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United States Department of the Interior

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FILE M.04 BR
Frenchtown/Big Flat Irrigation

July 07 2003

MEMORANDUM

To: Environmental Program Manager, Upper Columbia Area, Bureau of Reclamation, Yakima, Washington

From: Field Supervisor, Montana Ecological Services Field Office, Helena RMW

Subject: Biological Opinion for Bull Trout, Operations and Maintenance of the Big Flat and Frenchtown Irrigation Diversions

Attached is the U.S. Fish and Wildlife Service's (Service) *Biological Opinion for Bull Trout, Operations and Maintenance of the Big Flat and Frenchtown Irrigation Diversions* on the Bitterroot and Clark Fork rivers, respectively. This biological opinion addresses effects to the threatened bull trout in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

This biological opinion has been prepared using a number of documents and other sources, including the Bureau of Reclamations's (Reclamation) Biological Assessment for Operations and Maintenance of Big Flat Unit, Missoula Valley Project, and Frenchtown Project, Montana. Reclamations's biological assessment found that continued operation and maintenance of these irrigation systems had no effect on the threatened Canada lynx (*Lynx canadensis*), grizzly bear (*Ursus arctos horribilis*), gray wolf (*Canis lupus*) and the candidate yellow-billed cuckoo (*Coccyzus americanus*). The biological assessment also determined that continued operation and maintenance of the Big Flat and Frenchtown irrigation systems may affect, (but is) not likely to adversely affect the threatened bald eagle (*Haliaeetus leucocephalus*).

The Service notes the no effect determination for the Canada lynx, grizzly bear, gray wolf and yellow-billed cuckoo. The Service concurs with the determination that ongoing operations and maintenance of the Big Flat Unit and Frenchtown Project is not likely to adversely affect the bald eagle.

A complete administrative record of this consultation is on file at the Montana Field Office, U.S. Fish and Wildlife Service, Helena Montana.

If you have any questions, please feel free to contact Jay Frederick at (406) 449 5225 extension 207.

Endangered Species Act - Section 7 Consultation

BIOLOGICAL OPINION
for
Bull Trout
Operations and Maintenance
of the
Big Flat and Frenchtown Irrigation Diversions

2003

Agency: United States Department of Interior
Bureau of Reclamation

Consultation Conducted by: U.S. Fish and Wildlife Service
Montana Field Office

Date Issued: July 07 2003

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I. Introduction and consultation history

Introduction The Big Flat Unit of the Missoula Valley Irrigation Project and the Frenchtown Irrigation Project divert water from the Bitterroot and Clark Fork rivers, respectively. The Frenchtown irrigation diversion has been in place and functioning since 1937, the Big Flat Unit irrigation diversion has been in place and functioning since 1949. These irrigation systems were constructed by the Bureau of Reclamation, and both are currently operated by local irrigation districts.

Neither the Big Flat nor Frenchtown irrigation diversions are screened to prevent entrainment of fish, and fish of various species are known to be entrained and lost from the populations of these rivers. In addition, the initial construction and continued operation of these irrigation systems impacted riverine, riparian and flood plain habitat. Specifically this occurred in association with the Frenchtown irrigation system, where an intake channel was created in the floodplain of the Clark Fork River, diversion dams were constructed across side channels of the Clark Fork River, and a diversion berm is constructed in the wetted perimeter of the Clark Fork River during low flow years.

With the listing of bull trout (*Salvelinus confluentus*) under the Endangered Species Act (Act) in 1998, federal agencies were required to review ongoing programs and projects to insure that any action authorized, funded or carried out by the agency was not likely to jeopardize the continued existence of this species. The review of ongoing programs and projects is conducted in consultation with the U.S. Fish and Wildlife Service (Service).

This biological opinion addresses the Bureau of Reclamations's July 3 2002 biological assessment for operation and maintenance of the Big Flat Unit, Missoula Valley Project and Frenchtown Project for threatened, endangered and proposed species (USDI 2002a). The biological assessment found that the ongoing operation and maintenance of these facilities may affect, (and is) likely to adversely affect bull trout. The Service concurs with the determination that the ongoing operations and maintenance of the Big Flat Unit and Frenchtown Project is likely to adversely affect bull trout in the Bitterroot and Clark Fork rivers respectively, through entrainment in the Big Flat and Frenchtown irrigation canals.

The biological assessment also discussed potential impacts to other listed and candidate species. Further discussion of potential impacts to listed species can be found in section III E of this biological opinion.

This biological opinion addresses impacts to bull trout stemming from continued operation and maintenance of the facilities of the Big Flat Unit of the Missoula Valley Project and the Frenchtown Project. This includes withdrawal of water from the Clark Fork and Bitterroot rivers and manipulation of the channel of the Clark Fork River.

Summary of relevant water rights The following summary is adopted from information provided by the Bureau of Reclamation (USDI 2002a), incorporating a review of water rights data by the Montana Department of Natural Resources and Conservation at the request of the Service.

The mainstem of the Bitterroot River basin is currently in the claim examination phase of the adjudication process, and a claim examination is expected to be completed in three to four years (2005 or 2006). The surface water right for the Big Flat Unit of the Missoula Valley Project is held by the United States (Department of Interior, Bureau of Reclamation) and has a priority date of December 4 1944. The water right is for 35.8 cfs from the Bitterroot River, with an annual volume of 7880 acre-feet to irrigate a maximum of 944.6 acres. The original project was designed to irrigate 944 acres; less than 500 are currently irrigated by the Big Flat irrigation system.

A temporary preliminary decree has been issued for the Clark Fork River basin. For the Frenchtown Project, the surface water right is held by the Frenchtown Irrigation District and has a priority date of September 14 1933. The water right is for 172 cfs from the Clark Fork River to irrigate a maximum of 4676.1 acres. No annual volume was specified.

The Frenchtown Irrigation District water right includes water for stock watering at a rate of 30 gallons per animal unit per day with the period of stock water use from April 15 to December 19. The use of this water right for irrigation and stockwater does not increase the extent of the water right, but rather decrees the right to alternate and exchange the use or purpose of the water in accord with historic practices.

Relationship to the draft Recovery Plan for Bull Trout The construction of fish protection devices at the Big Flat and Frenchtown irrigation diversion structures is currently under evaluation by the Bureau of Reclamation. This biological opinion establishes direction for fish protection at these facilities. Eliminating the entrainment of fish into the Big Flat and Frenchtown irrigation systems partially implements draft Recovery Plan third-tier recovery measure 1.2.1, *Eliminate Entrainment in Diversions*.

Consultation history.... Informal consultation on the Big Flat Unit and Frenchtown Project was initiated several times with the request for and issuance of species lists for threatened and endangered "species occurring within or adjacent to the boundaries of the Frenchtown, Bitterroot and Hungry Horse projects in western Montana." Following the listing of bull trout, species lists were sent to the Bureau of Reclamation on January 12 1999, December 10 1999, July 28 2000, and February 6 2002.

Formal consultation for bull trout was initiated on July 17 2002 with the Service's receipt of the Bureau of Reclamation's Biological Assessment for operation and maintenance of the Big Flat Unit, Missoula Valley Project and Frenchtown Project (USDI 2002a). This analysis, field reviews conducted on April 15 and June 12 and September 16 2002, discussions with Bureau of Reclamation personnel and other specialists working in the area were used in the preparation of this biological opinion.

Critical habitat for bull trout was proposed on November 29 2002. The lower Bitterroot River at the point of diversion of the Big Flat irrigation canal and the Clark Fork River at the point of diversion of the Frenchtown irrigation canal are within the area proposed for critical habitat. At the request of the Service, the Bureau of Reclamation reviewed the ongoing operation and maintenance of the Big Flat and Frenchtown irrigation systems and the potential for these facilities to result in destruction or adverse modification of proposed critical habitat. The Bureau of Reclamation found that the ongoing operation and maintenance of the Big Flat Unit of the Missoula Valley Project and the Frenchtown Project were not likely to result in destruction or adverse modification or proposed critical habitat, and documented this finding to internal Bureau of Reclamation files (Dr. Stephen Grabowski, Bureau of Reclamation, pers. comm. 2003).

The National Marine Fisheries Service prepared a multi species biological opinion for the operation of the Federal Columbia River Power System in December 2000. This opinion considered the combined effects of 19 Bureau of Reclamation projects on streamflow in the principal channels of the Columbia and Snake rivers. Water withdrawals from the Big Flat Unit and Frenchtown Project were determined to contribute to streamflow depletions in the Columbia River mainstem, estuary and plume during the juvenile outmigration period.

II. Description of proposed action

Ongoing operations and maintenance of the Big Flat and Frenchtown irrigation systems involves a number of elements associated with diversion of the Bitterroot and Clark Fork rivers, capture of the flow into irrigation canals and dispersion of irrigation water onto pasture, farmland and residential property. Operations and maintenance of these irrigation systems also includes the partial and nearly complete obstruction of the flow of a large side channel of the Clark Fork River, the application of the biocide Magnicide H (a formulation of acrolein), and relatively minor periodic instream manipulation of bedload and gravel bar deposits.

The action area includes portions of the river channels of the Bitterroot and Clark Fork rivers, the area within and immediately adjacent to the irrigation canals and laterals and approximately 5500 acres of irrigated land on the north and south side of the Clark Fork River. The action area essentially includes all of the private land under irrigation by water diverted from the Bitterroot and Clark Fork rivers by the Big Flat and Frenchtown irrigation systems. The action area also includes portions of the river channels parallel to the principal canals of the Big Flat and Frenchtown irrigation systems. Specifically, the action area includes:

- approximately 500 acres of irrigated land on the south side of the Clark Fork River west of the city of Missoula that are part of the Big Flat Unit of the Missoula Valley Project;
- approximately 5000 acres of irrigated land on the north side of the Clark Fork River west of the city of Missoula that are part of the Frenchtown Project;
- the lower Bitterroot River from the point of diversion of the Big Flat Canal downstream to the confluence of the Bitterroot and Clark Fork rivers, a distance of approximately 4 miles; and
- the Clark Fork River from the confluence of the Bitterroot River downstream to the lowermost Frenchtown Project lands near Huson, Montana, a distance of approximately 21 miles.

The Big Flat irrigation system diverts water from the Bitterroot River at a point about 4 miles above the confluence of the Bitterroot and Clark Fork rivers. The river diversion is an excavated trench perpendicular to the river channel and approximately 30 feet in width. There is no diversion structure or berm into the Bitterroot River associated with the Big Flat diversion, and water is not actually impounded by this system. It does not appear that the diversion incorporated a side channel, tributary or other contributing terrain feature to the Bitterroot River. The Big Flat irrigation system is entirely gravity fed.

The Big Flat headgate is approximately 488 feet down the excavated trench from the Bitterroot River. The water right for the Big Flat irrigation system permits a period of use from April 15 through October 31. Though the period of operation of the Big Flat irrigation system is generally from May 1 through October 1, the trench from the Bitterroot River to the headgate is inundated with water year-round. The 9.3 mile long canal downstream from the headgate is dewatered in the non irrigation season, though seepage into the canal from sub-irrigated areas on the flood plain of the Bitterroot River does occur.

The water right for the Big Flat irrigation system is for 35.8 cubic feet per second (cfs). The capacity of the headgate and conveyance system is substantially less than the water right at 25.0 cfs (USDI 2002a). Weeds that accumulate in the Big Flat irrigation system are removed mechanically.

The Frenchtown Project is considerably larger than the Big Flat irrigation system. For the Frenchtown irrigation system, water is diverted from a side channel of the Clark Fork River. This sizable side channel is entirely obstructed by an earth and rock fill dam in which the headgate and 12-foot wide concrete sluiceway obstruct or route water into the irrigation canal or downstream side of the side channel, respectively. The dam is 16 feet high, has a crest length of 489 feet and contains approximately 12,000 cubic yards of fill material.

