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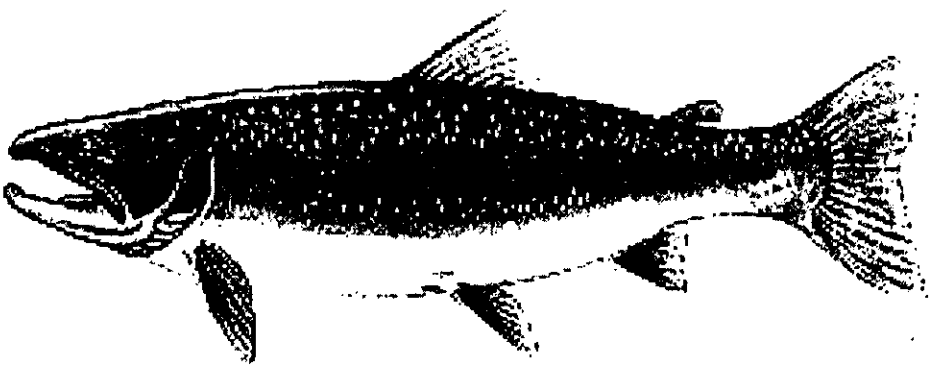
BITTERROOT RIVER DRAINAGE

BULL TROUT STATUS REPORT



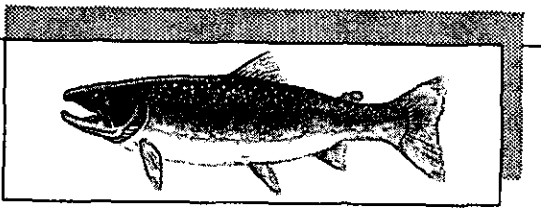
May 1995

Prepared for

The Montana Bull Trout Restoration Team

By

The Montana Bull Trout Scientific Group



Montana Bull Trout Restoration Team

Bonneville Power Administration

Confederated Salish & Kootenai Tribes

Department of State Lands

Montana Chapter American Fisheries Society

Montana Fish Wildlife & Parks

National Wildlife Federation

Plum Creek Timber Co.

US Fish & Wildlife Service

US Forest Service

TO: Bull Trout Restoration Interested Parties

Bull trout, a native Montana fish, has been the subject of extensive study and broad discussion since Governor Racicot appointed the Bull Trout Restoration Team in early 1994.

The bull trout status reports reflect a portion of both the study and discussion which has occurred during the last two years. These status reports, prepared by the Bull Trout Scientific Group, are designed to provide information about bull trout populations, habitat needs, and threats.

Status Reports have been prepared for bull trout populations in 11 restoration/conservation areas:

- Bitterroot River
- Lower Clark Fork River, downstream of Thompson Falls
- Middle Clark Fork River from Thompson Falls to Milltown, including the lower Flathead River to Kerr Dam
- Upper Clark Fork River, including Rock Creek
- Blackfoot River
- Flathead Lake, including the North and Middle Forks of the Flathead River. Stillwater and Whitefish rivers
- South Fork Flathead River, upstream of Hungry Horse Dam
- Swan Lake/River
- Lower Kootenai River, below Kootenai Falls
- Middle Kootenai River, between Kootenai Falls and Libby Dam
- Upper Kootenai River/Lake Koocanusa, upstream of Libby Dam

Each of these 11 restoration/conservation areas consist of a number of critical populations. The areas have been delineated on the basis of natural barriers and dam-caused fragmentation of historically connected river systems.

These status reports are **working documents**; they are the result of a collaboration of biologists, hydrologists, and other scientists and have drawn on information and research done by people working within each management area.

These documents are intended to provide the most current and accurate information available to the Bull Trout Restoration Team (see Introduction, p. 1) and the local bull trout watershed groups, which will assist them in making informed decisions affecting

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the restoration and conservation of bull trout in Montana. It is hoped that the watershed groups will develop specific recovery actions to help restore bull trout in watersheds throughout western Montana.

The status reports describe risks to bull trout in each watershed. This description of threats and risks to the fish is the best scientific judgement of the Scientific Group and is based on information provided by the local biologists. New and additional information provided by the public, the watershed groups, and the field biologists will add to our understanding of these risks as recovery proceeds. A status review is a continuous process, hence the description of these reports as "working documents."

Likewise, the restoration goal described in each status report is based on the best science available. The goal describes what would be necessary to recover fully functioning bull trout populations in each watershed and may not reflect what is realistically practical in all watersheds, considering time, budget, local interest, and/or other overriding constraints. It is presented as a goal, not necessarily as an inflexible expected outcome.

It is the sincere hope of the Restoration Team and Scientific Group that these documents will assist the watershed groups in "going forth and doing good things" for bull trout.

As always, we welcome your comments regarding bull trout restoration. Please send your thoughts or call Glenn Marx, Governor's Office, Capitol Station, Helena, MT 50620 (444-5506) or Shelley Spalding, Montana Fish, Wildlife and Parks, P.O. Box 20071, Helena, MT 59620 (444-7409).

Sincerely,

Larry Peterman

Larry Peterman, Chairman
Bull Trout Restoration Team

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EXECUTIVE SUMMARY

Bull trout were one of three salmonids native to the Bitterroot River. It is believed bull trout were once widely distributed in the river and tributary streams. The present distribution of bull trout is much reduced from historic levels in this drainage.

The migratory bull trout life form in the Bitterroot River is thought to have nearly disappeared. At present, bull trout populations in the Bitterroot River drainage are generally composed of small sized, resident fish inhabiting tributary streams on the Bitterroot National Forest. These populations are generally isolated from one another. Few bull trout have been found in the Bitterroot River downstream of Hamilton in a number of years and they are rare in the river upstream of Hamilton.

