek during 1992 were among the best of the streams within the West Fork Jarbidge River watershed (NDOW 1992). Substrate embeddedness† is low (10.7 percent in 1992), and water temperatures suitable for spawning have been documented in September and October (NDOW 1992, 2001). However, low flows (14.2 liters per second, 0.5 cubic feet per second) during the spawning season may restrict use of Fox Creek by bull trout for spawning and rearing (NDOW 1992, 2001). The Jarbidge River Recovery Team is not considering establishing a potential local population of bull trout in Fox Creek for recovery. However, the recovery team does recommend performing occasional surveys of Fox Creek to detect any use by bull trout for foraging or other purposes.

Jim Bob Creek

Jim Bob Creek is a 3.7-kilometer (2.3-mile) long tributary to Robinson Creek (see below), an eastern tributary to the East Fork of the Jarbidge River. Jim Bob Creek is located entirely on the Humboldt-Toiyabe National Forest just outside of the Jarbidge Wilderness. There are no historical records of bull trout in Jim Bob Creek. The existing narrow wetted channel (1 meter, 3.3 feet) and shallow depth (16 centimeters, 6.3 inches) may preclude use by bull trout (Klott and Burton 2003b). However, available data indicate that temperatures (average 7-day maximum temperatures of 9.6 to 11.5 degrees Celsius [49.2 to 52.7 degrees Fahrenheit] for 1999 to 2001) and flows (33.7 liters per second [1.19 cubic feet per second] near the mouth) are generally suitable for bull trout despite flow reductions from water diversions for the Jim Bob Pipeline (Frederick and Klott 1999; Klott and Burton 2003b).

Water has been diverted from Jim Bob Creek since 1954 when a concrete weir was constructed less than 0.8 kilometer (0.5 mile) downstream of the headwaters (Township 46 North, Range 59 East, Section 11, NW¼, NE¼, SE¼). From the weir, water was historically diverted into a ditch and a 45.7 centimeter (18-inch) culvert (Klott and Burton 2003b). The diversion was reconstructed in the 1970's using rock gabions† and a concrete dam, and a pipeline replaced the ditch. The Jim Bob Pipeline system now consists of approximately 362 kilometers (225 miles) of pipeline, 145 water troughs, seven reservoirs, and five water storage tanks (Klott and Burton 2003b). Currently, an estimated 4.4 to 5 liters per second (0.16 to 0.18 cubic feet per second) are diverted into a 15.2-centimeter (6-inch) pipeline (Klott and Burton 2003b). There are no known fish passage barrier structures in Jim Bob Creek downstream of the diversion to the Robinson Creek confluence (Frederick and Klott 1999). However, the stream gradient is 10 percent in a reach approximately 1.3 kilometers (0.8 mile) downstream of the diversion (Johnson, *in litt.*, 2003a).

Jim Bob Creek was surveyed in July 1993, and only redband trout were present (NDOW 1993; Johnson 1996c). One site on lower Jim Bob Creek was sampled in July 2000 and again no bull trout were collected (NDOW 2001). The Jarbidge River Recovery Team does not consider that establishing a potential local population of bull trout in Jim Bob and Robinson Creeks is necessary for recovery. However, the recovery team does support performing occasional surveys of Jim Bob Creek in the future to detect any use by bull trout for foraging or other purposes. Habitat suitability may be improved through implementation of recovery actionss, which may increase the likelihood of bull trout using this stream.

Robinson Creek

Robinson Creek is an eastern tributary to the East Fork of the Jarbidge River. It is located primarily on National Forest land just outside of the Jarbidge Wilderness, with private land at the mouth. No bull trout were collected at a single survey site on Robinson Creek on October 16, 1984, although a bull trout was collected that day in the East Fork of the Jarbidge River near the mouth of Robinson Creek at Robinson Hole (Johnson 1995a). In July and September 1993, eight sites in Robinson Creek were surveyed, but no bull trout were collected (NDOW 1993; Johnson 1995a). The entire length of Robinson Creek was intensively surveyed for bull trout in July 2000, but none were collected or observed (NDOW 2001). Temperatures (less than 1 degree Celsius change) and flows (5.6 percent reduction) in Robinson Creek are slightly affected by the ongoing diversion of water in its one tributary, Jim Bob Creek (see above) (Frederick and Klott 1999; Klott and Burton 2003b).

The Jarbidge River Recovery Team does not consider that establishing a potential local population of bull trout in Robinson and Jim Bob Creeks is necessary for recovery. However, the recovery team does support performing occasional surveys of Robinson Creek in the future to detect any bull trout use for foraging or other purposes. Habitat suitability may be improved through implementation of recovery actions, which may increase the likelihood of bull trout using this stream.

Other Streams in the Jarbidge River Watershed

Four major tributaries enter the mainstem Jarbidge River downstream of the confluence of the East and West Forks: Columbet, Dorsey, Cougar, and Poison Creeks. None of these streams are known to support bull trout either now or historically. The Jarbidge River Recovery Team has not identified any of these streams as habitat for potential local populations or increased abundance of migratory bull trout.

REASONS FOR DECLINE

Throughout their range in the lower 48 states bull trout have been negatively impacted by the combined effects of a variety of factors, including habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, entrainment[†], and the introduction of nonnative species. Habitat alteration, primarily through the construction of impoundments, dams, and water diversions, has fragmented habitats, eliminated migratory corridors, and isolated bull trout in the headwaters of tributaries (Rieman *et al.* 1997; Dunham and Rieman 1999; Spruell *et al.* 1999; Rieman and Dunham 2000). The reasons for decline specific to the Jarbidge River Distinct Population Segment are detailed below, and are classified according to the five factors that may negatively impact a species, leading to its decline, as identified in section 4(a) of the Endangered Species Act. Those five factors are:

(A) the present or threatened destruction, modification, or curtailment of its habitat or range;
(B) overutilization for commercial, recreational, scientific, or educational purposes;
(C) disease or predation;
(D) the inadequacy of existing regulatory mechanisms;
(E) other natural or manmade factors affecting its continued existence.

Dams and Diversions (Factor A)

The middle Snake River once supported summer and fall runs of chinook salmon (*Oncorhynchus tshawytscha*) and steelhead (*Oncorhynchus mykiss*) in the vicinity of the Bruneau River (Gilbert and Evermann 1894; Bowler *et al.* 1992; Dauble 2000). The headwaters of the Bruneau River were reportedly used for spawning by fall run chinook salmon (Gilbert and Evermann 1894), but salmonids were likely rare historically in the entire Bruneau River (Lay 2000). It is unclear what fish species besides salmon historically migrated from the Snake River into the Bruneau River and on into the Jarbidge River because of few historical survey records for these relatively inaccessible waters. Bull trout had not been reported in the Snake River as of the 1890's (Gilbert and Evermann 1894). However, the Bruneau River is considered historical habitat for bull trout (Conley 1993). It is likely that fluvial adult bull trout utilized this migratory corridor along with other fluvial and anadromous salmonids as occurs in other Snake River tributary systems. Therefore, the historical distribution and abundance of bull trout associated with the Jarbidge River Distinct Population Segment were both likely more expansive than currently observed and may have seasonally extended downstream well beyond the currently designated boundary of this population segment.

Dams on the Snake River constructed without fish passage facilities permanently eliminated two-way connectivity between fish in the Jarbidge River Distinct Population Segment and other bull trout populations. Bliss Dam (River

Mile 560.3) is located on the Snake River near Hagerman, Idaho, and became operational in 1950. C.J. Strike Dam (River Mile 494) is located near Grand View, Idaho, just downstream of the mouth of the Bruneau River; it became operational in 1952. Even prior to completion of these Snake River dams, earlier smaller-scale diversion structures on the lower Bruneau River affected fish passage and reduced flows in the reach between the Snake River and Hot Springs, Idaho. As early as the 1890's, Gilbert and Evermann (1894) noted that an irrigation dam across the lower Bruneau River had already completely blocked salmon access to the river.

The first decreed surface water rights from the Bruneau River were issued in 1875 for irrigation near Bruneau, Idaho (Lay 2000). Water diversions from the Bruneau River into the Buckaroo Ditch have occurred since at least April 1912. The existing diversion structures for the Buckaroo and Hot Springs ditches are fish passage barriers. Together, these two ditches and the South Side Canal divert approximately 1.95 cubic meters per second (69 cubic feet per second) of water from the lower Bruneau River (Lay 2000). This 23.2-kilometer (14.4-mile) reach of the lower Bruneau River is identified as water quality limited under section 303(d) of the Clean Water Act (33 USC 1251 *et seq*.) for flow alteration, nutrients, sediment, and temperature (Lay 2000; IDEQ 2002).

Downstream dams and diversions were contributing factors in the past decline of bull trout in the Jarbidge River Distinct Population Segment. However, the Jarbidge River Recovery Team does not consider these migration barriers to be a current limiting factor for recovery of bull trout. This distinct population segment has adequate quantities of accessible foraging, migration, and overwintering habitats that will be further enhanced through implementation of recovery actions and will be sufficient to support expected increases in bull trout abundance and distribution under recovered conditions. In addition, dams and diversion structures are currently serving to shield bull trout and other native species in these watersheds from the adverse effects of nonnative fish present in the Snake River system. Maintaining this artificial isolation also conserves the unique genetic characteristics of bull trout in this distinct population segment, which are surviving under less than optimal environmental conditions on the fringe of the species' historical range.

Isolation and Habitat Fragmentation (Factor A)

Bull trout in the Jarbidge River Distinct Population Segment are geographically separate from other bull trout populations in the Snake River Basin, which are over 240 river kilometers (150 river miles) away. They are also isolated from these other bull trout populations by impassable dams and diversion structures (See **Dams and Diversions** above). This artificial physical isolation has been maintained since at least the late 1800's (Gilbert and Evermann 1894).

A small, isolated group of bull trout such as that in the Jarbidge River Distinct Population Segment is susceptible to genetic drift without migration and exchange of individuals among populations (Spruell *et al.* 1999; Taylor *et al.* 2001; Spruell *et al.* 2002; Spruell *et al.* 2003). Currently, bull trout in two Jarbidge River local populations are believed to be most closely related genetically to bull trout in the Boise and Malheur River Basins of Idaho and Oregon (Spruell, *in litt.*, 1998; Spruell *et al.* 2003), which are tributaries to the Snake River downstream of the Bruneau River and located in the Columbia River Distinct Population Segment. Genetic analyses indicate that bull trout in the Dave Creek (13 samples) and West Fork Jarbidge River (24 samples) local populations exhibit some genetic divergence themselves (Spruell, *in litt.*, 1998; Spruell *et al.* 2003), which could be related to strong spawning stream fidelity. It may also indicate some measure of physical isolation among bull trout local populations within the Jarbidge River core area.

Recent research indicates that water temperature is more important in determining bull trout distribution than instream cover, channel form, substrate, and abundance of other native and nonnative salmonids (Dunham *et al.* in press). On a seasonal basis, elevated water temperatures can act as a thermal barrier limiting or halting salmonid migrations and are particularly stressful for species such as bull trout with summer and fall spawning migrations (Sauter *et al.* 2001).

Elevated temperatures may isolate fish in cooler streams or stream reaches where cold water refugia are found.

In the Jarbidge River core area, warm water temperatures may seasonally inhibit movement of bull trout between the East and West Forks of the Jarbidge River and between local populations in their tributaries (Appendix A). Loss of riparian habitat, instream flow reductions, and other channel-disturbing activities affecting stream shading, pools, woody debris, streambanks, and groundwater movement, have likely contributed to altering water temperature regimes and bull trout distribution within the Jarbidge River core area. Long-term regional climate change has also likely been a cumulative factor relating to increased stream temperatures, although there are insufficient local climatological and stream records to detect long-term air and water temperature trends. Temperatures of three streams in the Jarbidge River watershed (Dave Creek, Slide Creek, West Fork of the Jarbidge River) monitored during 1999 closely followed daily and seasonal air temperature fluctuations (Werdon 2000a).

The mainstem Jarbidge and Bruneau Rivers are currently unsuitable for bull trout during several months of the year due to warm water temperatures. Natural geothermal springs in the vicinity of Robinson Hole, Murphy Hot Springs, Indian Hot Springs, Hot Springs, and Bruneau, Idaho, also likely affect water temperatures in the lower East Fork of the Jarbidge River, mainstem Jarbidge River, and Bruneau River to some extent. Flows in the Bruneau River downstream of Hot Springs, Idaho, may primarily be from natural geothermal sources (springs and thermal groundwater) during late spring through early fall (Lay 2000), which corresponds with natural seasonal declines in cooler runoff water as well as increased irrigation diversions.

Isolation and habitat fragmentation were contributing factors in the decline of bull trout in the Jarbidge River Distinct Population Segment. However, under present circumstances the Jarbidge River Recovery Team does not consider the isolation from other bull trout populations to be a significant threat to recovery (See **Dams and Diversions** above). In fact, currently this isolation may play a beneficial role in protecting bull trout from the negative impacts of nonnative fishes present in the Snake River system. The recovery team does consider the isolation of local populations and habitat fragmentation within the Jarbidge River core area, especially from elevated water temperatures, to be a long-term limiting factor in bull trout recovery. The recovery team has identified recovery actions to address water temperature concerns, wherever possible, and to complete genetic analyses of all six local populations and migratory bull trout within the core area.

Inadequacy of Existing Water Quality Standards (Factor D)

State water quality standards for temperature are inadequate for bull trout in the Jarbidge River core area. In Nevada, eight water quality standards have been set for the beneficial use of aquatic life in the East and West Forks of the Jarbidge River (Nevada Administrative Code 445A.218-220). The water temperature standards in Nevada are 21 degrees Celsius (67 degrees Fahrenheit) for May through October, and 7 degrees Celsius (45 degrees Fahrenheit) for November through April, with a less than 1 degree Celsius (2 degrees Fahrenheit) change for beneficial uses. The May through October standard exceeds temperatures conducive to bull trout spawning, incubation, and rearing (Rieman and McIntyre 1993; Buchanan and Gregory 1997).

The lower reaches of the East and West Forks of the Jarbidge River in Idaho are in a State-designated Bull Trout Key Watershed (Batt 1996). Water temperature criteria for key watersheds are set at a maximum weekly maximum temperature of 13 degrees Celsius (55.4 degrees Fahrenheit) or less between June and August for juvenile bull trout rearing and a daily average temperature of 9 degrees Celsius (48.2 degrees Fahrenheit) or less during September and October for spawning (Idaho Administrative Code 58.01.02.250.02.g). The Idaho Department of Environmental Quality will propose water quality standards (Total Maximum Daily Loads for pollutants) in the mainstem Jarbidge River by 2007 under section 303(d) of the Clean Water Act as part of a legal settlement agreement (Idaho Conservation League and The Lands Council *v*. Environmental Protection Agency and Idaho Department of Environmental Quality; Civ. No. C00-972 Z, W.D. Wash.). At this time, the potential designated beneficial uses and water quality standards for the Jarbidge River are unknown.