The irrigation season typically runs from May 1 through October 1 annually, though the permitted season (under the water right) is April 15 through October 19 and watering of stock with water from the irrigation system may occur until December 19 (USDI 2002a). The sluiceway on the diversion dam is closed by the irrigation district from April 1 through July 1 and for an undisclosed period following the irrigation season, though leakage from the sluiceway into the side channel is thought to be approximately 2 cfs (USDI 2002b). Considerable deposition of gravel and cobble sized material occurs above the dam and in the first one-quarter mile of canal downstream from the headgate. The principal canal of the Frenchtown project is 17 miles long and feeds approximately 21 miles of irrigation laterals. The water right for the Frenchtown irrigation system is for 172.0 cfs. Typical diversion for the Frenchtown irrigation system is substantially less at 115 cfs, however.

For a thorough discussion of the details of ongoing operations and maintenance of the Big Flat and Frenchtown irrigation systems, the reader is encouraged to review the *Biological Assessment for Operations and Maintenance of Big Flat Unit, Missoula Valley Project and Frenchtown Project, Montana* (USDI 2002a).

Concurrent with the analysis of Operations and Maintenance of the Big Flat Unit, Missoula Valley Project and Frenchtown Project, the Bureau of Reclamation is evaluating constructing fish protection facilities at or near the Big Flat and Frenchtown irrigation system headgates. To date, this analysis has produced the *Assessment of Fish Passage Needs and Potential Improvements at Frenchtown Main Canal and Big Flat Canal* (USDI 2000), the *Predesign Memorandum- French Town (sic) Canal Fish Facility Installation* (USDI 2002b) and the *Predesign Memorandum- Montana Fish Protection Facilities, Big Flat Canal Fish Screen Facility* (USDI 2002c). Review of these documents indicates that it is the intention of the Bureau of Reclamation to install screens on these diversions to prevent the entrainment of fish. Potential actions described in these analyses to protect fish from entrainment into the canals is not, however, considered in this biological opinion.

III . Status of the species and critical habitat

A. Species and critical habitat description

A.1 Species description Prior to 1980, bull trout and Dolly Varden (*S. malma* Girard) were combined under one name; the Dolly Varden (*S. malma* Walbaum). In 1980, with the support of the American Fisheries Society, these fish were recognized as two distinct species. Two of the most useful characteristics in separating the two species are the shape and size of the head (Cavender 1978), though correct identification may be difficult. Bull trout have an elongated body, somewhat rounded and slightly compressed laterally, and covered with cycloid scales numbering 190 to 240 along the lateral line. The mouth is large with the maxilla extending beyond the eye and with well-developed teeth on both jaws and head of the vomer (none on the shaft). Bull trout have 11 dorsal fin rays, 9 anal fin rays, and the caudal fin is slightly forked. Although they are often olive green to brown with paler sides, color is variable with locality and habitat. Their spotting pattern is easily recognizable, showing pale yellow spots on the back, and pale yellow and orange or red spots on the sides with no halos. Bull trout fins are often tinged with yellow or orange, while the pelvic, pectoral, and anal fins have white margins. Bull trout have no black or dark markings on the dorsal fin.

A.2 Listing history In September 1985, bull trout in the coterminous United States were designated as a category 2 candidate for listing in the Animal Notice of Review (USDI 1997). Category 2 candidates show some evidence of vulnerability but not enough information is available to support a listing of the species (USDI 1997). Their status changed in May 1993 when the Service placed bull trout in category 1 of the candidate species list (USDI 1997). The listing of category 1 species is justified, but precluded due to other higher priority listing actions (USDI 1997).

In June 1998, the Service published the final rule listing the Klamath River and Columbia River distinct population segments (DPS) as threatened (USDI 1998a), with an effective date of July 10 1998. In November 1999 the Service published a rule listing all populations of bull trout as threatened throughout its entire range in the coterminous United States (USDI 1999), with an effective date of December 1 1999.

A.3 Current known range Bull trout are found throughout the northwestern United States and western Canada (Rieman and McIntyre 1993). In the Klamath River basin, only isolated, resident bull trout are found in higher elevation headwater streams of the Upper Klamath Lake, Sprague River, and Sycan River watersheds (Goetz 1989; Light et al. 1996). The Columbia River basin is composed of 141 bull trout subpopulations residing in parts of Oregon, Washington, Idaho, and Montana (USDI 1998b). The Jarbidge River distinct population segment is the present southern limit of the range of bull trout in North America. This small population is located in the rugged headwaters of the east and west forks of the Jarbidge River, Nevada. Within Montana, bull trout exist in the headwaters of the Saskatchewan River, the Clark Fork and the Kootenai subbasins (USDI 1998b).

B. Life history

B.1 Life history forms Two distinct life-history forms, migratory and resident, occur throughout the range of bull trout (Pratt 1992; Rieman and McIntyre 1993). Migratory bull trout rear in natal tributaries for several years before moving to larger rivers (fluvial form), lakes (adfluvial form), or the ocean (anadromous) to mature. Migratory forms return to natal tributaries to spawn (MBTSG 1998). Migratory bull trout may use a wide range of habitats ranging from first to sixth order streams and varying by season and life stage. Resident populations often live in small headwater streams where they spend their entire lives (Thurow 1987; Goetz 1989).

Most bull trout spawning occurs between late August and early November (Pratt 1992; MBTSG 1998). Bull trout may spawn each year or in alternate years (Fraley and Shepard 1989). Hatching occurs in winter or early spring, and alevins may stay in the gravel for extended periods, typically emerging from the gravel in April. Growth is variable with different environments, but first spawning is usually noted after age 4, and the fish may live 10 or more years (Pratt 1992; Rieman and McIntyre 1993). Although spawning typically occurs in second to fifth order streams, juveniles may move upstream or downstream of reaches used by adults for spawning, presumably to forage in other accessible waters (Fraley and Shepard 1989; Ratliff 1992). Seasonal movements by adult bull trout may range up to 300 kilometers as migratory fish move from spawning and rearing areas into over-winter habitat in large lakes or rivers in the downstream reaches of large basins (Bjornn and Mallet 1964; Fraley and Shepard 1989).

B.2 Habitat requirements Common predators of juvenile bull trout are larger bull trout and non-native fish, such as lake trout (*S. namaycush*), brown trout (*Salmo trutta*) and brook trout (*S. fontinalis*) (Pratt and Huston 1993; Rieman and McIntyre 1993). Disease is not believed to be a critical factor in the long-term health and survival of bull trout populations (USDI 1999). Hybridization with brook trout poses a threat to the persistence of isolated or remnant populations. These hybrids are likely to be sterile, experience developmental problems and could eliminate a bull trout population (Leary et al. 1993; Rieman and McIntyre 1993).

Bull trout are sensitive to environmental disturbance at all life stages, and have very specific habitat requirements. Bull trout growth, survival, and long-term population persistence appear to be dependent upon five habitat characteristics: temperature, substrate composition, migratory corridors, channel stability and cover (Rieman and McIntyre 1993). Cover includes undercut banks, large woody debris, boulders, and pools that are used as rearing, foraging and resting habitat, and protection from predators (Fraley and Shepard 1989; Watson and Hillman 1997). Deep pools also help moderate stream temperatures, offering refuge from warmer water temperatures during summer low-flow conditions. Stream temperature and substrate type are especially important to bull trout.

Temperature Like other species of char, bull trout are particularly intolerant of warm water and are typically associated with the coldest stream reaches within basins they inhabit (Craig 2001; Selong et al. 2001). The most heavily populated reaches in several Oregon streams seldom exceed 15 degrees C (Buckman et al. 1992; Ratliff 1992; Ziller 1992). Cold water temperatures are required for successful bull trout spawning. Many studies report water temperatures near 9 or 10 degrees C during the onset of spawning (Riehle et al.1997; Chandler et al. 2001). Bull trout spawning typically occurs in areas influenced by groundwater (Allan 1980; Shepard et al. 1982; Fraley and Shepard 1989; Ratliff 1992). In Montana's Swan River drainage, bull trout spawning site selection occurred primarily in stream reaches directly influenced by groundwater upwelling or directly downstream from upwelling reaches (Baxter et al. 1999; Baxter and Hauer 2000). Cold-water upwelling may moderate warmer summer stream temperatures (Bonneau and Scarnecchia 1996; Adams and Bjornn 1997) and extreme winter cold temperatures, which can result in anchor ice.

Cold water temperature also influences the development of embryos and the distribution of juveniles (Fraley and Shepard 1989; Saffel and Scarnecchia 1995; Dunham and Chandler 2001). Selong et al. (2001) report the predicted ultimate upper incipient lethal temperature for age-0 bull trout during 60 day lab trials to be 20.9 degrees C and peak growth to occur at 13.2 degrees C. Goetz (1994) reports juvenile bull trout in the Cascade Mountains were not found in water temperatures above 12 degrees C.

Substrate composition Bull trout are more strongly tied to the stream bottom and substrate than other salmonids (Pratt 1992). Substrate composition has been repeatedly correlated with bull trout occurrence and abundance (Rieman and McIntyre 1993; Watson and Hillman 1997; Earle and McKenzie 2001) as well as selection of spawning sites (Graham et al. 1981; Boag and Hvenegaard 1997). Bull trout are more often found in areas with boulder and cobble substrate rather than areas of finer bed material (Watson and Hillman 1997).

Preferred spawning habitat includes low gradient reaches of mountain valley streams with loose, clean gravel and cobble substrate (Fraley and Shepard 1989; Reiser et al. 1997; MBTSG 1998). Fine sediments fill spaces between the gravel needed by incubating eggs and fry, lowering incubation survival and emergence success (Everest et al. 1987). If fine sediment is deposited into interstitial spaces during incubation, it can impede the movement of water through the gravel, lowering the levels of dissolved oxygen as well as inhibiting the removal of metabolic waste (MBTSG 1998). Because bull trout eggs incubate about 7 months (such as mid-September to mid-April) in the gravel, they are especially vulnerable to fine sediment accumulation and water quality degradation (Fraley and Shepard 1989). Some embryos can incubate and develop successfully but emerging fry can be trapped by fine sediment and entombed (MBTSG 1998).

Juveniles are similarly affected, as they also live on or within the streambed cobble (Pratt 1984). The accumulation of sediment leads to a reduction in pool depth and interstitial spaces, as well as causing channel braiding or dewatering (Shepard et al. 1984; Everest et al. 1987). Substrate interstices also provide important overwintering cover (Goetz 1994; Jakober 1995). Subadults and adults tend to occupy deep pools with boulder-rubble substrate and abundant cover (MBTSG 1998).

Migratory corridors Migratory bull trout ensure interchange of genetic material between populations, thereby promoting genetic variability. Unfortunately, many populations of migratory bull trout have been restricted or eliminated due to stream habitat alterations, including seasonal or permanent obstructions, detrimental changes in water quality, increased temperatures, and the alteration of natural stream flow patterns. Migratory corridors connect seasonal habitat for anadromous, adfluvial, and fluvial forms, and allow for dispersal of resident forms for recolonization of recovering habitats (Rieman and McIntyre 1993). Dam and reservoir construction and operation have altered major portions of bull trout habitat throughout the Columbia River Basin. Dams without fish passage create barriers to fluvial and adfluvial bull trout which isolates populations, and dams and reservoirs alter the natural hydrograph, thereby affecting forage, water temperature, and water quality (USDI 1999).

Channel stability and stream flow Bull trout are exceptionally sensitive to activities that directly or indirectly affect stream channel integrity. Juvenile and adult bull trout frequently inhabit areas of reduced water velocity, such as side channels, stream margins, and pools. These areas can be eliminated or degraded by management activities (Rieman and McIntyre 1993). Bull trout are also sensitive to activities that alter stream flow. Incubation to emergence may take up to 200 days during winter and early spring. The fall spawning period and strong association of juvenile fish with stream channel substrates make bull trout vulnerable to flow pattern changes and associated channel instability (Fraley and Shepard 1989; Pratt 1992; Pratt and Huston 1993; Rieman and McIntyre 1993).

Patterns of stream flow and the frequency of extreme flow events that influence substrate are important factors in population dynamics (Rieman and McIntyre 1993). Embryo and juvenile bull trout, closely associated with the substrate, may be particularly vulnerable to flooding and channel scour associated with rain-on-snow events common in some parts of the range (Rieman and McIntyre 1993). Channel dewatering and bed aggradation can also block access for spawning fish.