Risks

The two highest risks to bull trout recovery are the presence of introduced fish and dewatering of streams. Diversion dam barriers and effects of past and potential future forestry practices are also high risks.

Dewatering of streams leads to higher mid-summer water temperatures that likely favor brown and brook trout. Agricultural diversion dams can be barriers that block potential migration corridors for bull trout. Historical and potential future forestry practices can lead to increases in sediment and probably warmer summer stream temperatures that bull trout do not tolerate.

Rural residential development along stream corridors could lead to man made stream channel alterations, and grazing on the valley floor has removed riparian vegetation that kept water temperatures cooler.

Due to the fragmented distribution of bull trout, other significant risks to bull trout

restoration are such environmental instabilities as drought, landslides, floods and fire. Illegal introductions of fish and fisheries management are also high risks.

The most serious threat to restoration of bull trout in this drainage is fragmentation of bull trout populations into isolated units. Because remaining bull trout populations are fragmented, they are at a higher risk of extinction. Therefore, the effects of other risk factors such as agricultural and forestry practices on water quality and quantity, dewatering by irrigation diversions, and introduced species are exacerbated. When isolated populations become extinct, the probability of recolonization is low. In addition, the high number of risk factors, and the interactions between risk factors, complicate
restoration efforts.

Core Areas and Nodal Habitats

Core areas (those which currently support the strongest remaining populations of bull trout) are the upper East Fork of the Bitterroot River drainage above Bertie Lord Creek, Warm Springs Creek drainage, Sleeping Child Creek drainage, Skalkaho Creek drainage, Fred Burr Creek drainage, the West Fork Bitterroot River drainage above Painted Rocks Reservoir, and Burnt Fork Creek drainage. Other watersheds are being considered as core areas and may be added to the list when more information becomes available.

Nodal habitats (containing critical overwintering areas and migratory corridors) are the East Fork of the Bitterroot River, the West Fork of the Bitterroot River, Painted Rocks Reservoir, and the entire Bitterroot River mainstem.

The Restoration Goal

The restoration goal for bull trout in the Bitterroot River drainage is to establish a self-

reproducing migratory population in the Bitterroot River which spawns in tributary streams. Specifically, a preliminary goal is to have at least 100 redds or 2000 total individuals in the migratory population over a period of 15 years (3 generations), with spawning distributed among all the core watersheds. This preliminary goal is a minimum that would likely be an unstable population. If the preliminary goal is reached, an increasing trend and a higher, more stable number of fish would be the definitive goal.

Maintenance of self-sustaining bull trout populations in all the watersheds where they presently exist and maintenance of the population genetic structure throughout the watershed is part of the restoration goal. Under this goal all existing populations will at least remain stable or increase from current numbers in the future.

Once a restoration plan is finalized and implemented, a monitoring schedule will need to be developed to determine the success of the program. In addition, research needs are outlined in the plan.

BITTERROOT RIVER DRAINAGE BULL TROUT STATUS REPORT

INTRODUCTION

In January, 1994, the Governor of Montana established a Bull Trout Restoration Team to develop a restoration plan for bull trout (*Salvelinus confluentus*) in Montana. The Restoration Team appointed a Scientific Group to provide guidance on technical issues related to the restoration of this fish.

The Scientific Group prepared a Montana Bull Trout Restoration Plan which includes a review of the status of bull trout and risks to the survival of the species. Specific restoration strategies that address the highest threats will be discussed in a separate document. In addition, the Scientific Group prepared reports on three of the most significant issues in bull trout restoration: (1) land management concerns in bull trout restoration, (2) removal or suppression of introduced species and, (3) the use of hatcheries and transplantation in bull trout restoration. Because the threats facing bull trout vary widely across the state, separate reports were prepared for each of the twelve major recovery areas in Montana, except Rock Creek which is included in the Upper Clark Fork report. These recovery areas have been delineated largely due to fragmentation of historically connected systems Figure 1). Loss of interconnectivity results from migration barriers like dams or other habitat changes, such as altered thermal regimes or dewatering. Each of the twelve recovery areas contains core areas and nodal habitats for bull trout restoration.

This document addresses the historic and current status and distribution, identifies core and nodal habitats, describes major threats to the remaining populations and presents restoration goals for bull trout in the Bitterroot River Drainage (Figure 2).