The majority of available water quality data for streams within the Jarbidge River Distinct Population Segment are for water temperatures. Thermographs have been used to record temperatures over time in a number of headwater streams, as well as the East and West Forks of the Jarbidge River, mainstem Jarbidge River, and Bruneau River (Appendix A). A recent study relating bull trout distribution and abundance with water temperature concluded that the overall mean water temperature at a site was most closely associated with bull trout abundance (Gamett 2002). At sites where the mean water temperature was below 10 degrees Celsius (50 degrees Fahrenheit), bull trout were present; no bull trout were present at sites with mean temperatures above 12 degrees Celsius (53.6 degrees Fahrenheit) (Gamett 2002). The U.S. Environmental Protection Agency is recommending a 13 degree Celsius (55.4 degree Fahrenheit) 7-day average daily maximum temperature for bull trout rearing waters, equivalent to a summer mean temperature of 8.5 to 11 degrees Celsius (47.3 to 51.8 degrees Fahrenheit) (EPA 2002).

In 1999, overall mean water temperatures for 31 sites on three streams (Dave Creek, Slide Creek, West Fork of the Jarbidge River) in the Jarbidge River watershed were all less than 10 degrees Celsius (50 degrees Fahrenheit); bull trout were present at some, but not all, sites on each stream (Werdon 2000a). Daily average water temperatures were recorded in 1994 at three sites further downstream in the Jarbidge River core area: 1) 15.2 degrees Celsius (59.4 degrees Fahrenheit) downstream of the confluence of the East and West Forks of the Jarbidge River (June 29 to October 16); 2) 19.2 degrees Celsius (66.6 degrees Fahrenheit) in the Jarbidge River upstream of the Bruneau River confluence (June 28 to September 23); and 3) 24.6 degrees Celsius (76.3 degrees Fahrenheit) in the Bruneau River near Hot Springs, Idaho (June 28 to August 7) (Robertson 1995). In 1995, water temperatures near the mouth of the Jarbidge River were 3 to 7 degrees Celsius (5.4 to 12.6 degrees Fahrenheit) cooler than in the Bruneau River near the confluence (Robertson 1996).

Other water quality characteristics, in addition to temperature, have been periodically monitored since 1966 at stations established upstream and downstream of Jarbidge on the West Fork and upstream of Murphy Hot Springs on the East Fork by the Nevada Division of Environmental Protection. Also, site-specific water quality measurements have been recorded throughout the Jarbidge River watershed. It is unknown whether the current Nevada standards established for water quality characteristics other than temperature (*e.g.*, turbidity, suspended solids, fecal coliform, etc.) are adequate to protect bull trout.

Potentially toxic materials that have been detected in Nevada bull trout waters include arsenic and iron. Arsenic (50 micrograms per liter, 0.05 parts per million) was detected in effluent (pH 6.27) from the Gray Rock shaft at the Elkoro Mine in 1977 and at another site downstream of Jarbidge (McNeill *et al.* 1997). However, the levels of arsenic detected were well below the aquatic life standards (acute 1-hour exposure of 342 micrograms per liter [0.342 parts per million]; chronic 96-hour exposure of 180 micrograms per liter [0.18 parts per million]) set by the State of Nevada (Nevada Administrative Code 445A.144) and would be further diluted upon entering the West Fork of the Jarbidge River. Soluble iron levels downstream of the community of Jarbidge typically exceed 300 micrograms per liter (McNeill *et al.* 1997), but are lower than the State standard for aquatic life of 1,000 micrograms per liter (1 part per million) (Nevada Administrative Code 445A.144).

Water samples from the 4M Mine and Pavlak adits[†] were collected by the U.S. Forest Service in August 2002. Laboratory analyses of the samples indicate that the 4M Mine sample did not meet beneficial use standards designated for the West Fork of the Jarbidge River for some elements (*e.g.*, copper, silver, iron, lead, and zinc), however, further dilution would occur upon entering the West Fork (P. Gabby, U.S. Forest Service, *in litt.*, 2003; S. Wiemeyer, U.S. Fish and Wildlife Service, pers. comm. 2003). Detection limits for analysis of some sample parameters were not low enough to determine if beneficial use standards were exceeded, so additional sampling may be warranted (S. Wiemeyer, pers. comm. 2003).

Water quality was a contributing factor in the past decline of bull trout in the Jarbidge River Distinct Population Segment, particularly water quality problems associated with historical mining, livestock grazing, and forest management practices. The Jarbidge River Recovery Team considers water temperature to be a limiting factor in bull trout recovery. The recovery team will provide input to States and the Environmental Protection Agency to assist in revising water quality standards for temperature to better protect all bull trout life stages and life history strategies. More importantly, the recovery team has identified recovery actions to directly address water temperature concerns at the ground level, wherever possible.

Livestock Grazing (Factors A and E)

Livestock grazing has occurred in upland and riparian areas throughout most of the Jarbidge River watershed on both public and private lands. Grazing dates back to at least 1885, and during the period from 1885 to 1909 severe overgrazing by sheep was common practice in the watershed (Wilson 1906). By current standards, managed heavy sheep grazing continued until the 1930's, gradually diminishing until all grazing was eliminated in the upper watershed in 1960 (McNeill *et al.* 1997).

Cattle grazing (39,973 Animal Unit Months[†]) and limited sheep grazing (150 Animal Unit Months) still occur in the middle and lower portions of the Jarbidge River watershed (Frederick and Klott 1999; Blattel-Sam 2003; Klott and Burton 2003b). Three bull trout local populations (Dave Creek, Jack Creek, and Slide Creek) are directly or indirectly affected by livestock grazing to varying degrees. Bull trout foraging, migration, and overwintering habitat on the East Fork of the Jarbidge River is directly affected by livestock trailing at one crossing site near Murphy Hot Springs, Idaho. Livestock also periodically have access to the mainstem Jarbidge River from a few grazing allotments. However, there was no evidence of recent livestock use or impacts to bull trout habitat at one of these access locations at the mouth of the Jarbidge River during a recent inspection (Burton 2003).

Extensive livestock grazing occurs within many of the tributary drainages to the mainstem Jarbidge River with some localized problem areas. Although these intermittent and perennial mainstem tributaries are not known to support bull trout, grazing in these drainages can have indirect effects on bull trout because they flow into foraging, migration, and overwintering habitat. These same intermittent and perennial drainages and others higher in the watershed also have numerous small water diversions, water retention structures, and spring developments, which are used to supply an extensive network of stock watering pipelines, troughs, tanks, ponds, and reservoirs in Idaho and Nevada (Frederick and Klott 1999; Klott and Burton 2003b; Blattel-Sam 2003). Cumulatively, livestock water developments directly or indirectly affect flows and temperatures in some stream reaches, but effects may be nearly undetectable in most occupied bull trout habitats.

Overutilization of riparian vegetation by livestock can lead to a decline in plant health and loss of plant species that cover and stabilize streambanks with their root systems. The compacting and cutting action of livestock hooves on moist soils causes sloughing of banks where localized use for feeding, watering, and crossing occurs. The indirect effects of intensive livestock use are to increase stream bank erosion and widen the stream channel, increase embeddedness of the streambed substrate, and increase water temperatures (habitat degradation, Factor A). Livestock may also cause direct mortality of eggs or fry if redds (spawning beds) are trampled during watering or crossing (Factor E). This is a significant concern for the Dave Creek local population where livestock have direct access to the bull trout spawning and rearing habitat.

Livestock grazing was a contributing factor in the past decline of bull trout in the Jarbidge River Distinct Population Segment. The Jarbidge River Recovery Team considers livestock grazing to be a current limiting factor for bull trout recovery. This is primarily due to its effects on the Dave Creek local population, which has the most extensive known bull trout spawning and rearing habitat in the Jarbidge River core area. Dave Creek also contains bull trout that are genetically differentiated from those in the West Fork Jarbidge River local population (Spruell, *in litt.*, 1998; Spruell *et al.* 2003) and perhaps other local populations as well. Addressing grazing concerns in two other local populations (Jack Creek, Slide Creek) and foraging, migration, and overwintering habitats (lower East Fork and mainstem Jarbidge River) will also contribute to achieving recovery through increased bull trout abundance, but to a lesser extent than from expansion of the Dave Creek local population.

Transportation Networks (Factor A)

Overall road density is relatively low in the Jarbidge River watershed (U.S. Department of Agriculture and U.S. Department of the Interior 1998). However, high road densities (1.9 kilometers per square kilometer, 3.1 miles per square mile) occur in some portions of the watershed and impact watershed hydrology (Bockelman *et al.* 2002). Several unsurfaced, well-traveled roads are located parallel to or cross streams that are important bull trout habitats. Federal and local agency road construction, reconstruction, and maintenance have had and continue to have adverse effects on water quality and aquatic and riparian habitat in the Jarbidge River watershed. Poorly located and designed roads are constant sources of soil movement into adjacent stream systems through road maintenance, erosion, and vehicle use (Furniss *et al.* 1991; Lee *et al.* 1997). Roads are also conduits for related impacts such as noxious weed introductions, illegal transplants[†] of predatory or competing nonnative fishes, increased fishing harvest pressure and potential for poaching, dispersed recreation impacts, and introductions of toxic materials from vehicle spills.

Riparian roads have eliminated or reduced riparian vegetation through direct removal during construction activities and hazard tree removal, or indirectly through physiological stress from soil disturbance and compaction, root exposure, mechanical damage from passing vehicles and maintenance equipment, roadside application of herbicides, and potentially even applications of dust abatement compounds to road surfaces. Some remaining trees and shrubs along roads in the canyon of the West Fork of the Jarbidge River also exhibit insect galls, fungal infections, and mistletoe (Bockelman *et al.* 2002). Riparian vegetation functions that can be compromised by roads include streambank stability, stream shading, detritus and instream wood contributions, and sediment filtration.

Roads located in the canyon bottoms along the East and West Forks of the Jarbidge River restrict channel migration. Bank erosion has occurred in numerous stream reaches alongside roads in the Jarbidge River watershed with little or no intervening riparian vegetation, particularly where valley bottom widths are constricted (Bockelman *et al.* 2002). In addition, the width and/or density of riparian vegetation between roads and streams is often too narrow to hold back soil moving from the roads into the streams. Soil movement from road systems where the riparian vegetation zone is insufficiently wide to intercept this material can increase the water turbidity levels, increase embeddedness of the streambed substrate, fill pool habitats, create bank erosion, and gradually widen stream channels.

The existing road transportation network in the Jarbidge River watershed was a contributing factor in the decline of bull trout in the Jarbidge River Distinct Population Segment. The Jarbidge River Recovery Team considers roads to be a current limiting factor in the recovery of bull trout due to impacts on water quality, stream channels, and riparian habitats in foraging, migratory, and overwintering habitats. Addressing the impacts from road maintenance along the East and West Forks of the Jarbidge River will contribute to achieving recovery by improving habitat for migratory bull trout, maintaining connectivity among bull trout local populations for genetic exchange, and providing for increased bull trout abundance.

Fisheries Management

Harvest (Factor B)

Bull trout tend to forage aggressively and are easily caught by anglers using bait and lures, and therefore can be subject to overfishing (Boag 1987; Rode 1990). The West Fork of the Jarbidge River was considered heavily fished as early as 1934 (Durrant 1935). In 1961, estimated angler days per year for the West Fork in Nevada were 500 to 1,000, but by 1975 had increased to 3,830 angler days (NDOW 1961, 1975). Fishing pressure in both the East and West Forks within Nevada in the mid-1980's averaged 1,645 and 1,181 angler days per year, respectively (Johnson 1990). By the 1990's, fishing pressure in Nevada was estimated at between 1,500 to 3,500 angler days per year on the West Fork and

500 to 1,500 angler days on the East Fork (P. Coffin, U.S. Fish and Wildlife Service, pers. comm. 1996). Estimated fishing pressure for the Jarbidge River in Idaho is 500 angler days per year, primarily concentrated in the summer and fall seasons (Frederick and Klott 1999).

Potential overharvest of bull trout in the Jarbidge River watershed was first identified as a threat to the species by the State of Nevada (Johnson 1990). An estimated 100 to 400 bull trout were being harvested annually in Nevada before the species was proposed for listing and harvest regulations were modified (P. Coffin, U.S. Fish and Wildlife Service, pers. comm. 1994; P. Coffin, U.S. Fish and Wildlife Service, *in litt.*, 1995). Sizes of angler-harvested bull trout ranged from 150 to 305 millimeters (6 to 12 inches) in the West Fork and 150 to 180 millimeters (6 to 7 inches) in the East Fork (Johnson 1990). The Dave Creek local population has also experienced some fishing pressure, albeit much lighter. Anglers fishing there reported good success in catching bull trout during the 1970's; an average 23 angler days per year were spent fishing Dave Creek during the 1980's (Johnson 1995b). The Fall Creek local population has also received light fishing pressure with average angler days per year of 16 during the 1970's and 2.4 in the 1980's (Johnson 1996b).

Fishing regulations in Nevada allowed harvest of up to 10 trout (any species combination) per day in the Jarbidge River watershed until 1998, when fishing regulations were amended to prohibit harvest of bull trout. Harvest limits for native redband trout and stocked rainbow trout were also reduced to five fish in 1998. The fishing season in Nevada is currently open year-round, although high spring flows and weather-related access typically restrict fishing activity during a significant portion of the year in the Jarbidge River watershed.

Trout fishing regulations for the Jarbidge River system in Idaho have varied greatly since 1945. Generally, regulations went from a 15- to 20-trout (any species) limit with restrictions on fish less than 152 millimeters (6 inches) in the 1940's and 1950's to a 6- to 10-trout limit with restrictions on larger fish (305 to 406 millimeters,12 to 16 inches) in the 1970's and 1980's (F. Partridge, IDFG, *in litt.*, 1998). A two-trout limit was established for all species in 1992, and Idaho prohibited the harvest of bull trout beginning in 1995. No historical data are available on angler harvest rates for bull trout in the Idaho portions of the watershed. The Jarbidge River and its tributaries in Idaho are currently designated as Wild Trout streams and have a two-trout limit, with no gear or bait restrictions, and the fishing season is open from Memorial Day weekend through November each year (IDFG 2002).

Intentional illegal harvest (poaching) of bull trout occurs at least occasionally in the Jarbidge River watershed (Parrish, *in litt.*, 2001). However, incidental illegal harvest of bull trout is probably more common, and misidentification of bull trout by anglers is likely the most frequent cause (Schmetterling and Long 1999; Schmetterling *et al.* 1999). One key to bull trout recovery will be to increase recognition of bull trout among anglers and the non-angling public.

Angler harvest of bull trout was a contributing factor in the decline of bull trout in the Jarbidge River watershed. The Jarbidge River Recovery Team considers harvest and incidental mortality of released bull trout from recreational angling, especially loss of migratory individuals, to be a current limiting factor for bull trout recovery. Migratory bull trout are at greater risk from harvest than the resident form because of their lower numbers, road-accessible stream habitats, high fish visibility due to water clarity and low flows, biannual migration through or residence in human-populated areas, and more desirable larger size. These migratory fish are essential for recovery by providing opportunities for natural genetic exchange among local populations of bull trout in the Jarbidge River core area. The recovery team has identified recovery actions to evaluate current angling regulations and other means of minimizing loss of bull trout through angling.