Cover 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). Young-of-the-year bull trout tend to use areas of low velocity such as side channels, staying close to substrate and submerged debris (Rieman and McIntyre 1993). Juveniles live close to undercut banks, coarse rock substrate and woody debris in the channel (Pratt 1984; Goetz 1991; Pratt 1992). Adult fish use deep pools with boulder-rubble substrate, undercut banks and areas with large woody debris (Pratt 1984, 1985; MBTSG 1998). Cover also plays an important role to spawning bull trout by protecting the adults from disturbance or predation as well as providing security (MBTSG 1998). Jakober (1998) observed bull trout overwintering in deep beaver ponds and pools containing large woody debris in the Bitterroot River drainage, and suggested that suitable winter habitat may be more restrictive than summer habitat.

C. Population dynamics

C.1 Population size The Columbia River DPS of bull trout has declined in overall range and numbers of fish. Though still widespread, there have been numerous local extirpations reported throughout the Columbia River basin (Thomas 1992; Goetz 1994). The Service recognizes 141 subpopulations within the Columbia River DPS, indicating habitat fragmentation, isolation, and barriers that limit bull trout distribution and migration currently exist within the basin. Although strongholds still exist in some areas, bull trout generally occur throughout the Columbia River DPS as isolated subpopulations in headwater lakes or tributaries where migration is now restricted (USDI 1999).

The ensuing baseline and effects analysis uses the subpopulation as the unit of biological organization to demonstrate the influences of land management activities on population persistence at several scales. A subpopulation is considered a reproductively isolated group of bull trout that spawns within a particular area of a river system. The Service evaluated the status and distribution of bull trout for each recognized subpopulation in the Klamath River and Columbia River DPSs. The complete review of this evaluation is found in a status summary compiled by the Service (USDI 1998b).

To evaluate the current bull trout distribution and abundance for both the Klamath River and Columbia River DPSs, the Service analyzed data on bull trout relative to subpopulations because fragmentation and barriers have isolated bull trout throughout their current range. In areas where two groups of bull trout are separated by a barrier (e.g.,an impassable dam or waterfall, or reaches of unsuitable habitat) that allows only individuals upstream access to those downstream (i.e.,one-way passage), both groups were considered subpopulations. In addition, subpopulations were considered at risk of extirpation from naturally occurring events if they were:

- unlikely to be reestablished by individuals from another subpopulation (i.e., functionally or geographically isolated from other subpopulations);
- limited to a single spawning area (i.e., spatially restricted); and either
- characterized by low individual or spawning numbers; or
- primarily of a single life-history form.

For example, a subpopulation of resident fish isolated upstream from an impassable waterfall would be considered at risk of extirpation from naturally occurring events especially if the subpopulation had low numbers of fish that spawn in a restricted area. In such cases, a natural event such as a fire or flood affecting the spawning area could eliminate the subpopulation, and the impassable waterfall would prevent reestablishment from fish downstream. However, a subpopulation residing downstream from the waterfall might not be considered at the same level of risk of extirpation from naturally occurring events because there would be immigration potential by fish from the subpopulation upstream. Because resident bull trout may exhibit limited downstream movement, the Service's determination of subpopulations at risk of extirpation from naturally occurring events may overestimate the number of subpopulations likely to be reestablished (USDI 1998b).

In the process of reviewing information relative to the bull trout listing process, the status of subpopulations was based on modified criteria of Rieman et al. (1997), including the abundance, trends in abundance, and the presence of life-history forms of bull trout. The Service considered a subpopulation "strong" if 5,000 individuals or 500 spawning adults likely occur in the subpopulation, abundance appears stable or increasing, and life-history forms were likely to persist. The Service considers a subpopulation "depressed" if less than 5,000 individuals or 500 spawners likely occur in the subpopulation, abundance appears to be declining, or a life-history form historically present has been lost. If there was insufficient abundance, trend, and life-history information to classify the status of a subpopulation as either "strong" or "depressed", the status was considered "unknown."

Based on abundance, trends in abundance, and the presence of life-history forms, bull trout were considered strong in 13 percent of the occupied range in the interior Columbia River basin (Quigley and Arbelbide 1997). Using various estimates of bull trout range, Rieman et al. (1997) estimated that bull trout populations were strong in 6 percent of the subwatersheds in the Columbia River basin. Bull trout declines have been attributed to the effects of land and water management activities, including forest management and road building, mining, agricultural practices, livestock grazing (Meehan 1991; Frissell 1993), isolation and habitat fragmentation from dams and agricultural diversions (Rode 1990; Jakober 1995), fisheries management practices, poaching and the introduction of non-native species (Rode 1990; Bond 1992; Donald and Alger 1993; Leary et al. 1993; Pratt and Huston 1993; Rieman and McIntyre 1993; MBTSG 1998).

C.2 Population variability Distribution of existing bull trout populations is often patchy even where numbers are still strong and habitat is in good condition (Rieman and McIntyre 1993, 1995). It is unlikely bull trout occupied all of the accessible streams within the range at any one time. The number of bull trout within a population can vary dramatically both spatially and temporally. Redd counts are commonly used to assess population trends. Existing long-term redd count data indicate a high degree of variability within and between populations (Rieman and McIntyre 1996). Habitat preferences or selection is likely important (Rieman and McIntyre 1995; Dambacher and Jones 1997), but more stochastic extirpation and colonization processes may influence distribution even within suitable habitats (Rieman and McIntyre 1995).

C.3 Population stability The best available information indicates that bull trout are in widespread decline across their historic range and are restricted to numerous reproductively isolated subpopulations in the Columbia River basin with many recent local extirpations (Rieman et al. 1997; USDI 1998b). The largest contiguous areas supporting bull trout are "strongholds" in central Idaho and western Montana. Many bull trout subpopulations in the Columbia River DPS are characterized by declining trends.

D. Status and distribution

D1. Historic and current distribution The historic range of bull trout was restricted to North America (Cavender 1978; Haas and McPhail 1991). Bull trout have been recorded from the McCloud River in northern California, the Klamath River basin in Oregon and throughout much of interior Oregon, Washington, Idaho, western Montana, and British Columbia, and extending into Hudson Bay and the St. Mary's River in Saskatchewan (Rieman et al. 1997).

Bull trout may be a glacial relict and their broad distribution has probably contracted and expanded periodically with natural climate change (Williams et al. 1997). Genetic variation suggests an extended and evolutionarily important isolation between populations in the Klamath and Malheur basins and those in the Columbia River basin (Leary et al. 1993). Populations within the Columbia River basin are more closely allied and are thought to have expanded from common glacial refugia or to have maintained higher levels of gene flow among populations in recent geologic time (Williams et al. 1997).

Despite occurring widely across a major portion of the historic potential range, many areas support only remnant populations of bull trout. Bull trout were reported present in 36 percent and unknown or unclassified in 28 percent of the subwatersheds within the potential historic range. Strong populations were estimated to occur in only 6 percent of the potential historic range (Rieman et al. 1997). Bull trout are now extirpated in California and only remnant populations are found in much of Oregon (Ratliff and Howell 1992). A small population still exists in the headwaters of the east and west forks of the Jarbidge River in northeast Nevada.

Though bull trout may move throughout entire river basins seasonally, spawning and juvenile rearing appear to be restricted to the coldest streams or stream reaches. The downstream limits of habitat used by bull trout are strongly associated with gradients in elevation, longitude, and latitude, which likely approximate a gradient in climate across the basin (Goetz 1994). The patterns indicate that spatial and temporal variation in climate may strongly influence habitat available to bull trout. While temperatures are probably suitable throughout much of the northern portion of the range, predicted spawning and rearing habitat are restricted to increasingly isolated high elevation or headwater "islands" toward the south (Goetz 1994; Rieman and McIntyre 1995).

D.2 Status of Columbia River distinct population segment The Service recognizes 141 subpopulations in the Columbia River DPS within Idaho, Montana, Oregon, and Washington and additional subpopulations in British Columbia. Bull trout in this DPS are threatened by habitat loss and degradation, passage restrictions at dams, and competition from non-native brook trout and lake trout. The American Fisheries Society listed bull trout as a species of concern in all of its range (California, Idaho, Montana, Nevada, Oregon, Washington, Alberta and British Columbia) except Alaska, because of present or threatened destruction, modification, or curtailment of its habitat or range and introduction of exotic species (Williams et al. 1989). Bull trout have been categorized as an indicator species of forest and ecosystem health as they are particularly sensitive to environmental change (Rieman and McIntyre 1993).

The upper Columbia River geographic area includes the mainstem Columbia River and all tributaries upstream from Chief Joseph Dam in Washington, Idaho, and Montana. Bull trout are found in two large basins, the Kootenai River and Pend Oreille River, which includes the Clark Fork River. Numerous dams and degraded habitat have fragmented bull trout habitat and isolated fish into 71 subpopulations in 9 major river systems in the upper Columbia River Basin.

The nine major river systems with the number of subpopulations within each river system are: Spokane River (1), Pend Oreille River (3), Kootenai River (5), Flathead River (24), South Fork Flathead River (3), Swan River (3), Clark Fork River (4), Bitterroot River (27), and Blackfoot River (1).

The high number of subpopulations (27) in the Bitterroot River system, Montana, indicates a high degree of habitat fragmentation where numerous groups of resident bull trout are restricted primarily to headwaters. Bull trout are thought to be extirpated in 64 streams and lakes of various sizes, including: Nespelam, Sanpoil, and Kettle Rivers; Barnaby, Hall, Stranger, and Wilmont Creeks; 8 tributaries to Lake Pend Oreille; 5 tributaries to Pend Oreille River below Albeni Falls Dam; Lower Stillwater Lake; upper Clark Fork River, 12 streams in the Coeur d'Alene River basin; and approximately 25 streams in the St. Joe River basin (IDFG 1995).

Range wide, populations are generally isolated and remnant. Migratory life histories have been lost or limited throughout the range (Ratliff and Howell 1992; Pratt and Huston 1993; Rieman and McIntyre 1993, 1995; Goetz 1994; Jakober 1995; MBTSG 1998) and fluvial bull trout populations in the upper Columbia River portion of the DPS appear to be nearly extirpated. Resident populations existing in headwater tributary reaches are isolated and generally low in abundance (Thomas 1992).

Generally, where status is known and population data exist, bull trout populations throughout the Columbia River DPS are at best stable and more often declining (Thomas 1992; Schill 1992; Pratt and Huston 1993). Presently, bull trout in the Columbia basin occupy about 45 percent of their estimated historic range (Quigley and Arbelbide 1997). Of the 141 subpopulations, 75 are at risk of natural extirpation through physical isolation. Many of the remaining bull trout occur as isolated subpopulations in headwater tributaries, or in tributaries where the migratory corridors have been lost or restricted. Few bull trout subpopulations are considered "strong" in terms of relative abundance and subpopulation stability. Those few remaining strongholds are generally associated with large areas of contiguous habitats such as portions of the Snake River basin in Central Idaho, the Upper Flathead River in Montana, and the Blue Mountains in Washington and Oregon.

The upper Columbia River area contains several strongholds for bull trout (USDI 1998b). Bull trout are considered strong in Hungry Horse Reservoir and Swan Lake. Trends in abundance are stable in Hungry Horse Reservoir, and increasing in Swan Lake (Rieman and Myers 1997). Although high numbers of bull trout are found in Lake Pend Oreille and the upper Kootenai River, trends in abundance are either negative or unknown. The Service considers 50 of the 71 subpopulations in the upper Columbia River drainage at risk of extirpation because of naturally occurring events due to isolation, single life-history form, and low abundance.

In summary, the Columbia River DPS has declined in overall range and numbers of fish. Though still widespread, there have been numerous local extirpations reported throughout the Columbia River basin. The population segment is composed of 141 subpopulations indicating habitat fragmentation, isolation, and barriers that limit bull trout distribution and migration within the basin. Although some strongholds still exist, bull trout generally occur as isolated subpopulations in headwater lakes or tributaries where migratory fish have been lost.