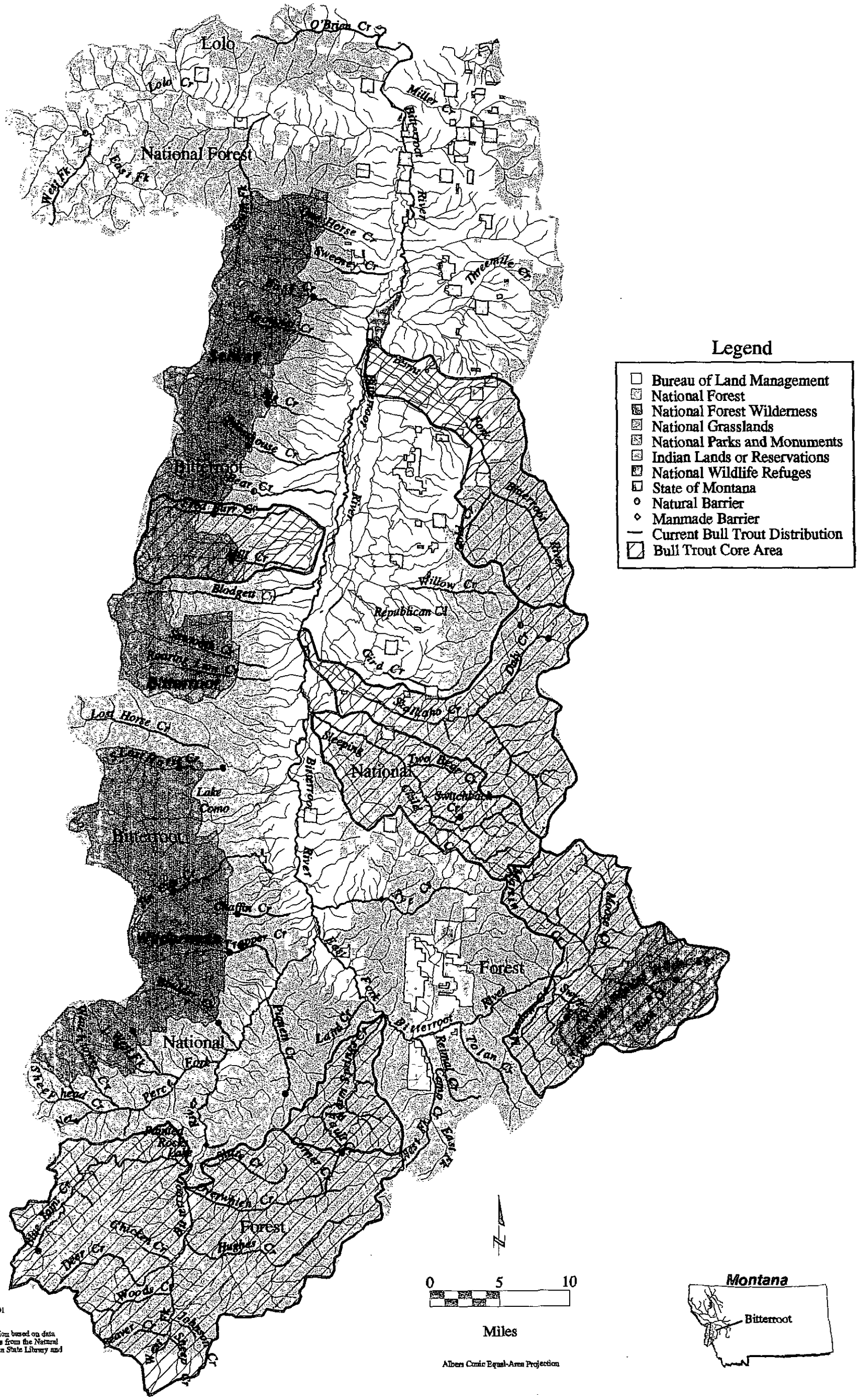
The Bitterroot River is born in the high peaks of the Bitterroot and Sapphire Mountains in western Montana (Figure 1). The East and West forks join near the town of Conner and from there the mainstem flows north through the irrigated crop and pasture land of the Bitterroot Valley some 85 miles to where it enters the Clark Fork River near Missoula (FWP 1991a). The total drainage area, upstream of the U.S. Geological Survey gage near Missoula, is 2814 miles^2 (USGS 1993). The major landowners in the drainage are the U.S. Forest Service, which manages most of the higher elevation lands and private landowners who own some of the forested and most of the unforested valley floor.

The Bitterroot River has 27 major tributaries on the west side and 12 on the east side. The approximate mean annual flow of the Bitterroot River in 1991 was 2080 cfs measured near the mouth of the river (Ingman 1992). In general, the west side tributaries contribute 40% of the stream discharge and the east side tributaries contribute 24.5%. The headwater tributaries contribute the remaining 35.5% (FWP 1991a).

The major life form of bull trout in the Bitterroot drainage today is resident fish that tend to live in higher elevation streams within the national forest. Migratory forms that live in the Bitterroot River are rare.

Figure 1. Bull Trout Restoration/Conservation Areas in Montana

Figure 2. Bull trout distribution and core areas in the Bitterroot drainage.



Map produced by:
Jeffrey Hutter
Montana Fish, Wildlife & Parks
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Bull trout distribution and barriers information based on data collected up to November, 1995. Base layers from the Natural Resource Information System at the Montana State Library and digitized @ 1:100,000.

May 16, 1996
/GIS/JEFF/BULLTRT/BC8.CMP

Montana Fish, Wildlife & Parks

HISTORIC AND CURRENT STATUS OF BULL TROUT IN THE BITTERROOT RIVER DRAINAGE

Historic Distribution

Historically, bull trout were likely distributed throughout the Bitterroot drainage. There are no major natural barriers to fish migration that would have excluded bull trout from any significant portions of the Bitterroot River drainage except barrier falls at higher elevations in tributary streams. Historically, bull trout likely used the river and all of the major tributaries and some of the smaller ones. There were two other salmonid species native to the Bitterroot River - westslope cutthroat trout (*Oncorhynchus clarki lewisi*) and mountain whitefish (*Prosopium williamsoni*). Numerous authors mention the presence of bull trout in the Bitterroot River. Chalfant (1974) describes Native American use of bull trout in the Bitterroot River. He stated that historically, considerable fishing, including the use of traps, was employed along the Bitterroot River and on the streams flowing into it in September and October. It is unknown whether there was historic use of the Bitterroot River by migratory bull trout from Lake Pend Oreille in Idaho.

Other authors describe bull trout from the Bitterroot River during more recent history (Evermann 1892; Anonymous 1929; Mitchell 1970). Oral histories from elderly Tribal members and local anglers who fished the river in the 1920's and 1930's describe large, migratory bull trout in the Bitterroot River.

Mitchell (1970) also reports collecting a bull trout from the West Fork of the Bitterroot River. Whitney (1955) collected bull trout in Hughes Creek, Moose Creek, South Fork Skalkaho Creek, Meadow Creek, West Fork Bitterroot River, and Skalkaho Creek in 1952 and 1954. Unpublished data collected prior to 1970 by the Montana Department of Fish, Wildlife, and Parks documented bull trout in the following waters (date of collection in parentheses): Burnt

Fork Reservoir (1964), Painted Rocks Reservoir (1967), Nez Perce Fork Bitterroot River (1963, 1966), East Fork Bitterroot River (1952), Lolo Creek (1968), Lost Horse Creek (1961), and Lost Park Creek (1966).

