BACKGROUND

In 1998, the U.S. Fish and Wildlife Service (Service) issued the *Biological Opinion for the Effects to Bull Trout from the Continued Implementation of Land and Resource Management Plans and Resource Management Plans as Amended by the Interim Strategies for Managing Fish Producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana and portions of Nevada (INFISH)* and the *Interim Strategy for Managing Anadromous Fish-producing Watersheds in Eastern Oregon and Washington, Idaho and portions of California (PACFISH*; UDSI 1998d). The 1987 Kootenai National Forest Plan (USDA 1987) was included in the plans addressed in that consultation.

Part B of this document represents the Service's biological opinion for the impacts of the Forest Service action to permit the Rock Creek mine on bull trout (*Salvelinus confluentus)* based on our review of the May 10, 1999, biological assessment and its potential effects on bull trout in the September 2001 Final Environmental Impact Statement (MDEQ and USDA Forest Service 2001) in accordance with section 7 of the Endangered Species Act (Act), as amended (16 USC 1531 et seq.). The Service issued a biological opinion on this federal action on May 9, 2003, which the U.S. District Court set aside and remanded to the Service in March 2005. For analyses in this biological opinion, the Service used new and updated technical information (to July 2006). Significant updates include, but are not limited to the following:

- Designation of critical habitat for bull trout on September 26, 2005;
- In 2004 and 2005, several adult adfluvial bull trout were radio-tracked into Rock Creek;
- Service adoption of new terminology (May, 2005) different from the original listing (1998);
- Service guidance on adverse modification determination of critical habitat, December 9, 2004;
- Service guidance on jeopardy determinations under section 7 of the Act for bull trout, September 26, 2005 (70 FR 56212) (April 20, 2006, guidance memorandum);
- Improved upstream passage of adult bull trout around Cabinet Gorge Dam since 2001;
- Consolidation of four core areas in the lower Clark Fork River into one (July 2006);
- Five-year Status Review, Bull Trout Core Area Conservation Status Assessment (USDI 2005b).

For a complete review of the consultation history for the proposed action, please refer to the Introduction (Part A), Consultation History – Rock Creek mine project, in this biological opinion.