D.3 Bitterroot and Middle Clark Fork River Section 7 Watersheds Section 7 watersheds were adopted by the Western Montana Bull Trout Level 1 Consultation team to facilitate streamlined consultation and watershed analysis. Section 7 watersheds correspond to bull trout Restoration/Conservation Areas identified by the Montana Bull Trout Scientific Group in 1996, prior to the listing of bull trout under the Endangered Species Act. The Upper Clark Fork, Middle Clark Fork and Bitterroot Section 7 Watersheds also correspond to *core areas* as described in the draft bull trout recovery plan (USDI 2002d). These spatial units form the basis for baseline condition analysis at the watershed scale.

The predominant life history form of bull trout in the middle Clark Fork River is currently the fluvial migratory form. Bull trout in the lower Bitterroot River are thought to be adult bull trout from the middle Clark Fork River, or adults, subadults and juveniles from upstream populations from the upper Bitterroot River basin (USDA 2000d). As such, the number and distribution of fish in the middle Clark Fork and lower Bitterroot rivers is determined, at least in part, by those factors that restrict or preclude unfettered migratory movements into or out of this portion of the Clark Fork River. Though physically outside the Middle Clark Fork Section 7 Watershed and the action area, factors that restrict or preclude migratory movement into the action area will be discussed at length in this and the following section, *Bull trout in the action area*.

Bitterroot River Fisheries biologists from the Bitterroot National Forest prepared the *Bitterroot River Section 7 Watershed Baseline* analysis in May 2000 (USDA 2000d). An updated watershed baseline assessment was completed following the 2000 Bitterroot Fires and provided to the Service in November 2002. These assessments incorporate data generated by the Forest Service, Montana Fish Wildlife and Parks and where available, private sources.

The Bitterroot River originates in the Bitterroot and Sapphire Mountains of western Montana and flows north approximately 85 miles to where it enters the Clark Fork River near Missoula at river mile (RM) 349. There are 39 major tributaries to the Bitterroot River, 27 draining the west side of the valley, and 12 draining the east side. Many of the tributaries support resident bull trout (MBTSG 1995). The approximate mean annual flow of the Bitterroot River is 2,596 cfs about 6 miles upstream from its confluence with the Clark Fork (USGS 1999). The Bitterroot River is one of two primary nonpoint sources of sediments and nutrients to the upper Clark Fork River (MDHES 1994).

Historical accounts of large bull trout in the main channel of the Bitterroot River suggest that the migratory form was formerly common (MBTSG 1995). Bull and westslope cutthroat trout were once found in most tributaries of the Bitterroot River up to barrier falls at higher elevations (USDA 2000d). Of the 208 streams in this basin, exclusive of the Lolo Creek drainage, 90 and 178 streams contained bull trout and westslope cutthroat trout, respectively (MBTSG 1995). The number of fish in these populations ranged from rare to abundant.

There are likely a few fluvial bull trout in the Bitterroot River; numbers are thought to be extremely low (USDA 2000d). Nelson et al. (2002) found four adult (> 250 mm) bull trout entering lower Sleeping Child Creek from the Bitterroot River over a 17 month sampling period, suggesting a limited, localized fluvial component using the Bitterroot River upstream from Hamilton. Bull trout are considered rare in the lower Bitterroot River (W. L. Knotek, MFWP, pers. comm. 2002) and the lower portion of the Bitterroot River may contain bull trout from the Clark Fork River (USDA 2000d). There are apparently no substantial barriers to fish movement between the Clark Fork and the lower Bitterroot, as Knotek (pers. comm. 2002) documented westslope cutthroat trout ascending the Bitterroot River to near Stevensville after spawning in Rattlesnake Creek.

The loss of migratory fish in all but the upper reaches of the river is attributed to chronic dewatering of the mainstem of the Bitterroot River and the lower reaches of most of its tributaries (Clancy 1993, 1996; MBTSG 1995). Diversions on the mainstem of the Bitterroot River are often partial fish passage barriers and entrain downstream migrants into irrigation ditches (MBTSG 1995). Nearly 65 miles of 18 tributary streams are chronically dewatered in the Bitterroot River basin (MBTSG 1995). Dewatering of tributary streams for irrigation is a limitation to bull trout restoration in the Bitterroot River basin (MBTSG 1995) and a primary cause of habitat fragmentation isolating 27 subpopulations.

Clark Fork River The Middle Clark Fork River Section 7 Watershed consists primarily of private residential, private timber, and agricultural lands in the valley bottom, and federally managed public lands in the more mountainous areas. The upstream extent of the Middle Clark Fork River Section 7 Watershed is Milltown Dam, 5 miles east of Missoula. The Clark Fork River flows northwest approximately 90 miles to the confluence of the Clark Fork with the Flathead River, approximately 8 miles southeast of Plains. The confluence of the Clark Fork and Flathead Rivers forms the downstream extent of the Middle Clark Fork River Section 7 Watershed. There are 9 major tributaries to the middle Clark Fork River (MBTSG 1996), including the Bitterroot River. The approximate mean annual flow of the middle Clark Fork River is 7145 cfs upstream from its confluence with the Flathead River (USGS 1999).

Fisheries biologists and hydrologists from the Lolo National Forest prepared the *Middle Clark Fork River Section 7 Consultation Watershed* analysis (USDA 2000b) to establish a baseline condition for bull trout in this portion of the Clark Fork River drainage. This baseline analysis, periodic updates and relevant past and ongoing research are summarized here. Since the completion of the initial baseline assessment, upland areas of the Middle Clark Fork River Section 7 Watershed experienced extensive fires and subsequent mudslides. Post fire conditions in the Middle Clark Fork River Section 7 Watershed were addressed in the Burned Area Assessment prepared by the Lolo National Forest (USDA 2001a).

Prior to 1907, bull trout from Lake Pend Oreille in northeastern Idaho moved throughout the Clark Fork river system (MBTSG 1996; USDI 2002d). Construction of Thompson Falls (1916), Cabinet Gorge (1952) and Noxon Rapids (1958) dams essentially eliminated the natural upstream migration of adfluvial bull trout from Lake Pend Oreille, and greatly reduced the number of bull trout in the Clark Fork River basin upstream from the dams (USDI 2002d). As a result, bull trout currently found in the mainstem of the Clark Fork River downstream from Milltown Dam and upstream from Thompson Falls Dam are predominately fish that spawn in direct tributaries to this section of the river. Spawning migratory bull trout or redds have been observed in the St. Regis River and Fish, West Fork Fish, North Fork Fish, Trout, Cedar, Petty, Rattlesnake, Cache, and Montana Creeks (MBTSG 1996).

Several of the tributaries to the middle Clark Fork River such as Rattlesnake, Crow, Mission, Post, and Dry Creeks were also dammed in the last century. With the exception of Crow Creek, these are historic bull trout spawning and rearing streams. Some of these dams block migratory fish from spawning habitat and have isolated bull trout upstream from the dams (MBTSG 1996). The Montana Bull Trout Scientific Group recognized the existence of dams as one of the primary causes of bull trout declines in this section of the Clark Fork River system (MBTSG 1996).

The St. Regis River and Fish, Trout, Cedar, Petty, Ninemile, Tamarack, Grant, Dry (near Superior), and Rattlesnake Creek drainages also support resident bull trout populations. Bull trout densities in these populations range from rare to moderate. Westslope cutthroat trout and mountain whitefish (*Prosopium williamsoni*) are the only other salmonid species native to the Middle Clark Fork River Section 7 Watershed (MBTSG 1996).

The Montana Bull Trout Scientific Group (MBTSG) report (1996) identified bull trout core areas in the middle Clark Fork River. Core areas as defined by MBTSG are drainages containing the strongest remaining populations of bull trout within each restoration/conservation area and warranting the most stringent levels of protection. Core areas in the Middle Clark Fork River Section 7 Watershed are the St. Regis River and Fish, Trout, Cedar, Petty, and Rattlesnake Creeks (MBTSG 1996). Please note that core areas as defined by the MBTSG differ from those identified in the draft bull trout recovery plan (USDI 2002d) in area and intent.

Bull trout abundance may vary widely from one core area to the next as they were identified relative to a particular restoration/conservation area. For example, bull trout abundance in Trout Creek is modest compared to bull trout strongholds such as those in the Swan or South Fork Flathead Rivers. To protect all existing bull trout populations and thus conserve genetic diversity, MBTSG designated core areas are the focus of restoration in the Montana Bull Trout Restoration Plan (MBTRT 2000). Core habitat designations were developed prior to ESA recovery criteria (currently in draft), but follow a consistent population-based approach.

Salmonid habitat within this drainage of 1,986 square miles has been degraded to varying degrees by past and continuing land uses. Sources of impairment are primarily mainstem river dams, mining, and silviculture. Illegal fish introductions, fish management, agriculture practices, dam operations, transportation systems, and illegal harvest also contribute to impairment (MBTSG 1996). Bull trout in the Middle Clark Fork River Section 7 Watershed are at a higher risk of extirpation now than in the historic past. Mainstem dams and habitat alterations in tributaries to the middle Clark Fork River have resulted in habitat fragmentation and the isolation of groups of fish.

Mining has impacted many areas of the Middle Clark Fork River Section 7 Watershed. Placer mining damaged portions of the St. Regis River and Ninemile Creek drainages. Impacts from the Butte and Anaconda area extend downstream at least as far downstream as Missoula (MBTSG 1996).

Past forestry practices including road construction, log skidding, riparian harvest, clear cutting, and log drives are major contributors to bull trout declines. Impacts include increased sediment and peak flows, thermal modifications, large woody debris reduction, and channel instability.

Percent surface fines are positively correlated with road densities across many forested areas. Decreased pool area and large woody debris levels occurred in developed watersheds when compared to undeveloped watersheds (USDI 1998c).

Of the introduced species, brook trout likely present the greatest threat to bull trout in the Middle Clark Fork River Section 7 Watershed. Bull trout hybridize with brook trout and the resulting offspring exhibit greatly reduced reproductive fitness (Kanda et. Al. 2002). Brook trout are present in the majority of bull trout streams in the drainage, except possibly the headwaters of Fish, Trout, Cedar, Rattlesnake, and Post Creeks (MBTSG 1996). Brook trout exhibit uneven distribution on the Lolo National Forest as 63 percent of developed and 13 percent of undeveloped watersheds were occupied (USDA 1998). Immediately upstream from the Middle Clark Fork Section 7 Watershed in Milltown Reservoir, northern pike (*Esox lucius*) predate on juvenile bull trout out migrating from the Blackfoot River and possibly the upper Clark Fork River (Schmetterling 2001).

During the summer of 2000, private land and National Forests in the Middle Clark Fork Section 7 Watershed experienced a series of wildfires, which altered the vegetative structure on approximately 74,000 acres or slightly more than 6 percent of the watershed. The resulting mosaic of burn severities is thought to largely resemble that of historic fires (USDA 2002a). Post fire sampling did not identify any drainage in which all fish were lost because of the 2000 Lolo National Forest fires (USDA 2000c; USDA 2001a). During early September 2000 however, thunderstorms falling on areas that burned with moderate and high severity produced fine sediment and debris torrents impacting native fish populations and habitat in Johnson Creek (USDA 2000c; USDA 2001a). Mudflows in Johnson Creek appear to have reduced the abundance of fish in a section of this stream. An upstream migration barrier at the mouth of Johnson Creek insures that fish dispersing downstream to avoid the mudflow will be lost to this stream. Similar mudflows occurred in Flat Creek. Although smaller, mudflows may have greater impacts than in Johnson Creek because of the presence of mine tailings eroded into Flat Creek. Other than Johnson and Flat Creeks, no fish kills are suspected in streams burned in the 2000 fires on the Lolo National Forest (USDA 2000c; USDA 2001a).

Recovery efforts for bull trout on the Clark Fork River are occurring in a number of areas. The Federal Energy Regulatory Commission (FERC) issued a license to the Avista Corporation allowing hydroelectric production at the Cabinet Gorge and Noxon Rapids dams in 1999. Pursuant to this license, the Avista Corporation funds activities intended to offset the adverse environmental impacts of their dams, reservoirs and power production. Activities designed to offset impacts to bull trout are identified in the Fish Passage/Native Salmonid Restoration Plan of the Clark Fork Settlement Agreement.