Current Distribution

Bull trout appear to be absent, or nearly so, from the mainstem Bitterroot River from the mouth of the river to Blodgett Creek because few bull trout have been collected in this portion of the river in several years (Figure 1). From Blodgett Creek to the East Fork of the Bitterroot, bull trout are rare, and in the upper reaches of the East and West Forks, some migratory fish (over 20") exist, but in low numbers.

In general, Bitterroot River tributary streams contain populations of small bull trout (rarely over 12" in length) in the upper reaches which are isolated from other bull trout streams. The connections between the tributaries and the mainstem Bitterroot River have often been severed by habitat degradation, dewatering and other passage barriers. Tributaries on the east side of the valley tend to have more bull trout than on the west side of the valley. Brown trout are common in the Bitterroot River and the lower end of tributary streams, and brook trout are common throughout many tributary streams.

Due to the lack of migratory bull trout today, quantitative monitoring of bull trout consists of time series population estimates of resident populations on the Bitterroot National Forest (BNF). This monitoring began in 1989. Inventory information is available throughout the Bitterroot Drainage and confirms the presence or absence of bull trout in various locations.

The lower Bitterroot River has been determined to be a major non-point source of nutrient pollution in the upper Clark Fork basin, primarily from sewage effluent from towns and also land development along the river (US EPA 1993). There are about 390 miles of stream,

including the entire mainstem of the Bitterroot, that are impaired or partially impaired for beneficial uses of the water (MT DHES 1994). Sources of impairment are primarily from agriculture (siltation and flow modification), silviculture (siltation and habitat modification) and resource extraction. However land development, road and highway modifications and wastewater effluent also contribute to impairment (MT DHES 1994).

The Bitterroot National Forest has classified the condition of most watersheds on the forest into three categories: "high risk", "sensitive", and "healthy". These categories are based on two major effects of management on watershed health: Sediment yields from road construction and increased water yields and peak flows from timber harvesting (Decker 1991). An analysis of the condition of the BNF streams indicates that about one third of the streams within the timber base are in healthy condition, one third are in sensitive condition, and one third are in high risk condition. Validation studies have found this model to be accurate 80% of the time. When the model is not accurate, the streams are usually in worse condition than predicted (Bitterroot National Forest 1991, 1992).

Bull trout populations with estimable numbers of individuals (10 or more fish larger than 5 inches/1000 feet of stream) have been found only in healthy and sensitive drainages. In the high risk drainages, no bull trout have been found at 80% of the sites, the other 20% contain very low numbers of bull trout (Clancy 1993).

Studies conducted on the (BNF) have found that, based on populations estimates, bull trout numbers are negatively correlated with the amount of fine sediment found in the stream (Clancy 1993; USDA Forest Service 1993). Weaver and Fraley (1991, 1993) found that the higher the percent of the spawning substrate that is < 0.25" in diameter, the lower the survival to emergence success of bull trout and westslope cutthroat trout. McNeil core samples taken on the BNF had a high average proportion of fine sediment (38 - 41% < 0.25") in developed and undeveloped drainages (Clancy 1991). Wolman pebble counts in undeveloped watersheds in the BNF generally have less than 25% fine sediment less than 0.25" (Decker et al. 1993).

Brook trout (*Salvelinus fontinalis*) are common in Bitterroot Valley streams. Approximately 75% of the bull trout streams also contain brook trout within the drainage, although not necessarily in the same stream reaches as the bull trout. Some genetic analysis has been done in the area. Streams that are known to contain bull trout X brook trout hybrids include Bear Creek, Gold Creek, Slate Creek, Woods Creek, Nez Perce Creek, Tin Cup Creek, Trapper Creek, Watchtower Creek, and the South Fork of Lolo Creek (Leary 1991, 1993). Data from the South Fork of Lolo Creek and Tolan Creek indicate that brook trout may be expanding their range and numbers at a relatively rapid rate in some habitats.

Overall, the drainage contains fragmented bull trout populations containing limited numbers of small fish with little or no genetic interchange.

CORE AREAS AND NODAL HABITATS FOR BULL TROUT IN THE BITTERROOT DRAINAGE

Core areas are drainages that currently contain the strongest remaining populations of bull trout and are usually relatively undisturbed. These areas need to have the most stringent levels of protection as they will potentially provide the stock for recolonization.

Core areas are the upper East Fork Bitterroot River drainage above Bertie Lord Creek, Warm Springs Creek drainage, Sleeping Child Creek drainage, Skalkaho Creek drainage, Fred Burr Creek drainage, West Fork Bitterroot River drainage above Painted Rocks Reservoir, and upper Burnt Fork Creek drainage (Figure 1). Other watersheds are being considered as core areas and may be added to the list when more information becomes available.

Nodal habitats (those containing migratory corridors, overwintering areas, and other critical habitat) are the East Fork Bitterroot River, the West Fork Bitterroot River, Painted Rocks Reservoir, and the entire Bitterroot River mainstem.

RISKS TO BULL TROUT IN THE BITTERROOT RIVER DRAINAGE

The risks to bull trout in the Bitterroot River drainage are listed in Table 1. The risks were evaluated by the Scientific Group based on the degree to which a risk factor was presumed to contribute to the current and past decline of the species (designated as current/historic in the table) and the threat the risk factor poses to future restoration of the fish (designated as restoration in the table). Those risks which are of greatest concern are noted with a double asterisk.