Nonnative Species (Factor E)

Nonnative salmonids have been introduced in the Jarbidge River and its tributaries dating back to the earliest fisheries surveys. Stocking of cutthroat trout in the West Fork of the Jarbidge River was recommended in 1935 due to heavy fishing pressure and the relatively small size of the native rainbow (redband) trout in this cold, relatively unproductive stream (Durrant 1935). Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*) were stocked in the West Fork of the Jarbidge River sometime prior to 1960 (Frederick and Klott 1999). However, no cutthroat trout were collected in later fisheries surveys of the West Fork from 1961 to the present. Cutthroat trout were also stocked in Buck Creek, a lower tributary to the West Fork in 1936 (Johnson 1993d). The impact to bull trout from the temporal presence of cutthroat trout in the Jarbidge River watershed is unknown, but was likely minimal.

Brook trout were introduced into the Jarbidge River watershed in Nevada as early as 1954, and over 2,270 kilograms (5,000 pounds) were stocked in the West Fork prior to 1961 (NDOW 1961; Johnson 1993b). Approximately one percent of the angler harvest on the West Fork from the 1960's through the 1980's consisted of brook trout (Johnson 1990). Brook trout were also reported from lower Buck Creek in 1969 (Johnson 1993d). However, brook trout failed to establish self-sustaining populations in these two streams. One introduced population has persisted in Emerald Lake at the headwaters of the East Fork of the Jarbidge River. Emerald Lake lacks a defined outlet to the East Fork, so natural movement into nearby bull trout habitat appears unlikely.

Brook trout were also present in Bear Creek, a tributary to the West Fork, during 1962 and 1963, although there are no stocking records for this stream (Johnson 1993b). At least one private stocking transplanted unknown trout species from Deep Creek in the Bruneau River watershed into Bear Creek in 1987 (Johnson 1993b). Brook trout were rediscovered in Bear Creek in 2002, and 39 brook trout of various sizes were removed that year (J. Harvey, U.S. Forest Service, pers. comm. 2002; G. Johnson, NDOW, pers. comm. 2003a). Additional brook trout from this same population were removed in 2003 (G. Johnson, NDOW, pers. comm. 2003b). It is unknown if this population has persisted undetected for decades or represents a more recent unauthorized introduction. Brook trout adversely impact bull trout populations through both competition and hybridization (Dambacher *et al.* 1992; Rich, Jr. 1996; Gunckel *et al.* 2001, 2002; Kanda *et al.* 2002).

Although native redband trout were and are abundant in the Jarbidge River watershed, hatchery rainbow trout have been stocked since at least the 1960's (NDOW 1961). Approximate numbers of catchable-size rainbow trout stocked annually in the West Fork of the Jarbidge River in Nevada from the 1970's through 1998 (except 1991) ranged from 2,000 to 4,242 fish (Johnson and Weller 1994; Johnson, *in litt.*, 2003a). The Idaho Department of Fish and Game also stocked a total of approximately 52,783 hatchery rainbow trout in the lower East (75 percent) and West (25 percent) Forks of the Jarbidge River from 1970 through 1989 (Partridge, *in litt.*, 1998). After 5 years without any stocking, hatchery rainbow trout in the West Fork are likely gone from the river (Johnson, *in litt.*, 2003a), through both size-selective angler harvest and natural mortality. Bull trout using the lower East and West Forks and mainstem Jarbidge River for foraging, migration, and overwintering have undoubtedly already benefitted from reduced interactions with these nonnatives.

Nonnative species were likely a contributing factor in the past decline of bull trout in the Jarbidge River Distinct Population Segment, but apparently only through competition and predation since hybridization has not been evident to date. The Jarbidge River Recovery Team considers the continued presence of brook trout in the immediate vicinity of one bull trout local population (East Fork Jarbidge River) and another source of brook trout (Bear Creek) intermittently connected to an important bull trout migratory corridor (West Fork of the Jarbidge River) to be a current limiting factor for bull trout recovery because of future hybridization and transplant concerns.

<u>Forest Management Practices (Factor A)</u>

The U.S. Forest Service authorized timber harvest in parts of the Jarbidge River watershed starting in 1910, and numerous private and commercial logging and lumber milling operations were established (Mathias and Berry 1997). This timber was used locally by miners and settlers for houses, mine buildings, and underground mine timbers. Forested slopes at the headwaters of the West Fork of the Jarbidge River were the most heavily harvested, along with the Deer Creek drainage (Schrader 1923). The riparian vegetation functions that are generally compromised by timber harvest activities include streambank stability, overhead shade, detritus and instream wood contributions, and sediment filtration.

No large-scale timber harvest is currently authorized on public lands in the Jarbidge River watershed. Dead wood may be gathered and used as firewood by recreationists in the Jarbidge Wilderness. Fuelwood cutting is prohibited in the Jarbidge Wilderness, West Fork Jarbidge River canyon, Bear Creek watershed, INFISH Riparian Habitat Conservation Areas, and U.S. Forest Service administrative and recreation sites (Blattel-Sam 2003). A limited Christmas tree harvest is allowed in certain areas via individual permit. However, unauthorized harvest and removal of instream and riparian large wood from public lands is still occurring, especially in areas along the East and West Forks of the Jarbidge River with road access (McNeill *et al.* 1997). The abundance of instream large wood is significantly lower in the West Fork of the Jarbidge River downstream of the Jarbidge Wilderness boundary (McNeill *et al.* 1997). This wood is removed for use as firewood and fuelwood and wherever it is perceived as a potential threat to private property and public roads and bridges in future flood events. Land management agencies have a limited presence due to the size and remote location of the Jarbidge River watershed, and therefore, harvest regulations on public lands are not enforced.

Forest management practices were one of the contributing factors in the past decline of bull trout in the Jarbidge River Distinct Population Segment. The Jarbidge River Recovery Team considers the ongoing loss of large woody debris to be a limiting factor for bull trout recovery due to detrimental impacts on natural stream processes such as pool formation in bull trout foraging, migration, and overwintering habitats.

Mining (Factor A)

The Jarbidge River watershed has a legacy of mining activity, primarily in the upper watershed in Nevada. The discovery of gold in the canyon of the West Fork of the Jarbidge River in 1909 was immediately followed by additional exploration and mine and mill development. Active mining in the area continued until the 1930's. The last major mine and mill shut down in 1936 (Mathias and Berry 1997). However, there are still several small, inactive mining operations in the watershed. Only limited new mineral exploration and mine reclamation activities are still occurring.

The earliest report of water quality problems in the Jarbidge River watershed was linked to mining activities. In a 1934 survey of the West Fork, impacts to water quality and fish populations were noted starting 3.2 kilometers (2 miles) upstream of the community of Jarbidge, with the river downstream too badly polluted by mine tailings for fish to survive (Durrant 1935). In November 1908, fish had been reported to be "plentiful" in this same reach of river (Mathias and Berry 1997). Mills located on the West Fork used cyanide for processing ore; some dumped their tailings directly into the river, while others were located upslope and runoff from tailings piles likely drained into the river (Schrader 1923; Mathias and Berry 1997). Most trout species native to cold, relatively unproductive waters are suited to a pH range of 6.5 to 9, and higher water temperatures reduce tolerance of pH extremes (Piper *et al.* 1982). Durrant (1935) reported a pH of 5 for a water sample from the West Fork, documenting acidic conditions in association with a maximum water temperature of 15.6 degrees Celsius (60 degrees Fahrenheit).

Dewatering was required at some historic mines on the West Fork, including the Gray Rock shaft at the Elkoro Mill, the Pavlak adit, and the Norman Mine (Schrader 1923; Camozzi 1942; McNeill *et al.* 1997). This groundwater effluent was thermally elevated and was discharged or drained into the West Fork, likely seasonally increasing stream temperatures to levels unsuitable for bull trout. From 1937 to 1941, pumped discharge from the Gray Rock shaft alone increased from approximately 76 liters per second (2.7 cubic feet per second) to over 800 liters per second (29 cubic feet per second) as the shaft became deeper (Camozzi 1942). This volume of discharged water greatly exceeded the base flow in the West Fork, which typically drops below 113 liters per second (4 cubic feet per second) each year. Estimated total discharge from the Gray Rock shaft during 1937 to 1941 was 26,500,000 cubic meters (21,500 acre-feet) of water (Camozzi 1942). Small volumes of water (2.65 liters per second, 0.09 cubic feet per second) still issue from the Gray Rock and Pavlak sites; the Norman Mine site has not been inspected recently (McNeill *et al.* 1997).

Mining was a significant contributing factor in the decline of bull trout in the Jarbidge River Distinct Population Segment. The cumulative effects of several other factors are also directly or indirectly linked to the mining era (*e.g.*, Forest Management Practices, Transportation Networks, Residential Development and Urbanization, Fisheries Management). The Jarbidge River Recovery Team does not consider the residual impacts from historical mining to be a limiting factor for bull trout recovery. However, the recovery team has identified recovery actions to address water quality and temperature concerns, if necessary, and to restore aquatic and riparian habitats associated with tailings sites as a conservation measure.

Residential Development and Urbanization (Factor A)

The communities of Jarbidge, Nevada, and Murphy Hot Springs, Idaho, were established during the gold mining boom and are located on the West and East Forks of the Jarbidge River, respectively. The peak population of Jarbidge was estimated at 1,500 in 1910 (Mathias and Berry 1997). However, the populations of both communities are now small and relatively stable with perhaps 175 seasonal and 25 year-round residents combined. Both communities are surrounded by public lands and are located in narrow river canyons, which limits opportunities for increased residential development. Most existing structures are in floodplain[†] areas, and flood protection and property restoration measures are undertaken periodically, as needed. However, these measures (*e.g.*, bulldozing in stream channels, large woody debris removal, and rock gabion construction) have not always been implemented with consideration of environmental effects.

Residential developments and associated human disturbance impact riparian vegetation, streambanks, water quality, and stream flows through stream channelization[†], bank stabilization, water diversions, instream wood removal, nutrient loading from septic systems and lawn fertilization, and road construction, maintenance, and dust abatement. The developed stream reaches associated with

Jarbidge and Murphy Hot Springs are within foraging, migration, and overwintering habitat for bull trout.

Residential development was a contributing factor in the decline of bull trout in the Jarbidge River Distinct Population Segment. However, the Jarbidge River Recovery Team does not consider residential development to be a limiting factor in bull trout recovery. New development is relatively confined, and ongoing impacts to bull trout from the two small communities themselves are localized and relatively minor. However, maintaining adequate conditions for fish passage through these developed stream reaches is essential for maintaining the connectivity among local populations of bull trout in the Jarbidge River core area required for recovery. The recovery team has identified actions to improve aquatic and riparian habitat conditions for bull trout throughout the Jarbidge River core area, which could have conservation benefits for bull trout if implemented in stream reaches adjacent to these residential developments in cooperation with willing landowners.

Recreation (Factor A)

Recreationists in the Jarbidge River watershed participate in a variety of activities on public lands such as camping at developed and dispersed recreation sites, hunting, fishing, picnicking, hiking, backpacking, horseback riding, on- and off-road vehicle use, and white-water trips. Three commercial outfitter guides operate in the Jarbidge Wilderness and use established base camps in the Humboldt-Toiyabe National Forest, while other commercial operations provide whitewater trips on the mainstem Jarbidge River and downstream in the Bruneau River. Three of seven Jarbidge Wilderness access portals are located in the Jarbidge River watershed.

Heavy use of some recreation sites on public land has impacted riparian vegetation and streambanks, particularly along the East and West Forks of the Jarbidge River. Both the Bureau of Land Management and U.S. Forest Service have implemented projects to reduce physical impacts to streams and riparian areas from public recreational use in the Jarbidge River watershed. Recreation was a contributing factor in the decline of bull trout in the Jarbidge River Distinct Population Segment, primarily from fishing (See **Fisheries Management** above). The Jarbidge River Recovery Team does not consider ongoing recreational activities to be a limiting factor for bull trout recovery in the Jarbidge River Distinct Population Segment, with the possible exception of off-road vehicle use which is increasing in streams and riparian areas.

ONGOING CONSERVATION MEASURES

Activities beneficial to recovering bull trout are ongoing in the Jarbidge River Distinct Population Segment, through both individual and cooperative efforts by the Bureau of Land Management, Duck Valley Shoshone-Paiute Tribes, Idaho Department of Fish and Game, Nevada Department of Wildlife, U.S. Fish and Wildlife Service, U.S. Forest Service, conservation groups, and other entities. The section below represents some of the completed and ongoing efforts within the distinct population segment. These proactive efforts are encouraging for long-term bull trout conservation and recovery.

Bureau of Land Management

The Bureau of Land Management has implemented several actions to reduce impacts of recreational activities (*e.g.*, camping, boating) on riparian habitats and water quality at dispersed and developed recreation sites. Projects have included armoring exposed soils in heavy use areas, physically delimiting use areas, and providing sanitary facilities. The Bureau is also establishing forage utilization standards in livestock grazing allotments containing bull trout habitat. Livestock exclusion fences have been constructed and additional riparian fencing is proposed to protect streams and springs.

The Bureau of Land Management has recently been monitoring stream and riparian habitat conditions in some bull trout habitats and also performed an initial bull trout spawning survey on one stream in 2001. The Bureau has also provided cost-share funding for several bull trout surveys by the Idaho Department of Fish and Game within the Jarbidge River Distinct Population Segment.

Idaho Department of Fish and Game

The Idaho Department of Fish and Game has implemented numerous changes to reduce impacts of fisheries management activities on bull trout. Specifically, the Department ceased stocking rainbow trout in 1990, and has modified fishing regulations in the Jarbidge River watershed to protect bull trout. In 1995 it became illegal to harvest bull trout in the Idaho portion of the watershed. The Idaho Department of Fish and Game has also reduced daily harvest and possession limits on other trout species (from six to two), shortened the fishing season, developed and distributed bull trout identification posters in cooperation with Federal agencies, and posted a bull trout sign along a major watershed access route to inform anglers of their presence in the basin. In addition, the Department has completed several bull trout surveys and monitored water temperatures in bull trout streams. Research specifically targeting fluvial bull trout was performed in 1998 and 1999.

Jarbidge Bull Trout Task Force

In 1994, a local watershed group was formed to gather and share information on bull trout in the Jarbidge River. Although currently inactive, the Jarbidge Bull Trout Task Force is open to representatives from Elko and Owyhee counties, residents of Jarbidge and Murphy Hot Springs, County road districts, private landowners, Nevada Department of Wildlife, Idaho Department of Fish and Game, Bureau of Land Management, U.S. Forest Service, and U.S. Fish and Wildlife Service. The task force obtained nearly $150,000 in 1997 to replace the Jack Creek culvert with a bridge to restore bull trout access into Jack Creek. Bull trout were rediscovered in Jack Creek in 1999.

Nevada Department of Wildlife

The Nevada Department of Wildlife has implemented several changes to reduce impacts of fisheries management activities on bull trout in the Jarbidge River watershed. In 1998 it became illegal to harvest bull trout in the Nevada portion of the basin. The Nevada Department of Wildlife has also reduced limits on other trout species (from 10 to 5), eliminated rainbow trout stocking, and developed and posted bull trout identification signs to provide information to anglers. In addition, the Department has completed numerous fish surveys and monitored water temperatures in many bull trout streams.