The Native Salmonid Restoration Plan calls for moving adult adfluvial bull trout that migrate upstream from Lake Pend Oreille over the Cabinet Gorge and Noxon Rapids dams. In its infancy, this experimental program moved 35 bull trout, captured in the Clark Fork River near the Cabinet Gorge Fish Hatchery, over the Cabinet Gorge Dam in 2001 and again in 2002. Two adult bull trout were subsequently moved over the Noxon Rapids Dam into Noxon Reservoir in both years (Lockard et al. 2002a; L. Lockard, USFWS, pers. comm. 2002).

The objective of this program is to increase the number of bull trout spawning above the dams and to some extent, it has already been successful. Lockard et al. (2002a) estimated that the female adfluvial bull trout transported from Idaho in 2001 potentially accounted for 60 percent of the eggs deposited by spawning bull trout in the East Fork of the Bull River, a major spawning tributary to the lower Clark Fork River.

The Downstream Juvenile Bull Trout Transport Program was designed to enhance the survival of out migrating juvenile bull trout by transporting captured fish from natal or rearing tributaries to release locations below Cabinet Gorge Dam. In 2001, 49 juvenile out migrating bull trout, captured in the Bull River and Rock Creek, were released into the Clark Fork River near the Cabinet Gorge Fish Hatchery (Lockard et al. 2002b).

In a separate but parallel effort, adult bull trout are also being moved over the Thompson Falls Dam, approximately 50 miles upstream from the Idaho/Montana state line. Three adult fluvial bull trout were captured at the base of the Thompson Falls dam, and two were moved over the dam in 2001 (Mabbott et al. *in litt.*). A single bull trout was moved over the dam in 2002 (L. Katzman, MFWP, pers. comm. 2002). Eventual improvements in capture efficiency will likely result in higher numbers of bull trout moved over the dam in future years. The Thompson Falls Dam is the nearest obstruction to upstream migration for adfluvial and fluvial bull trout downstream from the Frenchtown and Big Flat irrigation diversions.

Recent investigations have demonstrated that recruitment of bull trout to the Middle Clark Fork Section 7 Watershed is occurring from upstream from Milltown Dam, at least to a limited extent. Swanberg (1997a) captured and transported two adult bull trout to above Milltown Dam. These fish moved to what were likely their natal stream, where one apparently spawned (Swanberg 1997a). In 2000, Schmetterling and Liermann (2000) monitored the movement of seven bull trout trapped and transported over the dam. At least four of these large (mean length 663 mm) bull trout entered spawning tributaries, where it is assumed spawning occurred. Bull trout have been captured and moved over the Milltown Dam since 1998.

Some manner of bull trout passage, ranging from a minimum of capture and transport over the Milltown Dam to reestablishing unobstructed fish passage with the removal of Milltown Dam will continue in perpetuity (E. William Olsen, USFWS, pers. comm. 2002). The Environmental Protection Agency is concluding the Remedial Investigation/Feasibility Study analysis for the Milltown Reservoir Sediments Site. Various action alternatives for the Milltown Reservoir Sediments Site are under consideration, including alternatives that would involve varying degrees and combinations of dam removal, reservoir sediment removal, and river channel and floodplain reconstruction. Some of the alternatives require that the Milltown project be decommissioned and the dam removed. The Environmental Protection Agency anticipates the release of the Remedial Investigation/Feasibility Study that will include the selected alternative in 2003.

The Service anticipates that the transport of adult adfluvial fish over the Cabinet Gorge, Noxon Rapids and Thompson Falls dams, coupled with enhanced survival of out migrating juvenile bull trout from the downstream transport program and other bull trout recovery actions, will eventually result in an increase in the number of bull trout ascending the Clark Fork River

(Lockard et al. 2002b; Lockard pers. comm. 2002). The Service contends that the continued transport of adult migratory bull trout over Milltown Dam and reservoir and the potential removal of Milltown Dam will result in increased outmigration of juvenile bull trout into the Clark Fork River. These programs will lead to an increase in the number of adult and juvenile bull trout within the action area.

E. Analysis of the species/critical habitat likely to be affected

The proposed activities will occur within the Bitterroot and Middle Clark Fork River Bull Trout Section 7 Watersheds. The Bitterroot and Clark Fork rivers at the Big Flat and Frenchtown diversions have been proposed for designation as critical habitat for bull trout. and may affect, (and is) likely to adversely affect bull trout.

Other listed species The Bureau of Reclamations's biological assessment (USDI 2902a) found that continued operation and maintenance of these irrigation systems had no effect on the threatened Canada lynx (*Lynx canadensis*), grizzly bear (*Ursus arctos horribilis*), gray wolf (*Canis lupus*) and the candidate yellow-billed cuckoo (*Coccyzus americanus*). The biological assessment also determined that continued operation and maintenance of the Big Flat and Frenchtown irrigation systems may affect, (but is) not likely to adversely affect the threatened bald eagle (*Haliaeetus leucocephalus*).

The Service notes the no effect determination for the Canada lynx, grizzly bear, gray wolf and yellow-billed cuckoo. The Service concurs with the determination that ongoing operations and maintenance of the Big Flat Unit and Frenchtown Project is not likely to adversely affect the bald eagle.

IV. Environmental baseline

Regulations implementing the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.; 50 CFR 402.02) define the environmental baseline as the past and present impacts of all federal, state or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed federal projects in the action area, which have already undergone section 7 consultation, and the impacts of state and private actions in the action area which are contemporaneous with the consultation in progress. Such actions include, but are not limited to, previous timber harvest, road construction, residential development and other land management activities.

A. Status of the species within the action area

Bull trout in the action area The action area for this biological opinion is the lower 4 miles of the Bitterroot River and that section of the Middle Clark Fork River Section 7 Watershed from the confluence of the Bitterroot River and the Clark Fork River, downstream approximately 21 miles to a point near the town of Huson, Montana. See Section II, *Description of the proposed action*. Though the point of diversion for the Big Flat Unit is on the Bitterroot River, the main area of irrigation is within the immediate drainage area of the Clark Fork River.

The Service (USDI 1998b) recognized one bull trout subpopulation within the Middle Clark Fork River Section 7 Watershed. The Middle Clark Fork River Section 7 Consultation Watershed analysis (USDA 2000b) identified 10 sixth-code hydrologic units that occur within the action area of the Big Flat and Frenchtown irrigation systems. Analysis of these hydrologic units using the analysis matrix developed by the Service (USDI 1998d) determined that all 10 hydrologic units were functioning at unacceptable risk for the majority of population and habitat categories. All 10 hydrologic units received an integrated species and habitat determination of functioning at unacceptable risk. This determination was largely driven by the lack of upstream and downstream connectivity as a result of the several large dams that obstruct migratory movement in the river and habitat degradation.

Adult bull trout are currently considered uncommon in the Middle Clark Fork Section 7 Watershed (USDA 2000b) and rare in the lower Bitterroot River (Knotek, cited in USDI 2002a; USDA 2000d). Recent survey and analysis work indicates that adult fluvial bull trout occur in the lower Bitterroot and Clark Fork rivers within the action area at about 1 to 3 adult fish per mile (USDI 2002a). Surveys in this portion of the Clark Fork River typically occur in June and/or October (Knotek, pers. comm. 2002). Large river sampling typically has a low sampling efficiency for small or juvenile fish, however, and estimates of relative abundance are for fish 8 inches in length and longer (Knotek, pers. comm. 2002). Fluvial bull trout typically enter larger rivers (leaving natal and rearing streams) primarily as juvenile fish at 2 to 3 years of age (Fraley and Shepard 1989), and juvenile bull trout entering the Clark Fork River average 200 mm (Schmetterling 2001) or 250 mm (Lockard et al. 2002b). As such, the method of sampling used to develop the 1 to 3 bull trout per mile estimate of relative abundance underestimates the juvenile component entering the fluvial population from headwater tributaries.

Juvenile bull trout are likely moving into the action area as river flow increases in the spring of the year. As a secondary observation to a larger investigation, Schmetterling (2001) identified a narrow time period when juvenile bull trout were outmigrating from the Blackfoot and possibly the Clark Fork River. Juvenile bull trout entered Milltown Reservoir from upstream rearing areas in early to mid May, 2000, which corresponds to the ascending limb of the of the annual peak in the Clark Fork River hydrograph.

Lockard et al. (2002b) captured juvenile bull trout moving downstream in the Bull River or Rock Creek (below Noxon Reservoir) from April through December, and out-migration of juveniles peaked in late July to early August and again in mid to late October 2001. Lockard et al. (2002b) recognized that the recorded results may not actually represent true peaks in outmigration, however, as the majority of sampled juvenile fish were captured in weir traps. As weir traps were not in operation during periods of high flow, numerous bull trout could have moved downstream past the weir when traps were not in operation.

Adult fluvial bull trout in the action area begin migration to spawning tributaries as early as April, and upstream movements to the base of Milltown Dam have been documented though the month of May (Swanberg 1997a). Schmetterling and Liermann (2000) identified a peak period of adult fluvial bull trout capture at Milltown Dam from June 28 to July 4 in 2000. Katzman (pers. comm. 2002) reports capturing adult bull trout at the base of the Thompson Falls Dam in late July 2001 and 2002, apparently in up stream migration. Using radiotelemetry, Swanberg

(1997a) monitored an adult fluvial bull trout holding near the confluence of Rattlesnake Creek and the Clark Fork River through July and into August, later moving freely in Clark Fork River channel flow through October.

Knotek (2002) found adult fluvial bull trout migrating up Rattlesnake Creek from the Clark Fork River late in June through early August, with the peak of upstream migration in July. Using radiotelemetry, Knotek documented bull trout that spawn in Rattlesnake Creek using that portion of the middle Clark Fork River from Missoula downstream to Frenchtown during the non-spawning period of the year (Knotek, pers. comm. 2002). In addition, Knotek (2002) suggested that bull trout migration into Rattlesnake Creek was influenced by elevated water temperatures in the Clark Fork River, indicating that the timing of upstream migration may fluctuate annually with changes in river volume and temperature. Rattlesnake Creek is approximately 8 miles upstream from the Frenchtown diversion structure.

Water Temperature In the Clark Fork River, the temperature of main-channel water can vary greatly during periods of the year when bull trout are moving to or toward spawning habitat. Bull trout are known to enter the Clark Fork River from Lake Pend Oreille in January, April, August and September (Normandeau 2001 *in* Gillin 2002). None have entered the fish ladder/artificial spawning channel at the Cabinet Gorge Fish Hatchery, below Cabinet Gorge Dam, until August 6, however, and the majority of bull trout that ascend the ladder do so in September (Gillin 2002). During August and September, water in the river can range from 16 to 19 degrees C, leading Gillin (2002) to suggest that while bull trout are holding in the main channel of the Clark Fork River, they are finding cold water microhabitats associated with tributaries or upwelling in the main channel.

Bull trout captured at the Cabinet Gorge Fish Hatchery are released at various locations in Cabinet Gorge Reservoir. Bull trout transported into the Bull River Bay of Cabinet Gorge Reservoir have been released into water with surface temperatures ranging from 11 to 20 degrees C after a short acclimation period (Lockard et al. 2002a). Adult bull trout attempting to ascend Noxon Rapids, captured at the base of the dam, are released into water with a surface temperature exceeding 21 degrees C.

At Thompson Falls Dam, adult fluvial bull trout have been captured while attempting to move upstream of the dam from mid April through late July. Bull trout have been captured at the base of the dam in water that is 18 degrees C (2001) and 20 degrees C (2002) (Katzman pers. com. 2002). Schmetterling and Liermann (2000) documented water temperature at the base of Milltown Dam in excess of 16 degrees C in late June and early July, the peak period of bull trout capture at the base of the dam.