The two highest risks to bull trout recovery are the presence of introduced fish and dewatering of streams. Diversion dam barriers and effects of past and potential future forestry practices are also high risks.

Dewatering of streams leads to higher mid-summer water temperatures that likely favor brown and brook trout. Agricultural diversion dams can be barriers that block potential migration corridors for bull trout. Historical and potential future forestry practices can lead to increases in sediment and probably warmer summer stream temperatures that bull trout do not tolerate.

Rural residential development along stream corridors could lead to man made stream channel alterations, and grazing on the valley floor has removed riparian vegetation that kept water temperatures cooler.

Due to the fragmented distribution of bull trout, other significant risks to bull trout restoration are such environmental instabilities as drought, landslides, floods and fire. Illegal introductions of fish and fisheries management, which encourages large size brown and rainbow trout, are also high risks.

Table 1. **Risks to bull trout.** * = high risk in Bitterroot
** = very high risk to recovery

RISK	CURRENT/HISTORIC	RESTORATION
Environmental Instability		
Drought	*	*
Landslide/Geology	*	*
Flood/Rain on Snow	*	*
Fire	*	*
Introduced Species		
Private Ponds		
Legal Introductions	*	**
Illegal Introductions		*
Fisheries Management		*
Barriers		
Culverts		
Diversions	*	**
Thermal	*	*
Dams		
Habitat		
Rural Residential Development		**
Mining		
Grazing	*	**
Agriculture and Dewatering	*	**
Dam Operations		
Forestry	*	**
Recreational Developments		
Transportation		
Population		
Population Trend	*	*
Distribution/Fragmentation	*	*
Abundance	*	*
Biological Sampling		
Angling	*	
Illegal Harvest		

Environmental Instability (high risk)

Drought, Landslide/Geology, Flood/Rain on Snow, Fire

There are two components to the risk from environmental instability. First, the likelihood of a catastrophic event occurring and, second, the risk to the bull trout population if such an event should occur.

In the Bitterroot, fire, flood and drought are more likely to occur than landslides or rain on snow events. (Rain on snow is a common term used to describe cloudy weather periods when warm winds and rain combine to produce rapid snowmelt. These events generally occur during early to mid- winter periods.) Man's activities have increased the chances of some of these events occurring. However, the primary reason these events are of concern is because the bull trout population is fragmented. Under current conditions, if a catastrophic event were to cause a local extinction of the species, the opportunities for the fish to recolonize the habitat is extremely limited. If bull trout interconnectedness can be restored, then the risk from environmental instability would be lessened.

Introduced Species

The introduced game fish species found in the Bitterroot drainage include brook, brown (*Salmo trutta*), rainbow (*Oncorhynchus mykiss*), and Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*), largemouth bass (*Micropterus salmoides*), northern pike (*Esox lucius*), and walleye (*Stizostedion vitreum*) (at least one confirmed catch). The salmonids, particularly brook trout and brown trout, are believed to be the greatest threat to bull trout.

Bull trout hybridize with brook trout and the offspring are generally sterile (Leary et al. 1983). Hybridization has been confirmed to be occurring in some Bitterroot River tributaries (Leary 1991, 1993). The available data indicate this can be an unstable situation resulting in a dramatic decline or replacement of bull trout by brook trout (Leary et al. 1983).

Brown trout are suspected to adversely affect bull trout (Nelson 1965; Moyle 1976; Rode

1990; Pratt and Huston 1993). At this point the mechanism of the supposed adverse interaction (whether competition or predation) between bull trout and brown trout or other introduced species is not known and more information is needed. However, the result of the interaction may be detrimental to bull trout.

Private Ponds

The stocking of introduced trout species in private ponds is of increasing concern in the Bitterroot drainage. The human population of the valley is growing rapidly and many people are constructing ponds on their property. Although there is a requirement that private ponds be licensed by Montana Fish, Wildlife, and Parks before they are stocked with fish, some people are unaware of, or circumvent, the law. The existing permit system is inadequate to control the spread of introduced species. The concern is that brook trout, or other species, may spread from ponds into waters where they do not presently exist. There is also the potential for introduction of fish diseases through private fish stocking.

In addition, the cumulative impact of numerous ponds within a drainage that drain into tributary streams may be warming water temperatures above levels preferred by bull trout.

Legal Introductions (very high risk)

At the present time, the only fish species stocked in the Bitterroot River drainage by Montana Fish, Wildlife, and Parks is westslope cutthroat trout. This species is native throughout the drainage and is stocked only into some of the high mountain lakes in the basin. This stocking program is not believed to be detrimental to bull trout.

However, in the past the Department, other agencies and individuals have stocked a variety of non-native species, including brook trout, brown trout, rainbow trout and others. These fish have established self-reproducing populations in many Bitterroot Valley waters. It is the

legacy of these past stocking practices that poses a significant threat to the survival of bull trout today.

Illegal Introductions (high risk)

Illegal introductions of other aquatic species is another increasing concern. In addition to the risks posed by spreading introduced species, there is also a risk of introducing fish pathogens. Both northern pike and walleye have been illegally introduced into western Montana waters. These fish are not native to western Montana and have never been stocked in the region by any government agency. However, northern pike in particular are now found in many western Montana waters, including the Bitterroot River. In some areas, northern pike have completely replaced the existing trout fishery (J. DosSantos, Confederated Salish and Kootenai Tribes, personal communication; J. Vashro, Montana Department of Fish, Wildlife, and Parks, personal communication).

It is impossible to predict what species might be illegally introduced or what impact those fish may have on the native fauna. It is clear that continued illegal introductions will complicate restoration efforts for bull trout. The recent discovery of whirling disease in the Madison River and other streams underscores the potential problems associated with illegal introductions.