Nevada Division of Environmental Protection

The Nevada Division of Environmental Protection, in cooperation with the U.S. Forest Service, installed observation wells and initiated monitoring of groundwater to detect any leachate movement associated with a recently-closed landfill in 1999. The landfill perimeter is located within 14 meters (45 feet) of the West Fork of the Jarbidge River. This landfill served the town of Jarbidge since at least the 1940's, and any leachate could contain hazardous substances. The Nevada Division of Environmental Protection also routinely monitors surface water quality in the East and West Forks of the Jarbidge River.

U.S. Fish and Wildlife Service

We have and will continue to provide input to Federal land management agencies on ways to minimize and mitigate impacts of numerous proposed projects on bull trout through the section 7 process of the Endangered Species Act. We have collected stream temperature data and conducted fish and habitat surveys in the Jarbidge River watershed. In addition, we have provided funding for bull trout surveys and research conducted by the Nevada Department of Wildlife and Idaho Department of Fish and Game. We have also funded and produced a videotape on bull trout recovery with a rangewide perspective, which is available for use locally.

U.S. Forest Service

The U.S. Forest Service has implemented several actions to reduce impacts of various land management activities on bull trout. The agency has installed livestock exclosure and drift fences to protect springs and riparian areas and improve water quality, relocated livestock water pipelines, and modified grazing strategies in nine allotments. Related to recreation, the U.S. Forest Service relocated an outfitter guide camp away from a bull trout stream, increased enforcement of the existing firewood/fuelwood cutting and gathering closures, and hardened several intermittent stream road crossings that access recreation sites to reduce sedimentation into bull trout habitat downstream. Mining-related projects have included reclamation of old mine sites involving recontouring and seeding access roads and mine pads, closing adits, and testing water quality from mine shaft drainage.

The U.S. Forest Service reconstructed a reach of the West Fork of the Jarbidge River in the South Canyon area damaged in 1998 by unauthorized road construction. This project included channel reconstruction, hillside slope stabilization, and riparian vegetation plantings. Although the hillside slope stabilization site has since been damaged through additional road construction by private individuals, the restored river channel is still functioning as designed and provides a migratory corridor for bull trout.

RELATIONSHIP TO OTHER CONSERVATION/PLANNING/RECOVERY EFFORTS

State of Idaho

The Idaho Department of Fish and Game developed a draft management plan for bull trout in 1993 (Conley 1993). A separate State of Idaho Bull Trout Conservation Plan was subsequently approved in July 1996 (Batt 1996). The conservation plan identifies an overall mission of maintaining or restoring interacting groups of bull trout throughout the species' native range in Idaho and four goals to accomplish the mission: 1) maintenance of habitat conditions in areas supporting bull trout; 2) instituting cost-effective strategies to improve bull trout abundance and habitats; 3) establishing stable or increasing bull trout populations in a set of well-distributed subwatersheds[†]; and 4) providing for the economic viability of industries in Idaho (Batt 1996).

The overall approach of the State's conservation plan was to use existing, locally-developed groups of people established by Idaho legislation (*i.e.*, watershed advisory groups and basin advisory groups), which were formed to strengthen water quality protection and improve compliance with the Clean Water Act. With the assistance of technical advisory teams, watershed advisory groups were to develop problem assessments in 59 key watersheds in the state containing bull trout and submit the problem assessments to the basin advisory groups by January 1999. The problem assessments were then to be used in developing a conservation plan for each key watershed in Idaho, with at least six conservation plans developed per year.

The Technical Group of the Southwest Basin Native Fish Watershed Advisory Group in Idaho has prepared a Jarbidge River Watershed problem assessment report for bull trout (Parrish 1998). This document identifies short-term action items for implementation in the watershed including reducing road impacts, increasing angler education and angling regulation enforcement, and reducing livestock impacts through riparian fencing and alternative watering methods. This draft recovery plan for bull trout in the Jarbidge River Distinct Population Segment relies, in part, on information contained in this problem assessment, although the associated conservation plan has not yet been completed.

<u>State of Nevada</u>

In 1990, the Nevada Division of Wildlife prepared a management plan for bull trout that recommends management alternatives to ensure that human activities do not jeopardize the future of bull trout in Nevada (Johnson 1990). The recommended actions include bull trout population and habitat inventories, life history research, and potential population reestablishment; State involvement in watershed land use planning; angler harvest assessment; official State sensitive species designation for regulatory protection; nonnative fish stocking evaluation and prohibition; and potential nonnative fish eradications. Activities were scheduled for implementation from 1991 to 2000. This draft recovery plan for bull trout in the Jarbidge River Distinct Population Segment relies, in part, on information contained in this 1990 management plan. The Nevada Department of Wildlife is currently in the process of preparing an updated management plan for bull trout.

STRATEGY FOR RECOVERY

The recovery of bull trout is based on the concept of functional “core areas.” A core area represents the combination of both a core population (*i.e.*, one or more local populations of bull trout inhabiting a core habitat) and 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 habitat, as well as foraging, migration, and overwintering habitat) and constitutes the basic biological unit upon which to gauge recovery.

One core area was defined for the Jarbidge River Distinct Population Segment by the recovery team. The Jarbidge River core area includes headwaters and tributaries containing six local populations and the mainstem Jarbidge River downstream to the Bruneau River (Figure 2). The six currently identified local populations are: East Fork Jarbidge River (including the East Fork headwaters, Cougar Creek, and Fall Creek), West Fork Jarbidge River (including Sawmill Creek), Dave Creek, Jack Creek, Pine Creek, and Slide Creek. The Bruneau River is not currently included in the core area, although determining if bull trout use the Bruneau River is identified as a research need by the recovery team. Research needs apply where the recovery team needs more information in order to accurately plan and implement recovery actions. If research documents bull trout in the Bruneau River then the Jarbidge River core area boundary would be revised accordingly.

Ensuring the long-term persistence of local populations, especially those exhibiting migratory (fluvial) life history forms, is key to supporting a self-sustaining core area of bull trout in the Jarbidge River Distinct Population Segment. Migratory life history forms provide an opportunity for local populations to exchange genetic material, increase the diversity and stability of the core area, and reduce the risk of extinction of the distinct population segment. All migratory life history forms require intact spawning and rearing habitat connected to adequate foraging, migration, and overwintering habitat. Bull trout have specific ecological requirements and depend upon an interconnected network of complex habitats to support both resident and migratory life history forms and facilitate the potential for occasional dispersal between local populations to maintain gene flow and genetic variability, and to ensure the long-term viability of the core population as a whole.

The Jarbidge River Distinct Population Segment will be considered recovered when the Jarbidge River core area is fully functional, as measured by parameters addressing the distribution, abundance, productivity (stable or increasing adult population trend), and connectivity between local populations of bull trout (including the potential for expression of migratory life history forms). The conditions for recovery are identified in the goals, objectives, and recovery criteria below. The recovery actions identified in this plan are designed to sufficiently control or eliminate the threats to bull trout such that the recovery criteria may be attained for the Jarbidge River Distinct Population Segment of bull trout. Appendix B provides a table demonstrating which of the identified threats to bull trout in the Jarbidge River Distinct Population Segment will be addressed by the recovery actions proposed.

Presently bull trout are listed as threatened across their range within the lower 48 states (64 FR 58910). Prior to the coterminous listing, five distinct population segments of bull trout were identified. Although these bull trout population segments are disjunct and geographically isolated from one another, they include the entire distribution of bull trout within the United States, therefore a coterminous listing was found to be appropriate in accordance with our policy on the designation of distinct population segments (61 FR 4722). As provided in the final listing rule, we are continuing to use the term "distinct population segments" for the purposes of recovery planning and consultation (64 FR 58910).

A delisting determination can only be made on a "listable entity" under the Endangered Species Act (Act). Listable entities include species, subspecies, or distinct population segments of vertebrate animals, as defined by the Act and U.S. Fish and Wildlife Service policy (61 FR 4722). Because bull trout were listed at the coterminous level in 1999, currently delisting can only occur at the coterminous level (64 FR 58910). In the future, if warranted by additional information, and if the Jarbidge River population is reconfirmed as meeting the definition of a distinct population segment under a regulatory rulemaking process, delisting may be considered separately for the Jarbidge River Distinct Population Segment of bull trout once it has achieved a recovered state (61 FR 4722). For the purposes of recovery planning, here we have defined recovery criteria for the delisting of the Jarbidge River Distinct Population Segment as currently delineated.

Recovery Goals and Objectives

The goal of the bull trout recovery plan is to **ensure the long-term persistence of self-sustaining, complex, interacting groups**[†] **of bull trout distributed throughout their native range, so that the species can be delisted.** To accomplish the Jarbidge River Distinct Population Segment's contribution toward this goal, recovery objectives addressing distribution, abundance, habitat and genetics were identified. These objectives are as follows:

- Maintain the current distribution of bull trout within the Jarbidge River core area and expand distribution where possible.
- Maintain stable or increasing trends in abundance of both resident and migratory bull trout in the Jarbidge River core area, with a focus on the migratory life history form.
- Restore and maintain suitable habitat conditions for all bull trout life history stages and strategies.

- Conserve genetic diversity and increase natural opportunities for genetic exchange among bull trout populations and migratory fish within the Jarbidge River core area.

Rieman and McIntyre (1993) and Rieman and Allendorf (2001) evaluated bull trout population numbers and habitat thresholds necessary for long-term species viability. Four elements and associated characteristics were identified to consider when evaluating bull trout population viability: 1) Number of local populations in a core area; 2) adult abundance (number of spawning fish present in a core area in a given year); 3) productivity (reproductive rate of the population, as measured by population trend and variability); and 4) connectivity (presence of migratory life history form and functional habitat).

Recovery criteria for the Jarbidge River Distinct Population Segment reflect: 1) the stated objectives for the distinct population segment; 2) evaluation of each population element under both current and recovered conditions; and 3) consideration of current and recovered habitat characteristics within the distinct population segment. This approach to developing recovery criteria acknowledges that the status of local populations in the core area may remain short of ideals based on conservation biology theory. This core area may be limited by natural attributes (*e.g.*, climate) or other factors and may always remain at a relatively high risk of extinction. Recovery criteria will be revised and refined in the future as more detailed information on bull trout population dynamics becomes available. Given the limited information on bull trout in this population segment, the identified range of adult abundance should be viewed as a best estimate. Again, the Jarbidge River Recovery Team relied heavily on the professional judgement of its members in setting recovery criteria. The recovery team members have a wide range of field experience with bull trout, fish population monitoring, and habitat conditions in the Jarbidge River watershed.

Recovery Criteria for the Jarbidge River Distinct Population Segment:

1. **The biological and ecological function of the Jarbidge River core area for bull trout within the distinct population segment has been restored. The components of a fully functioning core area include:**

a) **Habitat is sufficiently maintained or restored to provide for the persistence of broadly distributed local populations within the core area.** The term "broadly distributed" implies that local populations are able to access and are actively using habitat that fully provides for spawning, rearing, foraging, migrating, and overwintering needs at recovered abundance levels. An actual quantitative estimate of the amount of habitat that will be required to meet this criterion is unknown at this time; the adequacy of habitat restoration and management efforts must be measured indirectly by criteria 1b through 1d. The six currently identified local populations that will be used as a measure of broad distribution across the distinct population segment include: East Fork Jarbidge River (including the East Fork headwaters, Cougar Creek, and Fall Creek); West Fork Jarbidge River (including Sawmill Creek); Dave Creek; Jack Creek; Pine Creek; and Slide Creek. The current distribution of bull trout may be expanded within these local populations under recovered conditions.

The Jarbidge River Recovery Team used professional judgement to designate local populations of bull trout based upon available survey data, including juvenile observations, documentation of suitable habitat for bull trout spawning and rearing, redd observations, or the presence of adults during the spawning season, as well as geographical isolation and limited genetic data. However, further genetic research is needed to ensure these designations accurately represent local population structure.

b) **Adult bull trout are sufficiently abundant to provide for the persistence and viability of the core area and to support both**

resident and migratory adult bull trout. This level of abundance is estimated to be within a range of 270 to 1,000 spawning fish per year. This range was derived by the Jarbidge River Recovery Team using professional judgement to estimate the productive capacity of currently recognized local populations in a recovered condition and conservation biology theory. Productive capacity determinations incorporated analysis of existing bull trout population survey data and amounts of existing utilized habitat and underutilized or unutilized habitats perceived as recoverable within local populations. Resident and migratory life history forms are both included in this adult abundance range, but the relative proportion of each form required for recovery is considered a research need. As additional population data are collected, the recovered adult abundance range will be refined to be more precise and to reflect both the resident and migratory life history form components.

Local populations considered by the Jarbidge River Recovery Team to have potential for increased bull trout productive capacity (spawning and rearing) include Dave Creek, Jack Creek, Pine Creek, and Slide Creek. Other streams capable of supporting increased bull trout abundance within foraging, migration, and overwintering habitats include the East and West Forks of the Jarbidge River, and mainstem Jarbidge and Bruneau Rivers. These increases will be accomplished through implementation of recovery actions to reduce stream temperatures (*e.g.*, Dave Creek, East and West Forks of the Jarbidge River) and sedimentation (*e.g.*, Dave Creek, Slide Creek, East and West Forks of the Jarbidge River) and increase large woody debris and pools (Dave Creek, East and West Forks of the Jarbidge River), as well as natural habitat recovery from flood damages (*e.g.*, Jack Creek and Pine Creek). Increased production of migratory bull trout from the upper Jarbidge River watershed under recovered conditions may expand foraging, migration, and overwintering use of the lower mainstem Jarbidge and Bruneau Rivers.

c) **Measures of bull trout abundance within the core area shows a stable or increasing trend based on 10 to 15 years (representing at least 2 bull trout generations) of monitoring data.** In the Jarbidge River Distinct Population Segment, long-term, statistically-reliable bull trout population abundance data are not currently available to identify a trend in abundance. The development of a standardized monitoring and evaluation program to accurately describe trends in bull trout abundance is identified as a priority research need by the Jarbidge River Recovery Team. Achievement of this recovery criterion will be based on a minimum of 10 years of adequate population monitoring data.

d) **Habitat within the core area is connected so as to provide for the potential full expression of migratory behavior, allow for the refounding of extirpated populations, and provide for the potential of genetic exchange between populations.** The Jarbidge River Distinct Population Segment is a depleted, genetically-unique, physically-isolated population of bull trout on the margin of the species' range. It is the southernmost extant occurrence of the species. Therefore, this distinct population segment is a high conservation priority for maintaining the maximum genetic diversity and evolutionary potential of the species' range wide (Epifanio *et al.* 2003; B. Rieman, U.S. Forest Service, *in litt.*, 2003).

The Jarbidge River Recovery Team evaluated the physical isolation of bull trout with respect to recovery both within and outside of the Jarbidge River Distinct Population Segment. Addressing fish passage barriers outside of the Jarbidge River core area, as well as outside of this population segment, could physically reconnect it with bull trout in the Columbia River Distinct Population Segment. However, the Recovery Team strongly advises against removing existing outside barriers due to a substantial threat of nonnative fish species invasions, which could cause adverse effects and prevent bull trout recovery.