Swanberg (1997b) found fluvial bull trout in the Blackfoot River, a major tributary to the Clark Fork directly upstream of the action area, began upstream movement on the descending limb of the hydrograph in early June (1994) to early July (1995). The initiation of upstream movement was correlated with increases water temperature. Though the river temperature varied greatly (range 12 to 20 degrees C), the mean temperature at which fish began upstream migrations was 17.7 degrees C in 1995.

To briefly summarize, review of local investigations into bull trout seasonal movements and selected habitat parameters strongly suggests that water temperature is not a reliable indicator of migratory bull trout distribution in the Clark Fork River from May through September. During this annual period, juvenile bull trout are likely to be entering the action area from upstream rearing tributaries as the flow in the Clark Fork and Bitterroot rivers ascends to peak. Adult fluvial and adfluvial bull trout are moving upstream below, above and within the action area from April to August, and are present in the action area during the rest of the year. Adult bull trout are using the Clark Fork River downstream from and upstream of the action area during periods of the year when the temperature of the river exceeds 16 degrees C. Adult and /or juvenile bull trout are reasonably certain to occur in the Clark Fork River in the action area throughout the annual operational period of the Frenchtown and Big Flat irrigation systems.

B. Factors affecting the species environment (habitat) within the action area

Habitat conditions within the action area of the Big Flat and Frenchtown irrigation systems are influenced by a number of factors. Habitat for bull trout in the Bitterroot and Clark Fork rivers within the action area is influenced by those factors identified in *Status of the Species within the Action Area* above. Habitat specific to the principal irrigation systems is limited to an excavated trench from the Bitterroot River to the headgate on the Big Flat irrigation system canal and the side channel of the Clark Fork River above and below the irrigation diversion dam for the Frenchtown irrigation system.

The excavated trench leading to the headgate on the Big Flat canal forms off-channel, slow water habitat that is favorable to many fish species present in this area, at least on a seasonal basis. This habitat feature contains low velocity habitat that could be attractive to bull trout during peak flow of the Bitterroot River or as foraging habitat as seasonal fluctuations in temperature permit. The excavated trench is unshaded for its entire length of approximately 488 feet, but was observed to hold thousands of small fish of unknown species in August of 2002 (D. Morris, USBOR, pers. comm. 2002). The excavated trench may be thermally unfavorable to bull trout when river temperature warms to 15 degrees C, typically in late June.

The excavated trench is perpendicular to the flow of the Bitterroot River, and is not associated with a substantial meander. The trench forms a long, slow moving habitat feature ending at the Big Flat headgate, which captures 25 cfs.

Review of drawings completed during the period of construction (1935) of the Frenchtown irrigation system, period U.S. Geological Survey topographic maps and field review indicate that the side channel of the Clark Fork River, prior to construction of the Frenchtown diversion dam, may have been predominately intermittent in nature (USDI 2000). The side channel originates on the east side of the Clark Fork River in a location where the actual thalweg is on the west side. Construction of the Frenchtown irrigation system included excavation of a intake channel approximately 1000 feet in length, leading to a wider, deeper section of the side channel. The intake channel originated at the downstream end of a scoured depression on the east side of the Clark Fork River and likely followed the existing thalweg of the side channel. Construction of the intake channel involved excavation or deepening of a channel approximately 30 feet wide and, in it's current configuration, 4 feet deep. This channel was excavated through coarse alluvial deposits beneath the flood plain and on the developing bar of the river, and appears to be periodically maintained by the irrigation district.

The side channel of the Clark Fork River upstream from the Frenchtown irrigation dam is also slow water habitat, and has favorable stream margins for juvenile fish rearing. The water elevation in this portion of the side channel is artificially elevated by the diversion dam during periods when the sluiceway is closed, increasing the wetted area and depth of low velocity refugia. Typically, the sluiceway is closed prior to and during the irrigation period, beginning approximately April 1 (USDI 2002b). Conversely, the side channel downstream of the diversion structure is partially-if not mostly-dewatered during much of the year (USDI 2002b). During a field review in April 2002, the residual flow below the closed sluiceway was estimated at less than 2 cfs.

Two small dikes were also constructed in overflow channels on the island formed to the west of the overflow channel. These low dikes obstruct high water flow from the side channel to the Clark Fork River and probably from the Clark Fork River to the side channel, depending on river stage.

The ecological outcome of these actions is that the side channel from the Clark Fork River to the diversion dam is wider, deeper and is inundated for a greater part of the year than likely occurred prior to construction of the facilities. The channel that is now inundated is approximately 3200 feet long, and forms slow, off channel habitat adjacent to the Clark Fork River. In addition, impoundment of the side channel by the dam and low dikes across the two small overflow channels likely results in a higher frequency of flood plain inundation immediately adjacent to the side channel than occurred in the historic past.

Immediately upstream of the Frenchtown diversion dam, there is a lowered portion of the channel bank that acts as a waste way around the dam and back to the side channel during high flows. A rough comparison of the surveyed height of this lowered section and construction period (1935) drawings indicates the slow water side channel enhanced by and immediately upstream of the irrigation dam is approximately 9 feet deep. This side channel leads directly to the unscreened headgate that captures 115 cfs.

Observations of ponded water in sink areas within the waste way adjacent to the side channel suggest the bottom of the side channel is at or below the water table, suggesting that ground water is entering the side channel upstream of the diversion dam (Gordon et al. 1992). The extent of the ground water/surface interface is not known. Though some temperature gradient may occur between the surface of the water and pool bottom, the Service assumes that the water in this channel is relatively isothermic.

V. Effects of the action

A. Analyses for effects of the action

"Effects of the action" refers to the direct and indirect effects of an action on the species or critical habitat, which, when combined with the effects of other activities interrelated or interdependent with that action, will be added to the environmental baseline. Direct effects are considered immediate effects of the project on the species or its habitat. Indirect effects are those caused by the proposed action and are later in time, but are still reasonably certain to occur. Interrelated actions are part of a larger action and depend upon the larger action for their justification. Interdependent actions have no independent utility apart from the action under consultation.

The Service has found no indication that the flow diverted from the Big Flat or Frenchtown irrigation systems is purposefully returned to the river(s) in measurable quantities. The Big Flat and Frenchtown irrigation systems originate in sections of the Bitterroot and Clark Fork river valleys that are characterized by broad floodplains. Floodplains generally consist of deposited alluvium overlain by finer river-deposited sediments, and typically are well drained (Brooks et al. 1991). The majority of the water from the Big Flat and Frenchtown irrigation diversions is thought to percolate into or evaporate from the ground surface. Impacts to bull trout that stem from contaminated agricultural or domestic runoff originating from land irrigated by the Frenchtown or Big Flat irrigation systems returning to the Clark Fork or Bitterroot rivers are not known to occur.

A.1 Entrainment into irrigation canals Bull trout have not been positively identified in limited sampling efforts down-canal from the headgates of either the Big Flat or Frenchtown irrigation systems. Bull trout are thought to currently occur in relatively low numbers in the Clark Fork and Bitterroot Rivers (USDA 2000; USDA 2000a; USDI 2002a) in the vicinity of the points of diversion. The number of bull trout occupying the lower Bitterroot River and Clark Fork River undoubtedly fluctuates with seasonal movement in migratory habitat. The Service believes, however, that entrainment of bull trout into the Frenchtown irrigation system is reasonably certain to be occurring on a periodic basis. Though data specific to seasonal habitat use by bull trout in the lower Bitterroot River are lacking, increases in the number of bull trout that are anticipated to occur with recovery efforts will lead to entrainment in the Big Flat irrigation canal as well.

Water temperature data collected at the base of Milltown Dam suggest the temperature of river water in the vicinity of the Frenchtown irrigation diversion would be less than 15 degrees C in early May and again in mid September. Schmetterling (2001) documented the outmigration of juvenile bull trout from the Blackfoot River, directly upstream from the action area in early May. The U.S. Geological Survey website describes site 12352500 and provides temperature data for the Bitterroot River directly upstream from Missoula, near the Big Flat irrigation diversion. Water temperature in the lower Bitterroot River did not exceed 15 degrees C until July 1 2002 and dropped below 15 degrees C after about September 15 2002. There is no indication that the temperature of the water in the intake channels leading to the Frenchtown and Big Flat irrigation systems would differ appreciably from that of the Clark Fork or Bitterroot rivers, respectively, during the period when juveniles would be outmigrating from rearing streams. Water temperature in the channels leading to the Frenchtown and Big Flat irrigation diversions would be suitable for juvenile bull trout during the period of outmigration.

Juvenile bull trout typically migrate from rearing streams on the ascending limb of the hydrograph (Fraley and Shepard 1989; Schmetterling 2001). Reiland (1997) found that trout moved into irrigation canals on the West Gallatin River during the peak flow period of the river, suggesting that intake channels and irrigation canals provided low-velocity microhabitat that was favorable to trout. Through extensive electrofishing and trapping, Reiland also found that 46 percent of the total trout captured in 7 study canals were less that 203 mm in length, indicating that juvenile trout represent a large proportion of the fish entrained in irrigation canals.

In an earlier investigation of fish entrainment into irrigation diversions, Clothier (1953) found that trout entered irrigation canals early in the irrigation season during the period of high "debris laden" flow. Clothier observed that a concentrated down-canal movement of trout in irrigation diversions originating from the Gallatin River also occurred in late September, and speculated that the concentrated movement was associated with rainstorm-induced freshets and falling fall water temperatures. Clothier estimated that "fingerling" trout represented over 50 percent of the trout loss through canal entrainment. "Fingerling" trout in this example are assumed to be 7 inches or less in length.

Knotek (2002) found the species composition of fish entrained in the Cobban, Hughes-Fredline and Hamilton-Day irrigation diversions from Rattlesnake Creek, a tributary to the Clark Fork River, to be similar to the fish composition in lower Rattlesnake Creek, with the exception of bull trout. The relative abundance of bull trout in two of the three diversions sampled in 2001 was much higher than in the diverted stream. Knotek suggested that the diversion canals simulated slower, off-channel habitat that was attractive to juvenile and rearing bull trout.

Clothier (1953) also found the assemblage of fish entrained in 11 study canals to be representative of the fish found in the parent stream, the Gallatin River. Similarly, Clothier found a substantially higher percentage of cutthroat trout in down-canal movements than is thought to have occurred in the corresponding reach of the Gallatin River at that time (Clothier 1953).

In the Maclay Canal and Holt Canal, diversions from Lolo Creek, a tributary to the Bitterroot River, Knotek (2002) found the species composition of fish was essentially the same as found in Lolo Creek near the point of diversion. These observations suggest that entrainment into irrigation diversions may parallel the relative abundance of fish in the diverted stream. Reiland (1997) however, found otherwise.

Several researchers in the Clark Fork Basin have linked attractant flows to the upstream movement of fluvial and adfluvial bull trout (Gillin 2002; Lockard pers. comm. 2002; Schmetterling 2001). The lack of attractant flows could influence the movement of adult bull trout into irrigation canals, and may be one factor limiting the entrainment of adult bull trout. Reiland (*in litt.*) however, reports the entrainment of adult bull trout in the unscreened Flint Creek canal, a diversion of the East Fork of Rock Creek, a tributary to the Clark Fork River. Six adult bull trout were sampled in the Flint Creek canal in 1994, prior to the listing of bull trout. Annual salvage operations have recovered "numerous" adult bull trout since that time (Reiland *in litt.*; S. Gerdes, USFS, pers. comm. 2002)

The entrainment of fish species other than bull trout in the Big Flat and Frenchtown irrigation systems is also of concern. Juvenile fish of all species entrained in either irrigation system are lost to the prey base for bull trout in the Bitterroot and Clark Fork rivers, and the number of fish lost can be substantial. Evarts et al. (1991, *cited in* Reiland 1997) electrofished 16 canals operated by the Flathead Agency Irrigation Division and recovered over 8,600 trout over a 4-year period. Evarts et al. (1991) recovered over 20,000 fish of various species, and observed that this number represented only a fraction of fish present in the 16 study canals.