Fisheries Management (high risk)

The Bitterroot River is primarily a rainbow and brown trout fishery. Brown trout numbers are highest in the Darby section, and then steadily decline downstream. The area from one mile downstream of Darby Bridge to Como Bridge is a Large Trout Management Area with catch and release fishing, artificial lures only (FWP 1991a).

At this time, there is no information whether or not rainbow and brown trout are a detriment to bull trout in this drainage. In the future, sport fish management goals directed to

recreational fishing for introduced species may prove to be in conflict with the goal of restoring bull trout in this drainage. If bull trout are to persist over the long term, it may be necessary for the focus of fisheries management to adapt to a goal of further protecting imperiled native species.

Barriers

Numerous natural barriers exist on tributary streams, particularly on the BNF. At the present time, there are no plans to modify them or attempt to establish bull trout above them.

Culverts

There are some culverts in the drainage that are barriers to fish passage. However, in some areas, impassable culverts assist in keeping introduced fish out of a watershed. They are not considered a significant risk in the Bitterroot at this time.

Diversions (very high risk)

Diversions are a very significant risk to the restoration of the migratory bull trout population in some core habitats. Diversions may make it impossible for fish to migrate upstream from the river into the tributaries to spawn. In addition, downstream migrants may be trapped in the irrigation diversions and prevented from making it into the river. Most of the large tributary streams on both sides of the Bitterroot Valley north of Darby are heavily diverted. There are also some diversions on the mainstem Bitterroot River which may be barriers to fish passage.

Thermal (high risk)

Rieman and McIntyre (1993) concluded that temperature represents a critical habitat

characteristic for bull trout. Temperatures in excess of 59° F are thought to limit bull trout distribution in many systems (Bjornn 1961; Fraley and Shepard 1989; Brown 1992). Temperatures in the lower Bitterroot River and some of the tributaries meet or exceed 70° F during the summer months (Spoon 1987 and unpublished data). This evidence suggests that there may be thermal problems which limit bull trout distribution in the Bitterroot River and in the lower ends of some of the tributaries. Further research is needed to determine the specific causes of temperature increases in the mainstem Bitterroot River and the impact on bull trout.

The probable causes of the thermal problems include dewatering, lack of riparian vegetation to shade streams, warm irrigation return flows entering the tributary streams and river, warm water releases from irrigation reservoirs, and the proliferation of private fish ponds.

Dams

Most of the dams in the drainage are high in the mountains, generally above the area where bull trout are found. Painted Rocks Dam is a barrier to bull trout migration, however it is also a barrier to upstream dispersal of brown and rainbow trout and could protect bull trout from possible competition and predation by introduced species. Lake Como Dam is also a barrier to fish migration, however, the lake and its inflow stream are not believed to support bull trout.

Habitat Risk Factors

Rural Residential Development (very high risk)

There has been rapid growth of home building along riparian zones since the 1930's in the Bitterroot Valley (Javorsky 1994). Ravalli County had the highest population growth (22.8%) in Montana in the 1990 - 1994 time period (Lakes 1995). Streambank modification and destabilization and municipal point source pollution have been identified as sources of

impairment of water quality in the Bitterroot River (MT DHES 1994). Rural residential development is a high risk to long-term aquatic ecosystem health in the Bitterroot drainage. Development exacerbates temperature problems, increases nutrient loads, decreases bank stability and increases pressures to alter stream and riparian habitats.

Bull trout in headwater streams are not currently being directly impacted because many of the remaining bull trout populations are on lands owned by the Forest Service. However, the potential to restore the fish in the Bitterroot River will be limited by uncontrolled urban sprawl.

Mining

Past or present mining activity has been limited in the Bitterroot valley and is not a significant issue in this area.
Hughes Creek, a tributary of the West Fork, has been extensively placer and dredge mined.

Grazing (very high risk)

The influence of past grazing practices on streams in the Bitterroot Valley is unknown, but it could have been a significant factor in the decline of the bull trout in the Bitterroot River and tributary reaches.

Presently, the most severe grazing impacts tend to be in the valley bottom streams. Most of the current overgrazing is spatially separated from the remaining bull trout populations. However, grazing practices may be a significant risk factor for restoration of a migratory population.

Agriculture (water quantity and quality) (very high risk)

Approximately 64.5 miles of river and stream are estimated to suffer from chronic

dewatering in the Bitterroot River drainage. Waters that experience chronic dewatering include: North and South Bear Creek, Big Creek, the Bitterroot River from Corvallis to Stevensville, Blodgett Creek, Burnt Fork Creek, Carlton Creek, Kootenai Creek, Lolo Creek, Lost Horse Creek, Mill Creek, Mill Creek (tributary to Lolo Creek), O'Brien Creek, Rock Creek, Skalkaho Creek, South Fork of Lolo Creek, Sweathouse Creek, Sweeney Creek, and Tin Cup Creek (FWP 199[illegible]b).

Dewatering of streams restricts the distribution and movement of bull trout in tributary streams and is probably one of the primary causes for the loss of the species in the mainstem Bitterroot River. Dewatering also contributes to thermal problems in the tributaries and the mainstem river. Likely, as a result of dewatering, bull trout are generally found only upstream of areas impacted by irrigation withdrawals. Dewatered areas will be a barrier to the restoration of the species in this drainage.

Agriculture also impacts bull trout when farming practices encroach on riparian zones. Loss of riparian vegetation can result in bank destabilization, warmer water temperatures, increased sediment loads, and decreased floodwater and sediment storage.

Agriculture can also impact water quality by increasing nutrients entering streams. In some areas streams have been channelized for agricultural purposes causing loss of important physical fish habitat and increasing the erosive capability of streamflows against streambanks.