Streams within the Jarbidge River core area need to be comprehensively surveyed for physical and thermal (*e.g.*, seasonally-elevated water temperatures) barriers to bull trout passage. If present, such barriers would limit habitat connectivity and genetic exchange among local populations and migratory individuals. Any barriers identified as preventing connectivity within the Jarbidge River core area must be addressed for bull trout recovery purposes.

2. A monitoring plan has been developed and is ready for implementation, to cover a minimum of 5 years post-delisting, to ensure the ongoing recovery of the species and the continuing effectiveness of management actions.

To achieve recovery of bull trout in the Jarbidge River Distinct Population Segment, all five recovery criteria (local populations, adult abundance, population trends, connectivity, and post-delisting monitoring) must be met. The Recovery Team expects that the recovery process will be dynamic. Recovery progress will be assessed as more information becomes available, and the Recovery Team will make changes in recovery planning, as necessary.

<u>Research Needs</u>

Based on the best scientific information available, the Jarbidge River Recovery Team has identified specific recovery criteria and actions necessary for recovery of bull trout within the Jarbidge River Distinct Population Segment. However, the recovery team recognizes that some uncertainties exist regarding local populations, bull trout abundance and distribution, and migratory bull trout, which may affect the recovery criteria and recovery actions. Thus, the recovery team has identified essential research needs for the Jarbidge River Distinct Population Segment, which are discussed below. The recovery plan for the Jarbidge River Distinct Population Segment will be revised, updated, or amended as new information becomes available from actions addressing these research needs, as well as other sources. These plan modifications can be viewed as adaptive management, which is a continuing process of planning, research, monitoring, and evaluating management actions.

Standardized Bull Trout Population Monitoring and Assessment

The Jarbidge River Recovery Team recognizes an urgent need for developing and implementing a standardized bull trout population monitoring and assessment program. The Bull Trout Committee of the Western Division of the American Fisheries Society recently developed protocols for determining presence/absence and potential habitat suitability for juvenile and resident bull trout for use throughout the species' range (Peterson *et al.* 2001). The Jarbidge River Recovery Team will recommend use of these peer-reviewed protocols for bull trout surveys with the intended purposes in the Jarbidge River Distinct Population Segment.

In addition, the U.S. Fish and Wildlife Service is establishing a multi-agency bull trout Recovery Monitoring and Evaluation Technical Group. The Technical Group is tasked with: 1) increasing the utility of current data collection for recovery planning; 2) guiding and prioritizing future studies; 3) summarizing monitoring and evaluation needs of cooperators; 4) fostering coordination among monitoring programs; 5) developing and standardizing design elements; and 6) reviewing analytical methods of characterizing population and habitat status. Products of the technical group will be subject to independent scientific review, as appropriate. The Jarbidge River Recovery Team will adopt technical group products for bull trout monitoring within the Jarbidge River Distinct Population Segment.

Migratory Bull Trout

The migratory (fluvial) life history form of bull trout is important for long term persistence of the species in the Jarbidge River Distinct Population Segment. Given the isolation of the Jarbidge River Distinct Population Segment from other bull trout populations and the geographic separation among its local populations, migratory fish represent a valuable means of genetic exchange. Historically, migratory bull trout could move freely among the Jarbidge, Bruneau, and Snake Rivers. Movement between the Jarbidge and Bruneau Rivers is still possible, however, little is known regarding fluvial fish abundance, distribution, or habitat use. Research is needed to evaluate the remaining migratory population and determine the current and future roles of the mainstem Jarbidge and Bruneau Rivers in bull trout recovery. Research is also needed to locate spawning habitats for these migratory fish. The recovery criterion for bull trout adult abundance will be adjusted, as necessary, based on these assessments. If the Jarbidge River Recovery Team determines that increased numbers of migratory fish are required for recovery, additional recovery actions likely will be identified for implementation in migratory corridors within the Jarbidge River Distinct Population Segment.

Bull Trout Genetics

Genetic sampling of bull trout in the Jarbidge River watershed has been limited (Spruell, *in litt.*, 1998; Spruell *et al.* 2003). Bull trout from only two of the six local populations have been genetically analyzed, and migratory fish also need to be analyzed. The Dave Creek (n = 13) and West Fork Jarbidge River (n = 24) samples exhibit some genetic divergence between local populations within the Jarbidge River core area (Spruell, *in litt.*, 1998; Spruell *et al.* 2003). The Jarbidge River Recovery Team identified the six local populations of bull trout in the core area based primarily on existing population sampling data (*e.g.*, juvenile fish locations, suitable spawning habitat, and spawning season bull trout distribution) and the limited genetic information available. A research need for this distinct population segment is to genetically evaluate local population structure and document genetic contributions of migratory bull trout, so that recovery criteria and management actions are appropriate and as effective as possible.

RECOVERY ACTIONS

Recovery for bull trout will entail reducing threats to the long-term persistence of populations and their habitats, ensuring the security of multiple interacting groups of bull trout, and providing access to habitat with conditions that allow for the expression of various life history forms.

Recovery Actions Narrative

The recovery actions narrative consists of a hierarchical listing of specific recovery actions identified by the Jarbidge River Recovery Team for implementation in the Jarbidge River Distinct Population Segment. These actions are listed and prioritized in the implementation schedule table that follows this section. Appendix B identifies the reason(s) for decline of bull trout that are addressed by each recovery action. The Jarbidge River Recovery Team should meet quarterly to develop annual work plans, coordinate research and sampling efforts, review work reports, and identify any needed recovery plan updates as recovery actions are completed, environmental conditions change, and monitoring results or other additional information become available.

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

1.1 Maintain or improve stream water quality in the Jarbidge River core area.

1.1.1 Assess and reduce sources of thermal loading in streams. Assess and mitigate increases in stream temperatures that negatively impact bull trout spawning and rearing habitat and migratory corridors. Non-point sources of stream thermal elevation include modified riparian vegetation structure, reduced instream flows, altered groundwater dynamics, and altered channel morphology[†]. Point sources of thermal elevation include natural thermal springs, which would not be addressed, as well as thermal groundwater effluent from historical mine sites (See Recovery Action 1.1.3). Priority watersheds for thermal loading assessment and mitigation include the East and West Forks of the Jarbidge River (migratory corridors) and Dave Creek (spawning and rearing habitat).

Also, inventory streams in the Jarbidge River core area to identify reaches with cold surface or groundwater inflows that should be protected from physical disturbance. Stream inventories would preliminarily involve locating areas of cold spring inflows and bedrock channel constrictions where groundwater upwelling is likely, as well as by examining existing stream water temperature data logger recordings and bull trout occurrence locations. Additional water temperature data loggers would be deployed to identify and better define the specific stream reaches.

1.1.2 Identify sediment sources and reduce sediment delivery to streams. Unsurfaced roads and livestock grazing are the main sources of fine sediment delivery to streams in the Jarbidge River core area besides natural watershed events (*e.g.*, floods). Reduce sediment delivery to streams by maintaining and repairing roads (including culverts and stream crossings) using recognized Best Management Practices. On a case-by-case basis, consider repairing, relocating, or removing roads that are identified as susceptible to mass wasting[†] and bank failure, intercept surface or groundwater, negatively impact riparian areas, or inhibit floodplain connectivity and natural stream functions.

Priorities for road repair and maintenance projects include the Jarbidge Road extending between Pine Creek Campground and Murphy Hot Springs, Idaho. Implement actions to reduce sediment input to the West Fork of the Jarbidge River from the Jarbidge Road, as identified in the U.S. Forest Service's Road Management Plan (USFS 2003). A dirt road crossing on Dave Creek (Township 47 North, Range 58 East, Sections 24 and 25) is also a priority site for repair and sedimentation reduction. Other possible sites for implementation include road crossings on Jack and Deer Creeks.

Reduce stream sedimentation from grazed lands through optimal livestock management. Include adequate utilization standards and targets to protect and enhance riparian habitat and water quality conditions in Federal permits for grazing allotments. Use management alternatives such as riparian fencing, seasons of use, and off-stream watering to reduce impacts of grazing on bull trout streams, where appropriate. Priority watersheds for implementation include Dave (including Morgan Draw), Jack, and Slide Creeks; watersheds of secondary importance likely include Buck Creek and livestock-accessible reaches of the East Fork of the Jarbidge River.

1.1.3 Assess and clean up non-operational mine sites. Assess non-operational mine sites and improve stream water quality by reclaiming sites identified as negatively impacting bull trout habitat. Reclamation may consist of removing debris and potentially hazardous materials (*e.g.*, 4M Mine on West Fork of the Jarbidge River) and stabilizing, removing, recontouring, and/or revegetating mine tailings formerly deposited in stream channels and floodplains (*e.g.*, Elkoro site on West Fork of the Jarbidge River). This action would also assess water quality of surface runoff and groundwater discharge from mine sites (*e.g.*, Gray Rock, Norman, Pavlak, and 4M Mine sites on West Fork of the Jarbidge River). Treatment or containment plans would be developed and implemented with willing landowners for problem sites.

1.1.4 Assess and reduce nutrient delivery to streams. Assess and reduce nutrient (*e.g.*, nitrogen, phosphorus) enrichment in streams where necessary to improve water quality for bull trout by: 1) modifying grazing practices in livestock allotments; 2) working with willing landowners to identify and repair any leaking domestic sewage disposal systems; and 3) assisting willing landowners in managing confined animal feed lot runoff. Priority watersheds for assessment include the East and West Forks of the Jarbidge River, and Buck, Dave, Jack, and Slide Creeks.

1.1.5 Determine effects of water withdrawals on stream temperatures and flows. Information on existing water withdrawals in the Jarbidge River core area is needed to determine if these factor into elevated stream temperatures in bull trout habitats (See Recovery Action 1.1.1). Locate and document water developments (*e.g.*, stream diversions, water pipelines, spring developments, water troughs, etc.) within or upstream of occupied bull trout habitats. Analyze effects on instream temperatures and flows in occupied habitats using information on the volume, timing, duration, and temperature of water withdrawals. Investigate options with water users to modify water deliveries and withdrawals to minimize any documented adverse effects to bull trout habitats.

1.2 Identify barriers for bull trout in streams within the Jarbidge River core area and implement actions to provide passage where necessary for recovery.

1.2.1 Identify and evaluate physical barriers to bull trout passage. Connectivity among bull trout habitats within the Jarbidge River core area is essential for maintaining opportunities for genetic exchange. This action is to identify all potential natural (*e.g.*, log jams, boulder piles, waterfalls) and constructed (*e.g.*, rock dams and diversions) physical barriers to fish passage, including seasonal and year-round barriers. Potential seasonal natural barriers have already been identified in Jack and Robinson Creeks, as well as the West Fork of the Jarbidge River. The West Fork also contains constructed potential barriers to evaluate near residential and recreational areas.

The Jarbidge River Recovery Team will evaluate the merits of providing fish passage at each identified barrier, and where necessary for recovery, will develop and implement actions to facilitate passage. Providing access around natural barriers would only be considered where it would clearly benefit species recovery. At this time, the Jarbidge River Recovery Team is not considering removal of any natural barriers upstream of occupied habitats that would result in upstream expansion of bull trout distribution. Potential barriers to bull trout passage associated with elevated stream temperatures are addressed under Recovery Action 1.1.1.

1.3 Identify impaired stream channel and riparian areas within the Jarbidge River core area and implement actions to restore natural functions.

1.3.1 Restore and maintain riparian habitat. Identify impacted riparian habitats for restoration activities and maintain riparian habitats within local population watersheds, bull trout migratory corridors, and contributing watersheds elsewhere in the Jarbidge River core area. Plant native vegetation and use bioengineering techniques to restore riparian communities, increase stream shading and canopy cover[†], and reduce erosion. Priority watersheds for restoration include the East and West Forks of the Jarbidge River and Dave Creek. Manage all riparian habitats to maintain riparian vegetation growth and function and to provide future sources of instream large woody debris.

1.3.2 Assess and restore stream channels. Preliminary stream channel assessments will be made using standard habitat assessment methodologies (*e.g.*, U.S. Forest Service's R1/R4 fish habitat inventories, etc.). Additional more detailed analyses of channel conditions will be made by a fluvial geomorphologist, as needed, prior to implementing restoration activities. Stream channel restoration activities will be conducted to restore proper stream function where necessary to improve bull trout habitat and habitat connectivity. Restoration activities would include recreating natural channel morphology (*e.g.*, channel cross section, stream sinuosity) and increasing the complexity of instream habitat by incorporating large woody debris and boulders and aiding pool development. Some channel restoration has already been completed on National Forest lands in bull trout habitat (*e.g.*, West Fork of the Jarbidge River upstream of Pine Creek). Priority watersheds for assessment and future channel restoration include Dave Creek and the East and West Forks of the Jarbidge River downstream of the Jarbidge Wilderness boundary.

1.3.3 <u>Assess and minimize livestock grazing impacts.</u> Assess grazing impacts through annual allotment monitoring efforts (*e.g.*, utilization monitoring, grazing implementation and effectiveness monitoring). Fish habitat assessment methodologies may also be used to document grazing impacts (*e.g.*, U.S. Forest Service's R1/R4 fish habitat inventories, etc.).

Minimize the effects of grazing on stream channels and riparian habitats through adaptive livestock management. Include performance standards (*e.g.*, utilization standards) and targets for habitat and water quality conditions in allotment management plans. Expand monitoring efforts by agencies and allotment permittees and document monitoring results to track progress. Use management alternatives such as installing riparian fencing, changing seasons of use, and possibly creating off-stream watering sites to reduce impacts. Priority watersheds for implementation include Dave (including Morgan Draw), Jack, and Slide Creeks. Other watersheds of secondary priority include livestock-accessible reaches of the East Fork of the Jarbidge River and mainstem Jarbidge River, as well as Buck and Deer Creeks.

1.3.4 <u>Minimize stream channel degradation.</u> Ensure that negative effects to bull trout habitat from ongoing and periodic flood control and streambank stabilization activities are avoided or minimized (*e.g.*, channel clearing, dredging, large woody debris removal, gabion construction). Replace undersized road bridges across the East and West Forks of the Jarbidge River with wider spans to accommodate flood flows and thereby minimize debris collection. Bridge replacement will also eliminate any residual leaching of carcinogenic compounds from treated wood bridge structures, such as creosote-treated abutment timbers. Prioritization for bridge replacement would examine bridge structure channel impacts, location, structure age and public safety concerns, and available funding opportunities and partnerships. Also, enforce State and Federal laws regulating activities in aquatic and riparian habitats (See Recovery Actions 6.2.3 and 6.3.1).

1.3.5 Reduce instream and riparian wood harvest. Implement public awareness campaign and enforce existing regulations prohibiting firewood and fuelwood cutting and other wood removal in riparian corridors. Priority areas for implementation include riparian zones along the East and West Forks of the Jarbidge River where collection of wood for local domestic and recreational uses and removal for flood control is most common.