Clothier (1953) captured 3011 salmonids over the 2-season Gallatin River study. Analysis of Clothier's results indicates that the number of salmonids captured represents less than 20 percent of the total fish captured in the 11 study canals in 1950 and 1951. Clothier reported that "thousands of sucker fry were observed in most canals" and that "adults sculpins and fry were also abundant, especially near the headgates."

It is unlikely that bull trout or other fish species are returned to the Bitterroot or Clark Fork rivers once entrained in the Big Flat or Frenchtown irrigation canals. As noted previously, the Service has found no indication that a substantial channelized return flow to either river occurs. If return flow to the Clark Fork or Bitterroot does occur, it is most likely at the downstream end of the Big Flat and Frenchtown Irrigation Districts, and thus at or near the termini of the canals. The Big Flat and Frenchtown irrigation canals are functionally "losing streams" as the down-canal volume of water becomes progressively less as a result of seepage and water use. Reduced flow volume would correspond to reduced habitat suitability and consequently, less use by salmonids. Clothier (1953) for example, found that trout were not found in the lower portions of irrigation ditches unless ditch flow, trout numbers or both were augmented by streamflow from a tributary that was intercepted by the irrigation ditch (see, however, Reiland 1997).

Excessive hydraulics at the headgate at the Frenchtown canal eliminate the potential for fish to re-enter the river once they have been entrained (USDI 2002b). The Big Flat headgate leads directly to a long siphon under U.S. Highway 93. The hydraulic head differential between the headgate and the downstream end of the siphon creates a velocity barrier that precludes the return of fish to the Bitterroot River once entrained (USDI 2002c). Once past the irrigation headgates at the Frenchtown and Big Flat irrigation systems, bull trout are lost to the population(s) of the Clark Fork and Bitterroot Rivers.

To briefly summarize, bull trout are known to occur in the action area throughout the annual period of operation of the Big Flat and Frenchtown irrigation diversions. Habitat in the excavated trench of the Big Flat diversion and the enhanced side channel leading to the Frenchtown irrigation diversion are likely to be attractive habitat for adult and/or juvenile bull trout on a seasonal basis. The irrigation diversions are unscreened, and other species of fish are known to be entrained, potentially in large numbers. It is unlikely that bull trout, once past the headgate of either the Big Flat or Frenchtown irrigation diversions are able to return to the Bitterroot or Clark Fork rivers.

A.2 Reduction in the volume of flow of the Bitterroot and Clark Fork Rivers There are a number of major water diversions from the Clark Fork and Bitterroot rivers upstream of the Big Flat and Frenchtown irrigations systems. A substantial portion of the volume of flow of each river is diverted, and is primarily used for irrigation. In the Missoula Valley, four major diversions in addition to the Frenchtown irrigation system carry water from the Clark Fork River.

On the Bitterroot, there are at least four major diversions upstream of the Big Flat irrigation diversion. See table 1.

Table 1 Irrigation Withdrawals from the Clark Fork and Bitterroot Rivers*			
Clark Fork River		**Bitterroot River**	
Irrigation System	***cfs****	***Irrigation System***	***cfs****
Orchard Homes diversion	40	Ward Irrigation	200
Hellgate diversion	142	Corvallis Canal	250
Missoula canal	193	Daly Ditches	452
Grass Valley	212	Supply Ditch	125
Total	***587***		***1027***
* From DNRC website; **based on decreed water rights.			

There are virtually hundreds of smaller diversions from tributaries to the Clark Fork and Bitterroot as well, which contribute to the reduction in instream flows. Table 2 describes the flow of the Clark Fork River upstream from the Frenchtown irrigation diversion and upstream from the confluence with the Bitterroot River. Table 2 also describes mean monthly streamflow from the Bitterroot River downstream from the Big Flat irrigation system.

Table 2 Mean of monthly streamflow of the Clark Fork and Bitterroot rivers*							
Clark Fork River above Bitterroot River (site 12553000)				Bitterroot River (site 12352500)			
Jan.	1,504	*July*	4,243	*Jan.*	909	*July*	3,276
Feb.	1,356	*Aug.*	1,801	*Feb.*	1,000	*Aug.*	1,050
Mar.	2,018	*Sept.*	1,522	*Mar.*	1,283	*Sept.*	892
April	3,752	*Oct.*	1,603	*April*	2,753	*Oct.*	1,033
May	9,636	*Nov.*	1,573	*May*	6,765	*Nov.*	1,094
June	10,930	*Dec.*	1,548	*June*	8,456	*Dec.*	1,021
*From USGS website							

Note that the four diversions described above represent 24 percent of the mean monthly streamflow of the Bitterroot River in July and nearly 50 percent of the mean monthly streamflow in August. The Big Flat Irrigation system withdrawals an additional 25 cfs from the mean monthly streamflow of the Bitterroot River during the annual period of operation of the irrigation system, representing a loss of an additional 1.2 percent of the mean monthly streamflow.

Reduced flow of the Bitterroot River during the warmest months of the year contributes to reduced habitat quality for bull trout and other fish species.

Withdrawal at the Frenchtown irrigation diversion is from the combined flow of the Bitterroot and Clark Fork Rivers. See table 3.

Table 3 Mean monthly streamflow of the Clark Fork River below the Bitterroot									
Jan.	2,252	*April*	6,375		*July*	5,862	*Oct.*	2,737
Feb.	2,499	*May*	14,829		*Aug.*	2,303	*Nov.*	2,745
Mar.	3,098	*June*	16,710		*Sept.*	2,294	*Dec.*	2,491

Irrigation withdrawals from the Bitterroot and Clark Fork rivers upstream from the Frenchtown irrigation diversion represent a 42 percent reduction in the mean monthly streamflow of the Clark Fork River. The additional 115 cfs withdrawn by the Frenchtown irrigation system represents an additional 3 percent of the mean monthly streamflow. These substantial reductions in mean monthly stream flow, especially during periods of elevated water temperatures, result in direct and indirect impacts to habitat quality in the Bitterroot and Clark Fork rivers. If improvements in canal efficiency can be gained and gains in efficiency translate to higher stream flows in July and August, a direct improvement to bull trout habitat can be achieved.

A.3 Manipulation of the Clark Fork River Channel The Frenchtown Irrigation District constructs a berm in the channel of the Clark Fork River at the entrance to the side channel to increase the flow toward the irrigation dam. As previously noted, the entrance to the side channel was excavated through deposited alluvium during the construction phase of the Frenchtown Project, and the thalweg is on the opposite side of the Clark Fork River. Construction of the berm occurs in years with below average flow, and is accomplished with heavy equipment. The berm is constructed of river- deposited alluvium on a gravel bar at the mouth of the intake channel and extends a few meters into the channel. The district removes the berm at the end of the irrigation season.

The actual berm constructed has little impact on bull trout habitat in the Clark Fork River. The berm is constructed in the principal channel of the Clark Fork River. Though some fine sediment is undoubtedly mobilized by construction of the berm, immediate deposition of the mobilized sediment likely occurs within a few meters of the place of excavation due to the reduced transport capacity of the river. The berm is reclaimed at the close of the irrigation season, again mobilizing fine sediment. The berm spans only a small portions of the Clark Fork River and does not present a substantial barrier to seasonal movements of bull trout.

A.4 Summary of effects to critical habitat The primary constituent elements (PCEs) of critical habitat for bull trout are:

1. Permanent water having low levels of contaminants such that normal reproduction, growth and survival are not inhibited.

2. Water temperatures ranging from 2 to 15C (36 to 59F), with adequate thermal refugia available for temperatures at the upper end of this range. Specific temperatures within this range will vary depending on bull trout life history stage and form, geography, elevation, diurnal and seasonal variation, shade, such as that provided by riparian habitat, and local groundwater influence.

3. Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures.

4. Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine substrate less than 0.63 cm (0.25 in) in diameter and minimal substrate embeddedness are characteristic of these conditions.

5. A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, a hydrograph that demonstrates the ability to support bull trout populations.

6. Springs, seeps, groundwater sources, and subsurface water connectivity to contribute to water quality and quantity.

7. Migratory corridors with minimal physical, biological, or chemical barriers between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows.

8. An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

9. Few or no predatory, interbreeding, or competitive nonnative species present.

Review of the effects to bull trout as described in sections A.1 through A.3, above, indicates that **Entrainment into irrigation canals, Reduction in the volume of flow in the Bitterroot and Clark Fork Rivers** and **Manipulation of the Clark Fork River Channel** directly or indirectly relate to critical habitat.

Entrainment of fish of all species and the loss of prey base to bull trout as described in section A.1 would relate directly to PCE number 8. The actual number of fish entrained in the Big Flat and Frenchtown irrigation systems has yet to be determined. In addition, the number of juvenile fish naturally occurring in the lower Bitterroot and middle Clark Fork rivers is difficult to ascertain with any degree of precision.

The Service considers the entrainment of fish of all species into the Big Flat and Frenchtown irrigation systems as lost to the forage base for juvenile and adult bull trout. As the assemblage and relative abundance of fish entrained in the Big Flat and Frenchtown irrigation systems is not known, and the relative abundance of fish in the smaller size classes in the lower Bitterroot and middle Clark Fork rivers is not known, the degree to which bull trout in these river systems are impacted is also not known. Though a substantial loss to the bull trout prey base may be occurring as a result of entrainment of adult and juvenile fish of all species, the actual loss cannot be quantified at this time.

The reduction in the volume of flow would relate directly to PCE number 5, and indirectly relate to PCE number 2. The withdrawal of 25 cfs from the lower Bitterroot River and 115 cfs from the Clark Fork River would represent a long term reduction of flow during the annual period of operation of the irrigation systems. Though a long term reduction in river volume could have an impact on stream habitat quantity and quality during at any time, this reduction would have the greatest impact on stream habitat quantity and quality during the annual period of low flow and elevated river temperature, typically August through early September. As noted previously, irrigation withdrawal at the Big Flat diversion is approximately 1.2 percent of the mean monthly flow of the lower Bitterroot River in August and irrigation withdrawal at the Frenchtown diversion is approximately 3 percent of the mean monthly flow of the Clark Fork River below the confluence with the Bitterroot River, also in August. When viewed as isolated occurrences of long term reductions in the volume of river flow, these irrigation diversions are unlikely to substantially reduce the ability of the Bitterroot and Clark Fork rivers to support bull trout populations.

Though local investigations have shown the adult bull trout have been found the Middle Clark Fork Section 7 Watershed upstream from and downstream from the action area during periods of elevated water temperature and during the month of August, river habitat in the vicinity of the Big Flat and Frenchtown irrigation diversions is primarily migratory and overwintering habitat. The Service expects fewer bull trout to occupy river habitat in the vicinity of the Big Flat and Frenchtown irrigation diversions during August and early September than other times of the year. As such, the minor modification of the Clark Fork River late in the irrigation season and the resultant volume of sediment produced is thought to be a minor impact to PCE number 1.

B. Species' response to the proposed action

The expected bull trout population response to the continued operation and maintenance of the Big Flat Unit of the Missoula Valley Project and the Frenchtown Project is continued loss of individuals to the population as a result of entrainment into irrigation canals. At the current time, the Service considers bull trout passing the headgate on either structure as lost to the population(s) of the Bitterroot or Clark Fork river systems.

Bull trout are widely dispersed in the middle Clark Fork River, and use the river for a migratory corridor and for over-wintering habitat in the deep pools for adult and subadult fish (USDA 2000b). It is likely that juvenile fish, recent out migrants from upstream spawning tributaries, occur in the vicinity of the Big Flat and Frenchtown irrigation diversions during the spring and possibly fall seasons. Entrainment likely occurs when juvenile and subadult bull trout seek off channel, slow water refugia early in the irrigation season, but could occur at other times of the year as well.

Though water diversion does not create an attractant flow, adult bull trout may use slow water habitat in the entrance canals to the Big Flat and Frenchtown diversions for foraging prior to and following periods of excessive water temperatures.

Given the status of the middle Clark Fork River subpopulation, this subpopulation is likely to remain viable and persist in the long term with continued operation and maintenance of the Big Flat and Frenchtown irrigation systems. Operation and maintenance of these irrigation systems does not directly impact important spawning drainages within the subpopulation such as the St. Regis River and Fish, Cedar, Petty, or Rattlesnake Creeks. In the short term, entrainment of bull trout may impact a relatively few fish. In the long term, however, as bull trout populations increase the number of bull trout entrained will grow as well.