Relationship Of Bull Trout Subpopulations, Core Areas, And Jeopardy Analyses

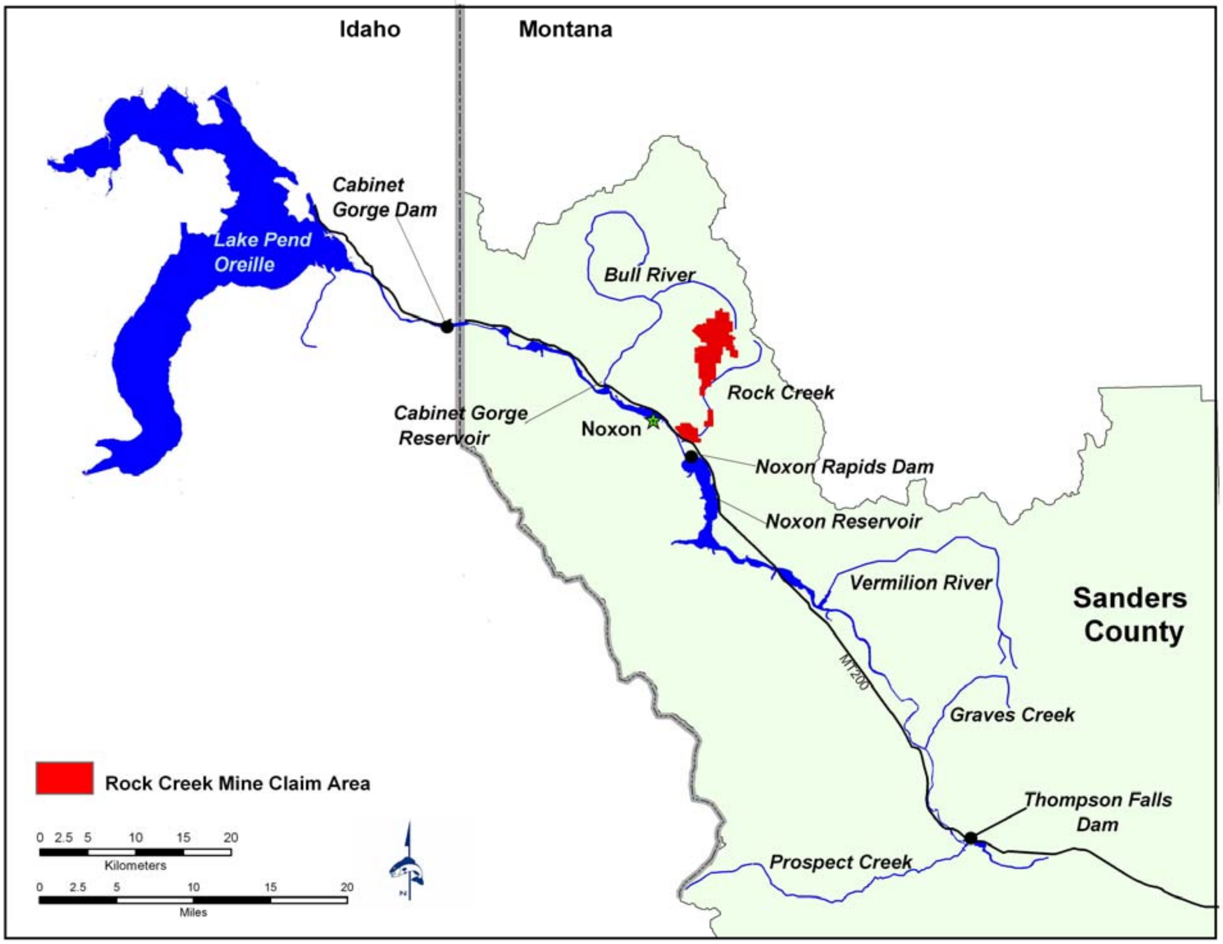
This section addresses the Court's concern regarding the Service's seeming contradiction of earlier findings related to language in previous biological opinions that suggested all bull trout subpopulations were critical to the Columbia River Distinct Population Segment (DPS). The Court indicated that the Service departed from this position (without explanation) when in 2003 the Service stated that extirpation of the Cabinet Gorge subpopulation was not likely to jeopardize the Columbia River DPS. The Service has since discontinued the use of the "subpopulation" terminology and adopted different terminology and units of analysis (i.e., core areas) for jeopardy analyses based on improved scientific information since the listing of bull trout and development of the Draft Bull Trout Recovery Plan. In this biological opinion, we describe the current status of the affected bull trout local population that occupies the Rock Creek watershed and the associated core area (an interacting group of local populations). Recent scientific information on the status of Rock Creek bull trout shows that the adfluvial component of bull trout has improved and has been partially restored due to the upstream and downstream fish passage that has recently been occurring around Cabinet Gorge Dam.

<u>Subpopulations in the original listing of bull trout</u>

Bull trout were listed as threatened in the Columbia and Klamath River Distinct Population Segments (DPS) on June 10, 1998 (50 CFR 17, Vol. 63(111):31647-31673). Concurrently, a proposed rule was published to list all remaining bull trout within three additional DPS's in the contiguous U.S. (Coastal – Puget Sound, Jarbidge River, and St. Mary – Belly Rivers). The initial listing rule for the Klamath and Columbia described 141 subpopulations of bull trout in the Columbia River DPS. A subpopulation was considered to be "a reproductively isolated group of bull trout that spawns within a particular area of a river system." For the action area (described below), the supporting documentation for the original 1998 listing rule (USDI 1998c) described Cabinet Gorge Reservoir as a subpopulation within the Clark Fork River Basin of the Columbia River DPS. A map of the general location of the proposed action in northwest Montana is shown in Figure B1.

In November, 1999, a final rule determined threatened status for "all populations of bull trout within the United States," thus making the original listing coterminous (50 CFR 17, Vol. 64(210):58910-58936, meaning the five DPSs were consolidated into one listed taxon. Furthermore this rule states that: "for the purposes of consultation and recovery, we recognize these five DPS's (Columbia River, Klamath River, Coastal-Puget Sound, Jarbridge River, and St Mary-Belly River) as interim recovery units" because of their uniqueness and significance. A discussion in the response to comments within that final rule (see Issue 3 in 64 FR 58918-58919) acknowledged the difficulty and some of the challenges in consistently applying subpopulation and metapopulation concepts to bull trout.

Figure B1. Map of the general location of the proposed Rock Creek Mine Facility in northwest Montana. Estimated surface disturbance within the mine claim area is 483 acres.