1.3.6 Minimize recreation impacts. Identify and reduce impacts of recreational activities (*e.g.*, dispersed and developed campsites, trails and trailheads, outfitter camps, off-road vehicles) on bull trout streams and riparian habitats. Minimize recreation impacts by implementing measures to reduce sedimentation (*e.g.*, hardening recreation site surfaces), prevent damage and loss of riparian vegetation, and limit woody debris removal; this will include increasing public awareness of recreational activity impacts. Relocate recreational sites and activities outside of riparian areas where necessary to avoid impacts to bull trout habitat, especially spawning and rearing areas.

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

2.1 Implement control of nonnative fishes in the Jarbidge River core area, where found to be feasible and appropriate.

2.1.1 Implement brook trout removal. Brook trout occur in Emerald Lake near the headwaters of the East Fork of the Jarbidge River and in Bear Creek, a tributary to the West Fork of the Jarbidge River. Due to the potential for future illegal transplants elsewhere in the watershed, these local sources of nonnative fish should be eliminated. Both brook trout populations likely originated from historical stockings. Removal of brook trout from Bear Creek should be accomplished by physical means (*e.g.*, electrofishing, netting, angling) rather than chemical treatment (*e.g.*, rotenone) methods to avoid water quality impacts to domestic users downstream. Physical removal efforts on Bear Creek were initiated in 2002 and continued in 2003.

Emerald Lake is in the Jarbidge Wilderness so treatment options will be limited by its remote location and Wilderness restrictions on motorized equipment and mechanical transport. Emerald Lake is a destination point for guided pack trips and other recreationists. When brook trout are removed, the associated fishing pressure (39 angler days/year) may be displaced to nearby waters including bull trout spawning and rearing habitat (Johnson, *in litt.*, 2003a). It may be appropriate under these circumstances to consider options for providing a different fishery in Emerald Lake that does not threaten bull trout through potential hybridization.

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

3.1 Develop and implement State fisheries management plans specifically for the Jarbidge River watershed that integrate adaptive management concepts.

3.1.1 Facilitate development and implementation of coordinated fisheries management plans for bull trout in the Jarbidge River core area by the States of Idaho and Nevada. State management plans should incorporate bull trout recovery goals and objectives, as well as recovery actions that are related to fisheries management. Plans should be based on science-directed adaptive management concepts, emphasizing ongoing integration of bull trout research and monitoring results. Evaluate the effectiveness of coordinated State fisheries management in meeting bull trout recovery goals and objectives and make adaptive changes to management plans, as necessary.

3.2 Evaluate and minimize illegal harvest and incidental angling mortality of bull trout in the Jarbidge River core area.

3.2.1 Implement angler surveys. Survey active anglers, outfitter guides, and appropriate license holders (*e.g.*, trout stamp purchase) to obtain updated local information on fishing pressure, species identification, bull trout capture rates and sizes, effective gear types, and fish health upon release. Surveys could include interviews with anglers and voluntary submissions of survey cards mailed to license holders and outfitters or available at local recreation sites.

3.2.2 Promote public awareness of angling regulations and low-impact angling techniques to ensure compliance with regulations. Continue to inform anglers about bull trout identification, special regulations, agency management of listed fish species, and techniques to reduce hooking mortality[†] of bull trout caught incidentally in recreational fisheries. Information sources include items such as signs, fliers, State fishing regulation brochures, and agency web sites. Also, ensure angler compliance with State and Federal regulations for bull trout through increased enforcement presence in high use areas.

3.2.3 Coordinate and evaluate scientific research. The Jarbidge River Recovery Team should coordinate scientific research involving bull trout in the Jarbidge River core area to ensure that recovery needs will be met. The recovery team should evaluate research objectives, survey protocols, impacts of concurrent or consecutive research projects, and identify overlapping research. Use of standardized sampling protocols and marking for bull trout in the Jarbidge River core area will be required (See Recovery Actions 5.1.1 and 5.2.1). A Federal permit under section 10 of the Endangered Species Act is currently required for intentional take[†] of bull trout in the Jarbidge River Distinct Population Segment for scientific purposes, such as during fish surveys and genetic sampling.

3.3 Evaluate effects of existing and proposed angling regulations on bull trout in the Jarbidge River core area.

3.3.1 Evaluate the impact of current angling regulations on bull trout and recommend any appropriate modifications to regulations. Incidental take of bull trout by angling in the Jarbidge River watershed is not currently authorized under the Endangered Species Act. The States of Idaho and Nevada have also prohibited bull trout harvest. However, bull trout occupied waters are not closed to recreational fishing, and angling under existing State regulations may result in unintentional mortality of bull trout through catch and release or species misidentification.

Existing regulations should be examined to determine if incidental capture and potential mortality of bull trout associated with other fisheries can be further reduced. For example, evaluate: 1) open seasons and open areas relative to bull trout seasonal distribution and life history, as well as angler accessibility; 2) bull trout susceptibility to the authorized gear types (*e.g.*, bait, lures, flies) and associated hooking mortality; 3) fishing pressure levels; and 4) harvest limits for other fish species. Based on these evaluations, the Jarbidge River Recovery Team should recommend State agencies adopt any modifications of angling regulations that will minimize incidental capture and mortality of 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 actions and fisheries management plans for the Jarbidge River core area.

4.1.1 Conduct genetic inventory of resident and migratory bull trout. Collate information on genetic samples already collected, standardize sample preservation and analysis techniques, and complete a coordinated genetic inventory of all bull trout local populations and the migratory life history form in the Jarbidge River watershed. Use this inventory to verify identified local populations and to verify whether or not there appears to be any metapopulation structure within the Jarbidge River core area.

4.2 Maintain and improve opportunities for gene flow among bull trout local populations in the Jarbidge River core area.

4.2.1 Manage local populations (numbers and life forms) to maintain long-term viability. Once local populations are verified (See Recovery Action 4.1.1), they should be managed accordingly to conserve genetic diversity. Long-term viability of bull trout in the Jarbidge River core area will be ensured by maintaining suitable habitat conditions for connectivity (See Recovery Actions 1.1.1, 1.2.1, and 1.3.2) and maintaining adequate numbers of migratory individuals.

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 actions.**

5.1 Design and implement a standardized monitoring program to assess the effectiveness of recovery actions affecting bull trout and their habitats within the Jarbidge River core area.

5.1.1 Develop and implement a standardized, statistically sound bull trout population monitoring program. Analyze existing bull trout survey data to identify information gaps and monitoring needs in the Jarbidge River core area. The Jarbidge River Recovery Team recommends using available peer-reviewed protocols for bull trout surveys in the Jarbidge River Distinct Population Segment, specifically those developed by Peterson *et al.* (2001) for determining presence/absence and potential habitat suitability for juvenile and resident bull trout. The Jarbidge River Recovery Team will also adopt monitoring program products developed by the multi-agency bull trout Recovery Monitoring and Evaluation Technical Group for bull trout monitoring within the Jarbidge River Distinct Population Segment. Monitoring programs must be able to detect statistical differences in abundance (population trends) and result in statistically-based determinations of presence and absence (population distribution).

5.1.2 Assess habitat restoration techniques. The Jarbidge River Recovery Team will evaluate the effectiveness of different active and passive habitat restoration techniques in restoring watershed function and enhancing local populations of bull trout.

5.2 Conduct research that evaluates relationships among bull trout distribution and abundance, bull trout habitat, and recovery actions.

5.2.1 Determine seasonal movement patterns and habitat use of migratory bull trout. This research will provide important information on the downstream extent of distribution and upstream spawning location(s) of migratory bull trout, as well as document any overlapping habitat use with resident fish. As part of this action, develop a coordinated bull trout marking and tracking strategy (*e.g.*, standardized fin clips, PIT tags, and radio tag implant frequencies) throughout the Jarbidge River watershed so that marked fish are recognized and reported whenever captured. Weirs should continue to be operated periodically (*e.g.*, every 3 to 5 years) to index migratory bull trout abundance. The Jarbidge River Recovery Team has identified this action as a priority research need.

5.2.2 Locate and assess bull trout spawning habitats. Develop a comprehensive map of existing and potential bull trout spawning reaches for all local populations in the Jarbidge River core area based primarily on redd surveys, in combination with water temperature, substrate, flow, and stream gradient data. This map would be used to delineate areas for focusing habitat protection and restoration efforts. The highest priority stream for assessment is Dave Creek, but documentation and mapping of all local populations is needed for recovery.

5.2.3 Assess suitability of degraded and unoccupied habitat for expanding distribution and abundance of bull trout. Evaluate habitat for potential expansion of bull trout distribution and abundance within the Jarbidge River core area. Existing local populations and occupied streams considered to have potential for increased productive capacity and bull trout abundance include Dave Creek, Jack Creek, Slide Creek, and the East and West Forks of the Jarbidge River. These increases will be accomplished through implementation of recovery actions to reduce stream temperatures (*e.g.*, Dave Creek, East and West

Forks of the Jarbidge River) and sedimentation (*e.g.*, Dave Creek, Slide Creek, East and West Forks of the Jarbidge River) and increase large woody debris and pools (Dave Creek, East and West Forks of the Jarbidge River), as well as natural habitat recovery from flood damages (*e.g.*, Jack Creek).

Identify any other potentially suitable, unoccupied habitat for bull trout in the Jarbidge River watershed. Specifically evaluate the suitability of Deer Creek, where bull trout have been observed occasionally, followed by Buck Creek and the Robinson and Jim Bob Creeks complex that have no bull trout records to date. If any potentially suitable habitat is identified, develop a comprehensive list of factors preventing or limiting use by bull trout (*e.g.*, barriers, diversions, water temperature, sediment, etc.) for consideration by the Jarbidge River Recovery Team. The recovery team will determine if expansion of bull trout in these areas will contribute to recovery, and if necessary, identify recovery actions to improve habitat suitability.

5.2.4 <u>Determine range of temperature tolerances for bull trout life stages and life history forms.</u> Using ongoing bull trout temperature tolerance studies in other bull trout Distinct Population Segments and local population habitat use data, evaluate water temperature as a potential limiting factor for recovery of bull trout in the Jarbidge River Distinct Population Segment. Incorporate results of this action into recommended revisions of State water quality standards for occupied streams in the Jarbidge River Distinct Population Segment (See Recovery Action 6.3.1).

5.3 Develop and conduct research and monitoring studies to improve information concerning the distribution and status of bull trout in the Jarbidge River Distinct Population Segment.

5.3.1 Increase bull trout surveys. Increase the frequency and extent of population monitoring using a standardized monitoring program (See Recovery Action 5.1.1) to determine seasonal movement and habitat use by resident adult and juvenile bull trout in local populations. Coordinate with surveys for migratory bull trout (See Recovery Action 5.2.1). Also, periodically monitor for presence/absence of bull trout in any identified potentially suitable habitat (See Recovery Action 5.2.3).

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

5.4.1 Determine basic life history characteristics. For both fluvial and resident bull trout, determine age- and size-specific fecundity, age and size at first spawning, longevity, repeat- or alternate-year spawning frequency, survival rates, and other basic life history characteristics. Due to low population numbers for both life history forms in the Jarbidge River core area, research should primarily be non-lethal (*e.g.*, blood samples, tagging) or opportunistic as specimens become available through incidental mortality rather than intentional sacrifice. This research will also incorporate data from bull trout populations in other Distinct Population Segments.

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 bull trout and their habitat in the Jarbidge River core area.

6.1.1 Support collaborative efforts by local watershed groups to implement bull trout recovery actions. Local watershed groups can accomplish site-specific habitat protection and restoration activities consistent with bull trout recovery. Local watershed groups are already established for the Jarbidge River core area, such as the Southwest Basin Native Fish Technical Group and the Jarbidge Bull Trout Task Force. The Jarbidge River Recovery Team should recruit the assistance of group members whenever possible and keep them informed of recovery progress.

6.1.2 Provide long-term habitat protection. Long-term protection can be accomplished through habitat conservation plans, land exchanges, land purchase from willing sellers, conservation easements, watershed restoration, and management plans. Initially, emphasis for protection measures should be directed toward identified bull trout spawning and rearing habitats where impacts are occurring (*e.g.*, Dave Creek local population).

6.1.3 Inform the public about bull trout habitat needs and recovery. Develop and distribute educational materials on bull trout ecology, life history, and habitat needs (*e.g.*, watershed form and function, riparian habitat and channel restoration, and large wood placement). Also provide more specific information on locally-important recovery issues such as roads and angling.

6.2 Enforce existing Federal and State habitat protection standards and regulations and evaluate their effectiveness for bull trout conservation.

6.2.1 Enforce water quality standards and regulations for streams. Enforce State standards of water quality for beneficial uses in the East and West Forks and mainstem Jarbidge River, especially standards for water temperature, turbidity, and suspended solids. The Jarbidge River Recovery Team supports voluntary compliance with the more stringent levels in the State of Nevada requirements to maintain existing higher water quality. Increase water quality monitoring in identified impaired drainages or stream reaches. The recovery team will also evaluate the effectiveness of existing standards in conserving bull trout and recommend changes, if necessary.

7. **Assess the implementation of bull trout recovery, and revise the recovery plan based on evaluations, as necessary.**

7.1 <u>Assess effectiveness of bull trout recovery efforts in the Jarbidge River core area.</u> Convene annual meetings of the Jarbidge River Jarbidge River Recovery Team to review progress on recovery plan implementation. Use a standardized monitoring program to evaluate the effectiveness of recovery efforts provided by the interagency bull trout Recovery Monitoring and Evaluation Technical Group (See Recovery Action 5.1.1). Assessments would be completed annually and documented in a progress report prepared by the Jarbidge River Recovery Team. Changes to the recovery plan would be made on an as needed basis.

IMPLEMENTATION SCHEDULE

Implementation schedules describe recovery action priorities, action numbers, action descriptions, duration of actions, potential or participating responsible parties, total estimated costs for the duration of the action, cost estimates for the next 5 years, and comments. Those actions, when accomplished, will lead to recovery of bull trout in the Jarbidge River Distinct Population Segment, and ultimately to recovery of bull trout in the coterminous United States.

Parties with authority, responsibility, or expressed interest to implement a specific recovery action are identified in the implementation schedule. Listing a responsible party does not imply that prior approval has been given, nor does it require that party to participate or expend funds. However, willing participants will benefit by demonstrating that their budget submission or funding request is for a recovery action identified in an approved recovery plan, and is therefore part of a coordinated effort to recover bull trout. In addition, section 7(a)(1) of the Endangered Species Act directs all Federal agencies to use their authorities to further the purposes of the Endangered Species Act by implementing programs for the conservation of threatened or endangered species.

In compliance with the U.S. Fish and Wildlife Service Endangered and Threatened Species Listing and Recovery Priority Guidelines, Recovery Plan Preparation and Implementation Priorities (48 FR 43103), we have considered and adopted priorities and subpriorities that represent recovery goals for bull trout across their native range in the coterminous United States. We also considered established conservation plans and the ongoing local, State, and Federal planning processes to maintain consistency and integration with those efforts. Assigning priorities does not imply some recovery actions are of low importance as all recovery actions are important to achieve the recovery objectives. We further recognize lower priority actions may be implemented ahead of higher priority actions because of the integration of bull trout recovery efforts with these existing plans and processes, and/or the availability of funding opportunities. All recovery actions will have assigned priorities based on the following:

- Priority 1: All actions that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

- Priority 2: All actions that must be taken to prevent a significant decline in species population or habitat quality or to prevent some other significant negative effect short of extinction.