Dam Operations

There are no hydroelectric facilities in this drainage, but there are several irrigation storage reservoirs in the valley. These dams likely alter nutrient and sediment storage and release regimes and alter downstream flow patterns, temperature regimes, and habitat. Fred Burr Dam washed out years ago and the downstream area is still suffering from the effects of high bedload movement.

Painted Rocks Reservoir may support a population of migratory bull trout that use inflowing tributaries for spawning and rearing. The reservoir is annually drawn down by releases for instream flow and irrigation purposes. Little water remains in the reservoir during the fall and winter months. Some minimum pool might be appropriate for bull trout since Painted Rocks has been identified as a nodal habitat.

Como Lake has historically been drawn down to the historic lake level by irrigation withdrawals. An additional 3 feet were added to the top of the dam in 1994 and 1995 to store water for instream flow and recreational uses.

Forestry (very high risk)

Past forestry practices (road construction, log skidding, riparian harvest, clearcutting, burning, terracing) were often damaging to watershed conditions and were contributing causes of the decline of bull trout (Clancy 1993, Decker et al 1993). Old railroads, truck roads and tractor skid roads were often built near tributary streams encroaching on floodplains and stream channels. The adverse effects of these practices include increased sediment in streams, increased peak flows, thermal modifications, loss of in-stream woody debris, and channel instability. Current forestry practices are more progressive but the risk is still high because of the existing road system, mixed land ownership, forestry practices on private land, and the lingering results of past activities. Most of the core habitats have a need for watershed rehabilitation. The existing transportation system used for timber access is a major impact on some tributary streams and is the focus of watershed improvement needs by the BNF.

Recreational Development

This is presently a low risk to bull trout in the Bitterroot Valley.

Transportation

Overall, the risk to bull trout is low, although in some specific locations channelization of streams for roads and railroads are a significant impact. Several East Fork Bitterroot River canyon meanders were straightened for US 93. Road maintenance may also impact bull trout when road sanding or deicing materials enter the stream or when road grading increases stream sediment loads. The Skalkaho highway is located on a major geologic fault, is poorly designed and drains large sediment loads into the adjacent streams.

In some locations US 93 is immediately adjacent to the Bitterroot River and there is potential for hazardous materials to enter the river in the event of an accident.

Population Risk Factors

Life History

Resident fish are now the predominant life form in the Bitterroot drainage. Migratory fish are rare and are only found in upstream portions of the Bitterroot River and possibly in Painted Rocks Reservoir. The connectivity of bull trout in different streams by the migratory form is thought to be important to the long term viability of the species.

Trend (declining) (high risk)

There is relatively little long-term population trend data. Time series monitoring of trout populations on the Bitterroot National Forest began in 1989, which is too recent to establish long-term trends. However, available evidence indicates that resident and migratory bull trout are probably continuing to decline from their historic distribution and abundance.

Distribution/Fragmentation (high risk)

Disruption of migratory corridors increases stress, reduces growth and survival and leads to the loss of the migratory life history form. Resident stocks living upstream from barriers are at an increased risk of extinction (Rieman and McIntyre 1993). Fragmentation is one of the most significant risk factors for bull trout in the Bitterroot River drainage. The migratory form appears to have been lost, or nearly so, from the Bitterroot River. Restoration of this life history form is needed for the long term survival of the species in this drainage.

Abundance (high risk)

If a population is small enough, random variation among individuals can lead to negative growth in the population long enough for the population to go extinct. As a population is restricted in abundance, or as the variation in its birth rate or survival increases, the predicted mean time to extinction will decrease (Rieman and McIntyre 1993).

The number of remaining migratory bull trout is so low that the risk of extinction is judged to be very high. For resident fish the risk varies by location. Some populations in tributaries on the east side of the valley are at low risk (adult populations number in the thousands in some of these tributaries) but populations in the west side tributaries are at high risk because of low populations.

Biological Sampling Loss

As a result of research on the impacts of electrofishing on fish, techniques and equipment have been modified to minimize electrofishing injure to fish. Electrofishing of streams on the Bitterroot National Forest is confined to short reaches and is highly spaced within a stream so that most bull trout habitat is never electrofished. There is also a FWP policy limiting the use of electrofishing in waters containing species of special concern. Overall, the risk of loss of bull

trout due to sampling is judged to be minimal.

Angling

In the past, bull trout harvest (both legal and illegal) may have been a significant risk factor. Stories of people targeting large bull trout on the East Fork of the Bitterroot River were circulated as recently as three years ago.

The current risk from angling is low because fishing for bull trout is no longer legal in this drainage. However, if bull trout are restored in the future, there will be some risk to bull trout from incidental hooking and handling mortality. Those drainages that receive significant fishing pressure (such as the Bitterroot River) may be more likely to have hooking mortality problems than more lightly fished waters (The Bitterroot River is the third most heavily fished water in Region 2. Fishing pressure in 1993 was 75,288 angler days, up from 52,776 angler days in 1991 (FWP 1991c; FWP 1993)). Misidentification of bull trout can be a problem because they look somewhat like the brook trout that are present in many tributary streams.

If, in the future, data indicate that hooking mortality is a significant problem then the core habitats could be closed to fishing entirely, particularly during spawning season. At this time such action is unnecessary as the risk is small in comparison to other risks.

Illegal Harvest

Since the Bitterroot does not contain very many large bull trout, widespread poaching of bull trout is unlikely. However, the small number of large bull trout also makes every fish significant.

If we are successful in restoring the migratory population there is a risk that poachers may be attracted to fish for bull trout.

RESTORATION GOAL

In the Bitterroot drainage, migratory bull trout are rare in the mainstem of the river and uncommon in the East and West Forks. It is estimated that the probability of extinction of migratory bull trout will increase if there are less than 100 redds or 2000 total individuals in the migratory population (Rieman and McIntyre 1993).