<u>Conflict with the use of subpopulations for section 7 consultation</u>

The Court pointed out that some previously issued biological opinions contained language that indicated the loss of a bull trout subpopulation would cause jeopardy to the DPS, and asked for further explanation of why the Service departed from this position in the 2003 Rock Creek biological opinion. In response to the Court's remand, our evaluation substantiated the Court's conclusion that some biological opinions were issued with this language while others were not. During preparation of the 2003 Rock Creek biological opinion, we were made aware through an email message from Region-1 of the Service that Region-1 had drafted an approach to jeopardy analyses which was intended to be used to address section 7 consultation until the Draft Recovery Plan was finalized (2/2/01 email from John Young, FWS, Portland Regional Office; see email attachment marked draft; Appendix A in this opinion is a copy of this email). The email message discussed the importance of a subpopulation to the DPS and the attachment was a document marked "Draft," that contained language that was proposed to be used in the Status of the Species section of biological opinions addressing effects to bull trout (see Appendix A). This proposed draft language stated that loss of a subpopulation "constitutes an unacceptable risk to the DPS," which has been interpreted and incorporated into some biological opinions as meaning the "loss of a subpopulation would cause jeopardy to the DPS." Because this was "draft" language, we did not use this language in the 2003 biological opinion, and in fact, recognized that the language may not be applicable to circumstances for the Rock Creek mine project and other situations in Montana (see below). However, as the Court found, other offices did use this draft language in their biological opinions for actions affecting bull trout resulting in an apparent inconsistency among biological opinions. Consequently, we requested updated information in an email to Region-1 (email to John Young, Portland Regional Office, 5/20/05). The response from Region-1 stated *"In light of new information available since the 1998 listing that has been incorporated into the draft Recovery Plan, which has been provided for public and agency comment on two occasions, and subjected to two separate peer reviews, my position is that it is now inappropriate to base bull trout conservation status and conservation requirement conclusions on the subpopulations identified in 1998."* Additionally, the Service has since discontinued the use of "subpopulation" terminology as a unit of analysis for jeopardy determinations as explained below.

The Court also raised a concern whether bull trout were suffering from "death by a thousand pinpricks" as a result of incidental take authorized by the many biological opinions on bull trout. When preparing the 2003 Rock Creek biological opinion, we recognized that each previous biological opinion incorporated updated environmental baselines to take into account the effects of the federal actions including "incidental take" that had been authorized under previous biological opinions. Updating environmental baselines based on previously proposed actions and associated incidental take is a requirement in preparing a biological opinion (see the Service's Consultation Handbook, pg 4-1 and pg 4-22, March 1998). Updating the baseline conditions on bull trout (population and habitat) is a regular procedure. To assist the Service in that regard, the Service has required updated baseline conditions from action agencies, including consideration of impacts from previous actions, as a procedure in the guidance document for federal land management agencies to use when assessing the effects of their actions on bull trout (*A Framework to Assist in Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale)*(Framework)(USDI 1998). During consultation with the federal action agency, it is routine for the Service to ensure that it has incorporated an updated baseline as required by the Framework. Therefore, all previous biological opinions had been considered in the updated baseline before another biological opinion was issued for any individual action or project affecting a subpopulation.

At the time of preparing the 2003 Rock Creek biological opinion there were no biological opinions within the range of bull trout with other than a no-jeopardy determination. Further, these actions did not adversely affect bull trout populations to the extent of loss of a subpopulation (see Status of the Species section, Consulted-on Effects Analysis of Previous Biological Opinions, for more detailed explanation). By extension, because all previous biological opinions were to have updated baselines and were no-jeopardy determinations, we concluded that the continued long-term survival and existence of the species had not been appreciably reduced range-wide. Subsequently, a recent assessment of all of the biological opinions (explained in more detail below in the Status of the Species section) from the time of listing until August 2003 (137 biological opinions) confirmed that no actions that have undergone section 7 consultation, considered either singly or cumulatively, will appreciably reduce the likelihood of survival and recovery of the bull trout or result in the loss of any subpopulations (USDI 2003) (Appendix B). We have also reviewed all biological opinions issued in the affected core area (Lower Clark Fork Core Area) since August 2003 and confirmed that no actions that have undergone section 7 consultation considered either singly or cumulatively, will appreciably reduce the likelihood of survival and recovery of the bull trout or result in the loss of any subpopulation. In fact, many of them will benefit bull trout.