- Priority 3: All other actions necessary to provide for full recovery of the species.

Within each priority level, the Jarbidge River Recovery Team identified a need to designate recovery actions for bull trout that may require an elevated status for immediate attention, and therefore, adopted two subpriorities to consider in ranking actions (A ranks higher than B):

A. Protection of relatively healthy local populations.

B. Expansion, restoration, and reconnection of existing local populations within the core area. This includes local populations at high risk of extirpation and where connectivity may be important to allow for continual movement of fish into populations at risk of extirpation. Connectivity between existing bull trout populations is essential for continued survival and recovery by allowing for the potential of genetic exchange, migratory behavior, and the survival of individuals and recolonization of areas vacated following random naturally occurring events.

Action Number and Action Description: Recovery actions as numbered in the recovery actions narrative. Refer to the action narrative for action descriptions.

Action Duration: Expected number of years to complete the corresponding action. Study designs can incorporate more than one action, which when combined can reduce the time needed for action completion.

Responsible or Participating Party: The following parties are those with the responsibility or capability to fund, authorize or carry out the corresponding recovery action. Lead parties are indicated in bold type. Additional identified parties are considered cooperators in restoration efforts. Identified parties include:

BLM	Bureau of Land Management
DV	Duck Valley Paiute-Shoshone Tribes
EC	Elko County, Nevada
EPA	Environmental Protection Agency
IDFG	Idaho Department of Fish and Game
IDEQ	Idaho Division of Environmental Quality
NDEP	Nevada Division of Environmental Protection
NDOW	Nevada Department of Wildlife
OC	Owyhee County, Idaho
USACE	U.S. Army Corps of Engineers

USFWS	U.S. Fish and Wildlife Service
USFS	U.S. Forest Service

Cost Estimates: Cost estimates are rough estimates and are only provided for general guidance. Total costs are estimated for both the duration of the action and also itemized annually for the next 5 years.

JARBIDGE RIVER DISTINCT POPULATION SEGMENT of BULL TROUT - IMPLEMENTATION SCHEDULE											
Priority number	Action number	Action description	Action duration (years)	Responsible parties (alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	
1B	2.1.1	Implement brook trout removal	5	**NDOW**, USFS, **USFWS**	125	10	40	15	15	15	Removal has started in one population
1B	5.1.1	Develop and implement a standardized, statistically sound bull trout population monitoring program	25	BLM, DV, **IDFG**, **NDOW**, USFS, **USFWS**	1,095	0	75	60	60	60	Rangewide monitoring program development is ongoing
1B	5.2.1	Determine seasonal movement patterns and habitat use of migratory bull trout	5	**BLM**, **IDFG**, **NDOW**, **USFWS**	150	0	30	30	30	30	Operate weirs every 3 to 5 years ($3K/year)
2A	1.1.1	Assess and reduce sources of thermal loading in streams	25	**BLM**, EC, OC **USFS**, USFWS	375	15	15	15	15	15	Some actions linked to 1.1.2 and 1.3.1
2A	1.1.2	Identify sediment sources and reduce sediment delivery to streams	20	**BLM**, **EC**, OC **USFS**, USFWS	500	25	25	25	25	25	Some sources and actions already identified; some actions linked to 1.1.1 and 1.3.1

JARBIDGE RIVER DISTINCT POPULATION SEGMENT of BULL TROUT - IMPLEMENTATION SCHEDULE												
Priority number	Action number	Action description	Action duration (years)	Responsible parties (alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	
2A	1.3.1	Restore and maintain riparian habitat	25	**BLM**, DV, **USFS**, USFWS	250	10	10	10	10	10	Some actions linked to 1.1.1 and 1.1.2
2A	1.3.2	Assess and restore stream channels	15	**BLM**, EC, **USFS**, **USFWS**	300	20	20	20	20	20	Take action based on assessment
2A	1.3.3	Assess and minimize livestock grazing impacts	10	**BLM, USFS**, USFWS	180	20	20	35	15	15	Take action based on assessment
2A	3.1.1	Facilitate development and implementation of coordinated fisheries management plans for bull trout in the Jarbidge River core area by the States of Idaho and Nevada	3	**IDFG, NDOW**, USFWS	30	10	10	10	0	0	Action linked to 2.1.1, 3.2.1, 3.2.2, 3.3.1, 4.2.1, and 5.1.1
2A	3.2.3	Coordinate and evaluate scientific research	25	**BLM, IDFG, NDOW, USFWS, USFS**	50	2	2	2	2	2	
2A	3.3.1	Evaluate the impact of current angling regulations on bull trout and recommend any appropriate modifications to regulations	1	**IDFG, NDOW**, USFWS	15	0	15	0	0	0	Action linked to 3.1.1
2A	4.1.1	Conduct genetic inventory of resident and migratory bull trout	3	**BLM**, IDFG, NDOW, **USFWS**	60	0	20	20	20	0	Incorporate existing data

JARBIDGE RIVER DISTINCT POPULATION SEGMENT of BULL TROUT - IMPLEMENTATION SCHEDULE											
Priority number	Action number	Action description	Action duration (years)	Responsible parties (alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	
2A	5.2.2	Locate and assess bull trout spawning habitats	3	**BLM**, IDFG, **NDOW**, USFS **USFWS**	210	70	70	70	0	0	
2A	5.3.1	Increase bull trout surveys	25	**BLM**, **IDFG**, **NDOW**, USFS, **USFWS**	620	20	60	60	60	20	Action linked to 5.1.1
2B	1.2.1	Identify and evaluate physical barriers to bull trout passage	2	BLM, **IDFG**, **NDOW**, USFS, **USFWS**	30	0	15	15	0	0	Take action based on assessment
2B	1.3.4	Minimize stream channel degradation	20	**BLM**, EC, OC, USACE, **USFS**, USFWS	1,350	0	150	0	150	0	Major cost is for nine bridge replacements
2B	1.3.5	Reduce instream and riparian wood harvest	3	**BLM**, **USFS**	12	0	5	5	2	0	
2B	5.2.3	Assess suitability of degraded and unoccupied habitats for expanding distribution and abundance of bull trout	3	**BLM**, **IDFG**, **NDOW**, USFS, **USFWS**	45	0	15	15	15	0	
2B	4.2.1	Manage local populations (numbers and life forms) to maintain long-term viability	25	**IDFG**, **NDOW**, **USFWS**	0	0	0	0	0	0	Incorporate data from 4.1.1 into ongoing management
2B	5.2.4	Determine range of temperature tolerances for bull trout life stages and life history forms	5	**BLM**, **IDFG**, **NDOW**, USFS, **USFWS**	75	15	15	15	15	15	

JARBIDGE RIVER DISTINCT POPULATION SEGMENT of BULL TROUT - IMPLEMENTATION SCHEDULE

Priority number	Action number	Action description	Action duration (years)	Responsible parties (alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	
3A	5.1.2	Assess habitat restoration techniques	24	**BLM**, DV, IDFG, NDOW, USFS, **USFWS**	120	0	5	5	5	5	
3B	1.1.3	Assess and clean up non-operational mine sites	2	EC, **USFS**, **USFWS**	35	0	10	25	0	0	Assessment first year; clean up at one mine next year; other actions based on assessment
3B	1.1.4	Assess and reduce nutrient delivery to streams	1	**BLM**, IDEQ, NDEP, **USFS**, **USFWS**	5	0	5	0	0	0	Take action based on assessment
3B	1.1.5	Determine effects of water withdrawals on stream temperatures and flows	2	**BLM**, IDFG, NDOW, **USFS**, USFWS	40	0	20	20	0	0	Take action based on assessment
3B	1.3.6	Minimize recreation impacts	5	**BLM**, **USFS**	50	0	10	10	10	10	
3B	3.2.1	Implement angler surveys	5	**IDFG, NDOW**, USFWS	25	5	5	5	5	5	
3B	3.2.2	Promote public awareness of angling regulations and low-impact angling techniques to ensure compliance with regulations	5	**IDFG, NDOW**, USFWS, USFS	20	4	4	4	4	4	

JARBIDGE RIVER DISTINCT POPULATION SEGMENT of BULL TROUT - IMPLEMENTATION SCHEDULE												
Priority number	Action number	Action description	Action duration (years)	Responsible parties (alphabetical)	Cost estimates ($1,000)						Comments
					Total cost	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	
3B	5.4.1	Determine basic life history characteristics	10	**BLM**, **IDFG, NDOW, USFWS**	150	15	15	15	15	15	
3B	6.1.1	Support collaborative efforts by local watershed groups to implement bull trout recovery actions	25	BLM, DV, IDFG, NDOW, USFS, **USFWS**	50	2	2	2	2	2	
3B	6.1.2	Provide long-term habitat protection	25	**BLM**, DV, NDOW, **USFS**, **USFWS**	10	0	10	0	0	0	
3B	6.1.3	Inform the public about bull trout habitat needs and recovery	25	IDFG, NDOW, **USFWS**, USFS	56	5	5	2	2	2	
3B	6.2.1	Enforce water quality standards and regulations for streams	25	**BLM**, **IDEQ**, **NDEP**, USFS	0	0	0	0	0	0	Ongoing
3B	7.1	Assess effectiveness of bull trout recovery efforts in the Jarbidge River core area	25	BLM, DV, IDFG, NDOW, USFS, **USFWS**	0	0	0	0	0	0	Coordinate with 5.1.1
			TOTAL ESTIMATED COSTS		6,033						

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APPENDIX A. Jarbidge River Watershed Stream Thermograph Data Summary

Stream	Elevation feet/meters	Date	Water Temperature Metrics (ºC)				BT	Data Source
			Mean Summer[a] 7/1-9/30	Mean Summer 7/30-9/22	Other Mean (See Date)	Maximum Daily Maximum (See Date)		
Bruneau mainstem	793/2,599	6/28-8/7/94			24.6	31.4	A	1
	~1,130/3,708	9/6-10/24/95				~22	S?	2
Jarbidge mainstem	~1,135/3,723	6/28-9/23/94			19.2	28.4	S?	1
		9/6-10/22/95				~21.5	S?	2
	~1,550/5,085	6/29-10/16/94			15.2	24.0	S	1
East Fork Jarbidge	~1,580/5,184	8/17-10/16/94				22.3	S	2
		8/17-10/16/95				20.7	S	2
	1,800/5,906	8/28-11/5/02			9.10	21.96	S	3
	1,805/5,922	8/28-11/5/02			9.05	23.07	S	3
	2,245/7,360	2003		8.10			Y	4

Bull Trout (BT): Y = year-round; S = seasonal; A = absent; * = possible fish barrier on lower Robinson Creek; ? = uncertain.

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Stream	Elevation feet/meters	Date	Water Temperature Metrics (ºC)				BT	Data Source
			Mean Summer[a] 7/1-9/30	Mean Summer 7/30-9/22	Other Mean (See Date)	Maximum Daily Maximum (See Date)		
West Fork Jarbidge	1,696/5,560	2003		14.91			S	4
	1,795/5,885	2001		14.93			S	4
	1,848/6,060	2002		13.95			S	4
	1,903/6,240	2001		13.88			S	4
		2002		12.59			S	4
	1,966/6,445	2002		11.73			S	4
	2,004/6,570	2002		11.13			S	4
	2,054/6,733	1999	10.14	10.54		15.2	S	5
	2,072/6,793	8/24-9/30/99	10.04	10.47	8.925	15.6	S	5
	2,079/6,815	1999	9.70	10.1		14.9	S	5
	2,105/6,901	1999	9.44	9.84		14.9	S	5
	2,117/6,940	1997		10.78		14.4	S	4, 6
	2,134/6,997	1999	8.84	9.20		14.5	Y	5

Bull Trout (BT): Y = year-round; S = seasonal; A = absent; * = possible fish barrier on lower Robinson Creek; ? = uncertain.

APPENDIX A. Jarbidge River Watershed Stream Thermograph Data Summary

Stream	Elevation feet/meters	Date	Water Temperature Metrics (ºC)				BT	Data Source
			Mean Summer[a] 7/1-9/30	Mean Summer 7/30-9/22	Other Mean (See Date)	Maximum Daily Maximum (See Date)		
West Fork Jarbidge (con't)	2,141/7,019	1999	8.86	9.23		14.4	Y	5
	2,153/7,058	1999	8.83	9.18		14.1	Y	5
	2,176/7,134	1999	8.7	9.05		14.1	Y	5
	2,248/7,370	1999	8.46	8.79		14.1	Y	5
	2,257/7,400	1998		8.9			Y	4
Bear	1,952/6,400	2000		11.6			A*	4
Cougar	2,074/6,800	1999		10.73			S	4

Bull Trout (BT): Y = year-round; S = seasonal; A = absent; * = possible fish barrier on lower Robinson Creek; ? = uncertain.

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Stream	Elevation feet/meters	Date	Water Temperature Metrics (ºC)				BT	Data Source
			Mean Summer[a] 7/1-9/30	Mean Summer 7/30-9/22	Other Mean (See Date)	Maximum Daily Maximum (See Date)		
Dave	1,905/6,245	8/24-9/30/99			9.30	16.8	S	5
	1,920/6,296	8/24-9/30/99			9.24	16.8	S	5
	1,938/6,355	8/24-9/30/99			9.32	17.5	S	5
	2,004/6,572	7/1-7/22/99			10.10	17.1	S	5
	2,020/6,623	8/25-9/30/99			8.73	17.9	Y	5
	2,052/6,728	8/25-9/30/99			8.54	17.9	Y	5
	2,083/6,831	8/25-9/30/99			8.3	17.5	Y	5
	2,089/6,849	1999	9.14	9.53		17.1	Y	5
	2,106/6,906	1999	8.62	8.98		16.4	Y	5
	2,150/7,054	1999				14.5	Y	5
	2,225/7,300	1999				13.1	Y	5
	2,381/7,600	1999		5.11			Y	4
Deer	2,159/7,080	2000		10.78			A	4

Bull Trout (BT): Y = year-round; S = seasonal; A = absent; * = possible fish barrier on lower Robinson Creek; ? = uncertain.

APPENDIX A. Jarbidge River Watershed Stream Thermograph Data Summary

Stream	Elevation feet/meters	Date	Water Temperature Metrics (ºC)				BT	Data Source
			Mean Summer[a] 7/1-9/30	Mean Summer 7/30-9/22	Other Mean (See Date)	Maximum Daily Maximum (See Date)		
Fall	2,001/6,560	1999		9.15			Y	4
Fox	2,147/7,040	2000		10.34			A	4
Gods Pocket	2,074/6,800	2002		9.11			A	4
Jack	1,800/5,906	1999	10.07	10.94			S	7
	1,928/6,320	1998		11.35			S	4
	2,050/6,720	1999		9.55			Y	4
Jim Bob	2,190/7,185	8/28-11/5/02			4.88	14.14	A*	3
	2,400/7,874	7/1-9/26/99			7.22	12.61	A*	8
		8/28-11/5/02			6.03	11.62	A*	3
	2,420/7,940	7/1-9/26/99			7.36	14.18	A*	8
		8/28-11/5/02			3.68	14.73	A*	3
Pine	2,020/6,628	1999	10.47			16.6	Y	5

Bull Trout (BT): Y = year-round; S = seasonal; A = absent; * = possible fish barrier on lower Robinson Creek; ? = uncertain.