VI. Cumulative effects

Cumulative effects include the effects of future state, tribal, local or private actions reasonably certain to occur in the action area under consideration in this biological opinion. Future federal actions unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

MBTSG (1996) identified several primary risks to bull trout in the middle Clark Fork River drainage including mainstem river dams, water quality degradation related to agricultural practices and potential timber harvest. Additional risks include illegal fish introductions, fish management, mining, dam operations, and transportation systems.

Impacts of these risks in the valley portions of the middle Clark Fork River watershed greatly reduce bull trout migration into this isolated section of the Clark Fork River and fragment migratory corridors between adfluvial and fluvial and resident bull trout populations. Residential development along stream corridors could lead to stream channel alterations exacerbating water temperature, nutrient, and bank stability problems. Private and DNRC salvage harvest and associated road construction reduce potential woody debris contributions, increase sediment, and increase summer stream temperatures.

Cumulative effects of the watershed are reflected in bull trout population numbers and life history forms. All watersheds are at risk of increased activities and concern for the viability and effects to bull trout populations has been summarized by the MBTSG (1996).

Possibly one of the largest impacts to fish and fish habitat in the Bitterroot and Clark Fork rivers is the reduction in flow volume resulting from withdrawal for agricultural irrigation. In the Clark Fork River valley in the vicinity of Missoula, Montana, there are four major diversions that with water rights to withdrawal over 587 cfs, nearly 25 percent of the mean monthly stream flow in August. In the Bitterroot River, there are at least four major diversions resulting in nearly 50 percent reduction of the mean monthly stream flow of the Bitterroot River during the month of August.

VII. Conclusion

After reviewing the current status of the Columbia River Basin DPS of bull trout, the environmental baseline for the action area, the effects of ongoing operation and maintenance of the Big Flat unit of the Missoula Valley Project and the Frenchtown Project and cumulative effects, it is the biological opinion of the Service that the continued operation and maintenance of the Big Flat Unit of the Missoula Valley Project and the Frenchtown Project, as currently occurring, is not likely to jeopardize the continued existence of the Columbia Basin DPS of bull trout. Implementing regulations for section 7 (50 CFR 402) defines "jeopardize the continued existence of" as "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species." Our rationale for this conclusion includes the following:

- The number of bull trout of all age classes entrained in the Big Flat and Frenchtown irrigation systems has not been determined, but is thought to be currently small.

- No impact to spawning habitat in important spawning drainages within the subpopulation area, such as the St. Regis River and Fish, Cedar, Petty, or Rattlesnake Creeks, is occurring as a result of continued operation of these facilities.

- Though the number of bull trout entrained in the Big Flat and Frenchtown irrigation systems is likely to increase over time, the relative abundance of bull trout in the Clark Fork and Bitterroot rivers is likely to increase as well.

Critical habitat for bull trout was proposed in November 2002. The action area is entirely within critical habitat as proposed. Though actions associated with the continued operation and maintenance of the Big Flat Unit of the Missoula Valley Project and the Frenchtown Project are likely to adversely affect habitat parameters of PCEs 1, 2, 5 and 8, destruction or adverse modification of critical habitat for bull trout at the DPS scale is not expected to occur.

Incidental Take Statement – Bureau of Reclamation

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibits the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act, provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are not discretionary, and must be undertaken by the Bureau of Reclamation so they become binding conditions of any contract issued to or agreement reached with a water users group for the exemption in section 7(o)(2) to apply. The Bureau of Reclamation has a continuing duty to regulate the activity covered by this incidental take statement. If the Bureau of Reclamation fails to assume and implement the terms and conditions of the incidental take statement, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Bureau of Reclamation must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR 402.14(i)(3)].

Amount or extent of take anticipated

The Service anticipates that continued operation and maintenance of the Big Flat and Frenchtown irrigation systems may result in incidental take of bull trout in the form of mortality resulting from fish being entrained into the irrigation systems. The Service considers any bull trout passing the headgate on the Big Flat or Frenchtown irrigation systems as permanently lost to the population(s) of bull trout in the Bitterroot and Clark Fork rivers. The potential for fish to return to the Bitterroot or Clark Fork River from the irrigation canals is thought to be extremely low due to the method of operation of the diversion facilities and volume of water entering the irrigation systems.

Migratory adult and juvenile bull trout occur in limited numbers in the lower portions of the Bitterroot River and Middle Clark Fork River, and existing fisheries survey information does not adequately represent the age and size structure of bull trout in these rivers. Juvenile fish that are entrained in the Big Flat and Frenchtown irrigations systems are likely dispersed along the 9 miles of the primary Big Flat canal and 17 miles of the Frenchtown canal and miles of laterals associated with these systems, making detection of juvenile bull trout extremely difficult. Survey information for the Big Flat and Frenchtown irrigation canals is extremely limited, and does not conclusively portray the assemblage of fish entrained by these systems. As such, the take associated with continued operation and maintenance of the Big Flat and Frenchtown irrigation systems is unquantifiable.

The measures currently under consideration by the Bureau of Reclamation to reduce or eliminate incidental take of bull trout- the construction of fish protection devices near the headgates of the Big Flat and Frenchtown irrigation systems- if and when fully implemented, will greatly minimize impacts to bull trout.

Effect of the take

In the accompanying biological opinion, the Service determined the anticipated level of incidental take would not substantially reduce the potential for persistence or recovery of the subpopulation encompassing the action area, and thus is not likely to result in jeopardy to the Columbia Basin DPS.

Reasonable and prudent measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize the potential of incidental take of bull trout.

RPM1. Identify and implement means to reduce the potential for incidental take of bull trout resulting from entrainment into the canals of the Big Flat Unit of the Missoula Valley Project and the Frenchtown Project.

RPM2. Implement reporting requirements as outlined in the terms and conditions below.

Terms and conditions

To be exempt from the prohibitions of Section 9 of the Act, the Bureau of Reclamation must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

To fulfill reasonable and prudent measure 1, the following terms and conditions shall be implemented:

TC1. The Bureau of Reclamation shall develop and implement a comprehensive plan to minimize the potential for incidental take of bull trout stemming from the entrainment of bull trout and other fish species into the Big Flat and Frenchtown irrigation systems. This plan shall be subject to review and approval by the Service, and shall be completed in four phases as described below:

TC1a. Inventory and data synthesis The Bureau of Reclamation shall quantitatively sample the fish assemblage entrained in each irrigation canal. Sampling will occur three or more times during the annual operational period of the irrigation system and at more than one location within the canals. Quantitative sampling shall be conducted using accepted fisheries principles and techniques appropriate to salmonids in the Pacific Northwest and shall produce estimates of the number of fish of all species entrained. Pre-implementation sampling should occur over a minimum of two operational seasons. The sampling design will be subject to the review and approval by the Service prior to the initiation of inventory.

TC1b. Develop proposed action Based on the information developed during the inventory and data synthesis phase, the Bureau of Reclamation shall identify a range of actions that are within the authority of the Bureau of Reclamation, within the scope of 50 CFR 402.14 (i)(2) (the "minor change rule") and designed to minimize impacts to bull trout from entrainment that is currently occurring and anticipated to occur in the future. The Bureau of Reclamation will select from this range specific implementable actions, incorporate these into a specific proposed action and develop an implementation schedule that includes the necessary National Environmental Policy Act analysis and documentation and, if necessary, site preparation and construction. The proposed action, implementation schedule and project design will be subject to review by Montana Fish, Wildlife and Parks and review and approval by the Service. The proposed action and implementation schedule will be provided to the Service in final form by February 15 2005. The proposed action may include:

1. constructing a fish protection device at the entrance to the principal canal of the Frenchtown Project, preventing the entrainment of bull trout and other fish species into this irrigation system.

2. constructing a fish protection device at the entrance to the principal canal of the Big Flat Unit of the Missoula Valley Project, preventing the entrainment of bull trout and other fish species into this irrigation system.

3. changing the method of water capture from an irrigation headgate to a pump operation or other alternate method of withdrawal to eliminate the entrainment of bull trout and other fish species at the Big Flat Unit of the Missoula Valley Project.

4. agreements with other federal and state and agencies and private groups to accomplish actions at the Big Flat or Frenchtown irrigation systems designed to minimize the potential for incidental take of bull trout.

TC1c. Implement proposed action The Bureau of Reclamation shall implement the proposed action to minimize the potential for incidental take of bull trout within a reasonable period of time following the conclusion of this formal consultation. Implementation of the proposed action will follow the implementation schedule as described above and may in part be subject to congressional appropriation.

TC1d. Monitor results The Bureau of Reclamation shall develop a monitoring plan in conjunction with selecting specific actions to reduce the potential for incidental take of bull trout. The monitoring plan will be subject to review and approval by the Service, and at a minimum shall contain:

> **1.** Implementation monitoring to ensure that selected actions are implemented correctly and in a timely fashion; and
>
> **2.** Effectiveness monitoring in the form of post implementation fisheries surveys of the principal canals of the Big Flat and Frenchtown irrigation systems to determine the effectiveness of actions in reducing the potential for incidental take of bull trout following implementation.

TC2. The Bureau of Reclamation shall ensure that measures taken to reduce the potential for incidental take of bull trout are operational and functioning throughout subsequent irrigation seasons until such time as the Bureau of Reclamation no longer has administrative control of the Big Flat and Frenchtown irrigation systems. The Bureau of Reclamation may accomplish this through long term maintenance agreements with water users groups, conservation groups or other interested parties.

Reporting Requirement: To fulfill reasonable and prudent measure 2, the following terms and conditions shall be implemented:

TC3. The Bureau of Reclamation will provide the Service and Montana Fish, Wildlife and Parks an annual report detailing the progress made in implementation of reasonable and prudent measure 1. This report shall be provided to the Service on or about March 1, annually for the prior year's work This term and condition may be suspended on mutual agreement between the Service and the Bureau of Reclamation.

TC4. The Bureau of Reclamation will provide summaries to the Service of all fisheries and compliance monitoring conducted in conjunction with design, implementation and effectiveness of the actions proposed to minimize the potential for incidental take of bull trout as described under TC1d, above. Summaries shall be provided to the Service on or about March 1, annually for the prior year's work.

TC5. Upon locating dead, injured or sick bull trout or upon observing destruction of redds, notification must be made within 24 hours to the Service's Montana Field Office at 406-449-5225 or jay_frederick@fws.gov. Record information relative to the date, time, and location of dead or injured bull trout when found, and possible cause of injury or death of each fish and provide this information to the Service.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize incidental take that might result from the proposed action. If during the course of the action, terms and conditions TC1 through TC5 are not adhered to, the level of incidental take anticipated in the biological opinion may be exceeded. Such incidental take may represent new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Service retains the discretion to determine whether non-compliance with terms and conditions TC1 through TC5 results in take exceeding that considered here, and whether consultation should be re-initiated. The federal agency must immediately provide an explanation of the causes of any non-compliance and review with the Service the need for possible modification of the reasonable and prudent measures.

Conservation recommendations

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. Evaluate the configuration of the diversion dam, headgate, dikes running parallel to the intake channel and the existing overflow channel to determine the feasibility of creating passive fish passage at the Frenchtown Project diversion facility.

2. Provide for upstream fish passage in the side channel to the Clark Fork River that contains the Frenchtown Project diversion facility.

3. Evaluate measures to improve the conveyance efficiency of the Big Flat and Frenchtown irrigation canals to reduce seepage loss. Retain all or part of water gained through improved conveyance efficiency in the river for instream flows.

4. Ensure that herbicide treatments to control aquatic plant species in the Frenchtown Project irrigation canal are applied following label directions and best management practices for herbicide application.

To keep the Service informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

Reinitiation notice

This concludes formal consultation on the action(s) outlined in the request. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

R. Mark Wilson　　　　Date
Field Supervisor
U.S. Fish and Wildlife Service

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