Therefore, the restoration goal for bull trout in the Bitterroot River drainage is to establish a self-reproducing migratory population in the Bitterroot River which spawns in tributary streams. Specifically, a preliminary goal is to have at least 100 redds or 2000 total individuals in the migratory population over a period of 15 years (3 generations), with spawning distributed among all the core watersheds. This preliminary goal is a minimum that would likely be an unstable population. If the preliminary goal is reached, an increasing trend and a higher, more stable number of fish would be the definitive goal.

Maintenance of self-sustaining bull trout populations in all the watersheds where they presently exist and maintenance of the population genetic structure throughout the watershed is part of the restoration goal. Under this goal all existing populations will at least remain stable or increase from current numbers in the future.

It should be recognized that this goal is based on the best information available at this time, but the level of uncertainty about the appropriateness of the numbers is high. Modifications of this goal may be appropriate in the future as more information becomes available.

The reestablishment of connectivity between the Bitterroot River and its tributaries is considered imperative for the long term survival of this species in this drainage. Otherwise it is believed that demographic factors, genetic factors, and natural or human caused catastrophic events will act in concert to gradually cause the elimination of remaining populations. Once

extirpated, the chances of natural recolonization given the present situation are essentially zero. A key component of the restoration goal for bull trout in the Bitterroot River drainage is to establish a self-reproducing migratory life form in the Bitterroot River with spawning in all core areas.

SOURCES OF UNCERTAINTY, DATA NEEDS

Distribution

More detailed information is needed on the distribution of bull trout and other species in the Bitterroot River drainage. Particularly, the streams draining the Bitterroot mountains on the west side of the valley need fish distribution surveys.

Fish population monitoring in brook trout/bull trout transition areas should be increased to observe whether brook trout are expanding their range.

Migratory Populations

We need to better understand migratory populations, how many fish constitute a viable population, and where they spawn. How much impact, if any, do the mainstem dams on the Clark Fork River have on bull trout in the Bitterroot River?

It is important to understand if "resident" populations of bull trout can refound a migratory form. Research is needed to answer this question.

Temperature

We need to gather more information about temperature regimes in the drainage, the causes of elevated temperatures and the impact on bull trout behavior and distribution. Is the temperature regime in the Bitterroot River suitable for bull trout recovery?

Restoration

We need to identify potential restoration sites.

Species Interactions

We need to know more about bull trout interactions with introduced species in general. In the Bitterroot, the primary concerns are interactions with brook and brown trout. Research is necessary to understand if "improving" the habitat in migration corridors in streams on the valley floor will lead to increased numbers of bull trout or if it will actually benefit introduced brown and brook trout. Also, how is habitat alteration related to species interactions and what is the pattern of brook trout colonization.

Barriers

We need an assessment of barriers - culverts, diversions, etc. to determine which ones should be fixed, particularly on streams that may be important to restoring the connectivity to the Bitterroot River.

Fire

The Forest Service is currently researching forest fire risk in the Bitterroot and this work may help in assessing the risk of fire to bull trout.

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APPENDIX A

ACRONYMS

FWP	Montana Fish, Wildlife & Parks
MDHES	Montana Department of Health and Environmental Sciences
TMDL	Total Mean Daily Load
US EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UCFRBSC	Upper Clark Fork River Basin Steering Comittee

GLOSSARY

aggrade:	raise the grade or level of a river valley or streambed by depositing streambed material or material or debris
core area:	a drainage that currently contains the strongest remaining populations of bull trout in a restoration area; usually relatively undisturbed habitat
cover:	anything that provides visual isolation or physical protection for a fish, including vegetation that overhangs the water, undercut banks, rocks, logs and other woody debris, turbulent water surfaces, and deep water
disjunct population:	a population found in a headwater lake, that appears to be self-reproducing, but is functionally isolated from the rest of the system
drainage:	an area (basin) mostly bounded upstream by ridges or other topographic features, encompassing part or all of a watershed
entrainment:	displacement of fish from a reservoir through an outlet from a dam or from a river into an irrigation ditch
escapement:	adult fish which return to spawn
fragmentation:	the breaking up of a larger population of fish into smaller disconnected subpopulations
fry:	first-year fish

migratory:	describes the life history pattern in which fish spawn and spend their early rearing years in specific tributaries, but migrate to larger rivers, lakes or reservoirs as adults during their non-spawning time
nodal habitat:	waters which provide migratory corridors, overwintering areas, or other critical life history requirements
redd:	a disturbed area in the gravel, or a nest, constructed by spawning fish in order to bury the fertilized eggs
resident:	fish, which are often found in tributary or small headwater streams, where the fish spend their entire lives
risk:	a factor which has contributed to the past or current decline of the species
restoration:	the process by which the decline of a species is stopped or reversed, and threats to its survival are removed or decreased so that its long-term survival in nature can be ensured
Restoration Team:	a policy-level group with representatives from state and federal agencies, conservation organizations and private industry; created by Governor Racicot to establish a Bull Trout Restoration Plan for Montana
population:	an interbreeding group of fish that spawn in a particular river system (or part of it) and are reproductively isolated
riparian area:	lands adjacent to water such as creeks, streams and rivers and, where vegetation is strongly influenced by the presence of water
Scientific Group:	composed of agency, private and university scientists appointed by the Restoration Team to conduct technical analysis
threat:	a factor which jeopardizes the future conservation of the species
watershed:	a drainage basin which contributes water, organic matter, dissolved nutrients, and sediments to a river, stream or lake (USDA 1995)
Watershed Group:	a group of agency representatives, landowners and recreational and commercial users of a watershed, plus a liaison from the Scientific Group; created by the Restoration Team and charged with developing recovery actions to help restore bull trout

APPENDIX B

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