APPENDIX A. Jarbidge River Watershed Stream Thermograph Data Summary

Stream	Elevation feet/meters	Date	Water Temperature Metrics (ºC)				BT	Data Source
			Mean Summer[a] 7/1-9/30	Mean Summer 7/30-9/22	Other Mean (See Date)	Maximum Daily Maximum (See Date)		
Robinson	~1,790/5,873	8/28-11/5/02			6.79	15.88	A	3
	2,144/7,030	1999		9.23			A*	4
	~2,185/7,169	8/28-11/5/02			4.76	14.76	A*	3
	~2,195/7,202	8/28-11/5/02			5.02	15.32	A*	3
Slide	2,053/6,736	1999	8.8	9.07		14.1	Y	5
	2,077/6,815	1999	8.19	8.6		14.1	Y	5
	2,106/6,910	1999	8.74	8.9		14.1	Y	5
	2,136/7,008	1999	8.46	8.62		12.9	Y	5
	2,168/7,113	8/25-9/30/99			6.58	11.8	Y	5
	2,172/7,120	1998		9.48			Y	4
	2,203/7,228	8/25-9/30/99			6.51	11.8	Y	5
	2,222/7,290	1999	8.08	8.12		12.9	Y	5
Slide (con't)	2,263/7,425	1999	8.49	8.56		13.3	Y	5

Bull Trout (BT): Y = year-round; S = seasonal; A = absent; * = possible fish barrier on lower Robinson Creek; ? = uncertain.

APPENDIX A. Jarbidge River Watershed Stream Thermograph Data Summary

Stream	Elevation feet/meters	Date	Water Temperature Metrics (ºC)				BT	Data Source
			Mean Summer[a] 7/1-9/30	Mean Summer 7/30-9/22	Other Mean (See Date)	Maximum Daily Maximum (See Date)		
	2,308/7,572	1999	8.31	8.39		13.3	Y	5
	2,373/7,786	1999	8.14	8.21		13.3	Y	5
Slide Trib. A	2,257/7,400	1998		8.59			Y	4

[a] Gamett (2002).

Data Sources: 1 = Robertson (1995); 2 = Robertson (1996); 3 = Brackett, C., and B. Brackett, *in litt.* 2003; 4 = Johnson, G., Nevada Division of Wildlife, *in litt.* 2003b; 5 = Werdon (2000a); 6 = NDOW (1997); 7 = Klott, J., Bureau of Land Management, *in litt.* 2000; 8 = Klott, J., Bureau of Land Management, *in litt.* 1999.

Bull Trout (BT): Y = year-round; S = seasonal; A = absent; * = possible fish barrier on lower Robinson Creek; ? = uncertain.

APPENDIX B. Recovery Actions and corresponding Reasons for Decline (threats) to bull trout in the Jarbidge River Distinct Population Segment.

	Reason for Decline (Threat) - Solid circles indicate limiting factor for recovery									
Recovery Action Number	Dams and Diversions	Forest Mgmt. Practices	Livestock Grazing	Transportation Networks	Mining	Residential Development and Urbanization	Fisheries Management	Isolation and Habitat Fragmentation	Inadequacy of Existing Water Quality Standards	Recreation
1.1.1		●	●	●	○	○		●	●	
1.1.2			●	●	○				○	
1.1.3					○					
1.1.4			○			○				
1.1.5			○			○				
1.2.1	○							●		○
1.3.1		○	●	●	○	○				○
1.3.2			○	●	○	○				
1.3.3			●							
1.3.4				○		○				
1.3.5				●		○				○
1.3.6										○

APPENDIX B. Recovery Actions and corresponding Reasons for Decline (threats) to bull trout in the Jarbidge River Distinct Population Segment.

	Reason for Decline (Threat) - Solid circles indicate limiting factor for recovery									
Recovery Action Number	Dams and Diversions	Forest Mgmt. Practices	Livestock Grazing	Transportation Networks	Mining	Residential Development and Urbanization	Fisheries Management	Isolation and Habitat Fragmentation	Inadequacy of Existing Water Quality Standards	Recreation
2.1.1							●			○
3.1.1							●			○
3.2.1							○			○
3.2.2							○			○
3.2.3							○			○
3.3.1							●			○
4.1.1							○	○		
4.2.1							○			○
5.1.1							●			
5.1.2			○	○	○	○		○		
5.2.1	○		○	○	○	○	○	●	○	○
5.2.2			●				○			○

APPENDIX B. Recovery Actions and corresponding Reasons for Decline (threats) to bull trout in the Jarbidge River Distinct Population Segment.

	Reason for Decline (Threat) - Solid circles indicate limiting factor for recovery									
Recovery Action Number	Dams and Diversions	Forest Mgmt. Practices	Livestock Grazing	Transportation Networks	Mining	Residential Development and Urbanization	Fisheries Management	Isolation and Habitat Fragmentation	Inadequacy of Existing Water Quality Standards	Recreation
5.2.3			○	○				○	○	
5.2.4								○	○	
5.3.1							●			
5.4.1							○			
6.1.1			○	○	○	○				○
6.1.2		○	○	○						
6.1.3		○	○	○		○	○			○
6.2.1			○	○	○	○		○	○	
7.1		○	○	○	○	○	○	○	○	○

APPENDIX C. Glossary of Technical Terms

Adit
A horizontal mine opening, open to the surface at one end.

Animal Unit Month (AUM)
The quantity of forage required by one mature cow and her calf (or the equivalent, for example, in sheep) for one month.

Adfluvial bull trout
Bull trout that migrate from tributary streams to a lake or reservoir to mature (one of three migratory bull trout life history forms, the others being anadromous and fluvial forms). Adfluvial bull trout return to a tributary to spawn.

Anadromous (fish)
A fish that is born in fresh water, migrates to the ocean to grow and live as an adult, and then returns to freshwater to spawn (reproduce). Anadramous bull trout are one of three migratory bull trout life history forms, the others being adfluvial and fluvial forms.

Artificial propagation
The use of artificial procedures to spawn adult fish and raise the resulting progeny in fresh water for release into the natural environment, either directly from the hatchery or by transfer into another area.

Canopy cover (of a stream)
Vegetation projecting over a stream, including crown cover (generally more that 1 meter [3.3 feet] above the water surface) and overhang cover (less than 1 meter [3.3 feet] above the water).

Channel morphology
The physical dimension, shape, form, pattern, profile, and structure of a stream channel.

Channel stability
The ability of a stream, over time and in the present climate, to transport the sediment and flows produced by its watershed in such a manner that the stream maintains its dimension, pattern, and profile without either aggrading or degrading.

Channelization
The straightening and deepening of a stream channel to permit the water to move faster, to reduce flooding, or to drain wetlands.

Char (*also* charr)
A fish belonging to the genus *Salvelinus* and related to both the trout and salmon. The bull trout, Dolly Varden trout, and the Mackinaw trout (or lake trout) are all members of the char family. Char live in the icy waters (both fresh and marine) of North America and Europe.

Connectivity (stream)
Suitable stream conditions that allow fish and other aquatic organisms to move freely upstream and downstream. Habitat linkages that connect to other habitat areas.

Core area
The combination of core habitat (*i.e.*, habitat that could supply all elements for the long-term security of bull trout) and a core population (a group of one or more local bull trout populations that exist within core habitat) constitutes the basic unit on which to gauge recovery. Core areas require both habitat and bull trout to function, and the number (replication) and characteristics of local populations inhabiting a core area provide a relative indication of the core area's likelihood to persist. In most cases, core areas are presumed to reflect the metapopulation structure of bull trout (see "metapopulation," below).

Core habitat
Habitat that encompasses spawning and rearing habitat (resident populations), with the addition of foraging, migrating, and overwintering habitat if the population includes migratory fish. Core habitat is defined as habitat that contains, or if restored would contain, all of the essential physical elements to provide for the security of and allow for the full expression of life history forms

of one or more local populations of bull trout. Core habitat may include currently unoccupied habitat if that habitat contains essential elements for bull trout to persist or is deemed critical to recovery.

Core population
A group of one or more bull trout local populations that exist within core habitat.

Discharge (stream)
With reference to stream flow, the quantity of water that passes a given point in a measured unit of time, such as cubic meters per second or, often, cubic feet per second.

Distinct population segment
A distinct population segment is a population subset of a vertebrate species or subspecies that meets the tests of discreteness and significance under the joint policy of the U.S. Fish and Wildlife Service and National Marine Fisheries Service (61 FR 4722). A distinct population segment designated as such under a regulatory rulemaking is a "listable entity" under the Endangered Species Act.

Entrainment
Process by which aquatic organisms are pulled through a diversion, turbine, spillway, or other device.

Extirpation
The elimination of a species from a particular local area.

Fine sediment (fines)
Sediment with particle sizes of 2.0 millimeters (0.08 inch) or less, including sand, silt, and clay.

Fish ladder
A device to help fish swim around a dam.

Floodplain
Adjacent to stream channels, areas that are typified by flat ground and are periodically submerged by floodwater.

Fluvial bull trout
Bull trout that migrate from tributary streams to larger rivers to mature (one of three migratory bull trout life history forms, the others being adfluvial and anadromous forms). Fluvial bull trout migrate to tributaries to spawn.

Foraging, migration, and overwintering habitat (bull trout)
Relatively large streams and mainstem rivers, lakes or reservoirs, estuaries, and nearshore environments, where subadult and adult migratory bull trout forage, migrate, mature, or overwinter. This habitat is typically downstream from spawning and rearing habitat and contains all the physical elements to meet critical overwintering, spawning migration, and subadult and adult rearing needs. Although use of foraging, migrating, and overwintering habitat by bull trout may be seasonal or very brief (as in some migratory corridors), it is a critical habitat component.

Fry
Young, recently hatched fish.

Gabion
A steel wire-mesh basket filled with stones or crushed rock to protect a bank or bottom from erosion.

Headwaters
The source of a stream. Headwater streams are the small swales, creeks, and streams that are the origin of most rivers. These small streams join together to form larger streams and rivers or run directly into larger streams and lakes.

Hooking mortality
Death of a fish from stress or injury after it is hooked and reeled in, then released back to the water.

Hybridization
Any crossing of individuals of different genetic composition, typically different species, that result in hybrid offspring.

Interacting groups (*also* "complex interacting groups")
Multiple local populations within a geographic area having connectivity that allows for individuals from each of these populations the opportunity to interact with one another.

Local population
A group of bull trout that spawn within a particular stream or portion of a stream system. Multiple local populations may exist within a core area. A local population is considered to be the smallest group of fish that is known to represent an interacting reproductive unit. For most waters where specific information is lacking, a local population may be represented by a single headwater tributary or complex of headwater tributaries. Gene flow may occur between local populations (*e.g.*, those within a core population), but is assumed to be infrequent compared with that among individuals within a local population.

Mass wasting
Loss of large amounts of material in a short period of time, *i.e.*, downward movement of land mass material or landslide.

Metapopulation
There are several different models of metapopulation dynamics, but in general a metapopulation refers to a population structure in which subpopulations may be distributed across the landscape in a patchy or semi-isolated pattern, but connectivity between these subpopulations is critical for maintaining the metapopulation as a whole. In the case of bull trout, we assumed that core areas represent the functional equivalent of a metapopulation structure for bull trout, and that the local populations within these core areas are interconnected by occasional dispersal between them and therefore share some genetic characteristics.

Migratory corridor (bull trout)
Stream reaches used by bull trout to move between habitats. A section of river or stream used by fish to access upstream spawning areas or downstream lake environments. *See also* "foraging, migration, and overwintering habitat."

Migratory life history form (bull trout)
Bull trout that migrate from spawning and rearing habitat to lakes or reservoirs (adfluvial), larger rivers (fluvial), or the ocean (anadromous) to grow and mature. Only the fluvial migratory form is known in the Jarbidge River Distinct Population Segment.

Nonnative species
Species not indigenous to an area, such as brook trout in the western United States.

Peak flow (stream)
Greatest stream discharge recorded over a specified period of time, usually a year, but often a season.

Potential local population
A local population that does not currently exist, but that could exist, if spawning and rearing habitat or connectivity were restored in that area, and contribute to recovery in a known or suspected unoccupied area. Alternatively, a potential local population may be a population that is suspected to exist, but that has not yet been adequately documented.

Recovery team (bull trout)
A team of people with technical expertise in various aspects of bull trout biology from Federal and State agencies, Tribes, private industry, and interest groups responsible for assisting in the development of the bull trout recovery plan.

Redd
A nest constructed by female fish of salmonid species in streambed gravels where eggs are deposited and fertilization occurs. Redds can usually be distinguished in the streambed gravel by a cleared depression, and an associated mound of gravel directly downstream.

Refounding
Reestablishment of a species into previously occupied habitat.

Resident life history form (bull trout)
Bull trout that do not migrate, but that reside in tributary streams their entire lives (one of four bull trout life history forms; the other three forms are all migratory [adfluvial, fluvial, or anadromous]).

Riparian
Area with distinctive soils and vegetation between a stream or other body of water and the adjacent upland. It includes wetlands and those portions of floodplains and valley bottoms that support riparian vegetation.

Salmonid
Fish of the family Salmonidae, including trout, salmon, chars, grayling, and whitefish. In general usage, the term most often refers to salmon, trout, and chars.

Spawning and rearing habitat/streams/areas (bull trout)
Stream reaches and the associated watershed areas that provide all habitat components necessary for spawning and juvenile rearing for a local bull trout population. Spawning and rearing habitat generally supports multiple year classes of juveniles of resident or migratory fish and may also support subadults and adults from local populations of resident bull trout.

Subpopulation (bull trout)
A reproductively isolated group of bull trout spawning within a particular area of a river system; the basic unit of analysis used in the initial listing of bull trout, but not used extensively in the recovery plan.

Substrate embeddedness
The filling of the interstitial spaces in rocky or gravel stream bottoms with silt or sediments, thereby eliminating the preferred physical characteristics of such substrates for spawning by bull trout (and other fish species).

Subwatershed
Topographic perimeter of the catchment area of a stream tributary.

Take
Activities that harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect; or attempt to engage in any such conduct to a listed (Endangered Species Act) species.

Transplants
Moving fish from one stream system to another without the use of artificial propagation.

Water right
Any vested or appropriation right under which a person may lawfully divert and use water. It is a real property right appurtenant to and severable from the land on or in connection with which the water is used; such water right passes as an appurtenance with a conveyance of the land by deed, lease, mortgage, will, or inheritance.

Watershed
The area of land from which rainfall (and/or snow melt) drains into a stream or other water body. Watersheds are also sometimes referred to as drainage basins or drainage areas. Ridges of higher ground generally form the boundaries between watersheds. At these boundaries, rain falling on one side flows toward the low point of one watershed, while rain falling on the other side of the boundary flows toward the low point of a different watershed.

Woody debris
Woody material such as trees and shrubs; includes all parts of a tree such as root system, bowl, and limbs. Large woody debris refers to the woody material whose smallest diameter is greater than 10 centimeters (4 inches) and whose length is greater than 1 meter (3.3 feet).