Discontinued use of subpopulations to address section 7 consultation

Prior to 2005, certain aspects of the original subpopulation classification system were considered problematic in application. For example, in the Bitterroot River watershed the listing described 27 separate subpopulations of bull trout, which were essentially isolated headwater populations that developed as an artifact of human-caused fragmentation of the habitat. Under natural conditions, we believed those subpopulations formed a single interacting group. The Service continued to work on these classification challenges, and in 2002 released a draft recovery plan. The Draft Bull Trout Recovery Plan (USDI 2002b) describes an organizational hierarchy for bull trout at nested spatial levels that include *recovery units, core areas, and local populations* (the lowest rung in the hierarchical --organizational level). Twenty-seven major watersheds were referred to as recovery units; terminology that has since been revised and they are now referred to as management units. The following definitions are from the Draft Bull Trout Recovery Plan (USDI 2002b):

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

- Core area: The combination of core habitat (*i.e.*, habitat that could supply all elements for the long-term security of bull trout) and a core population (a group of one or more local bull trout populations that exist within core habitat) constitutes the basic unit on which to gauge recovery. Core areas require both habitat and bull trout to function, and the number (replication) and characteristics of local populations inhabiting a core area provide a relative indication of the core area’s likelihood to persist. A core area represents the closest approximation of a biologically functioning unit for bull trout. Local populations within a core area have the potential to interact because of connected aquatic habitat.

- Recovery unit / management unit: Management units are the major units for managing recovery efforts; management units were described (as recovery units) in separate chapters in the draft recovery plan (USDI 2002b). Most management units, as proposed, consisted of one or more major river basins. Several factors were considered in our identifying management units, for example, biological and genetic factors, political boundaries, and ongoing conservation efforts. In some instances, management unit boundaries were modified to maximize efficiency of established watershed groups, encompass areas of common threats, or accommodate other logistic concerns. Some proposed management units included portions of mainstem rivers (e.g., Columbia and Snake rivers) when biological evidence warranted such inclusion.

Within each management unit, there are one or more core areas, which are intended to reflect the metapopulation structure of bull trout. By definition, a core area contains all of the necessary constituent elements for the long-term security of bull trout. Each core area represents the closest approximation of a biologically functioning unit for bull trout and as described below constitutes the unit on which the Service is gauging the status of bull trout. The Draft Bull Trout Recovery Plan recognizes core areas as the population units that are necessary to provide for bull trout biological needs in relation to genetic and phenotypic diversity, and spreading the risk of extinction caused by stochastic events. Peer review of the Draft Bull Trout Recovery Plan supported this approach. A panel of scientists invited to participate in the bull trout 5-year review process concluded that core areas are appropriate units of analysis by which threats to the bull trout and recovery standards should be measured [September 26, 2005, Final Rule Designating Critical Habitat for Bull Trout (FR 70, No 185, 56211-56311); USFWS, staff memorandum, *in litt.* 5/20/2005). Furthermore, in a staff memorandum issued by the Assistant Regional Directors of Ecological Service for Regions 1 and 6 (USFWS, *in litt*. 5/20/2005) and in the September 26, 2005 Final Rule Designating Critical Habitat for Bull Trout (FR 70, No 185, 56211-56311), additional guidance was given on the appropriate use of terminology to promote consistency in carrying out Service consultation responsibilities with respect to bull trout.

At the time of publication of the Draft Bull Trout Recovery Plan (October 2002), there were 27 recovery units described. Almost immediately upon publication, the Service recognized that these units may not meet the Service standard for "recovery units" and decided to call them "management units." Consequently, "recovery units" as described in the Draft Bull Trout Recovery Plan are interchangeable with "management units" and these units are used throughout this biological opinion. To clarify further, as mentioned above the previously five DPSs described in the June 10, 1998, listing of bull trout (FR 63, No.111, 31647-31674) were subsequently recognized as "interim recovery units" in the November 1, 1999, final listing rule for bull trout (FR 64, No. 210, 58910-58936). Note that "recovery units" as described in the Draft Bull Trout Recovery Plan should not be confused with "interim recovery units" as described in the aforementioned guidance (USFWS, *in litt*. 5/20/2005) and in the September 26, 2005 Final Rule Designating Critical Habitat for Bull Trout (FR 70, No 185, 56211-56311). These unit designations (recovery units and interim recovery units) are not the same in that the designations reflect different geographic scales ("recovery units" are interchangeable with "management units" and "interim recovery units" are interchangeable with "DPSs").

In summary, until the Draft Bull Trout Recovery Plan is finalized, the Service has adopted the use of *local population, core area, management unit, and interim recovery unit* for purposes of consultation and recovery. Table B1 illustrates the language used by the Service for purposes of consultation for bull trout, including this biological opinion, as well as the hierarchal relationships between these geographical units of analysis (see below for further explanation).

Table B1. Hierarchy of Units of Analysis for Bull Trout Jeopardy Analysis for the Rock Creek Mine Project

Name	Hierarchal Relationship
Columbia River Interim Recovery Unit	One of 5 interim recovery units in the range of the species within the coterminous United States
Clark Fork River Management Unit	One of 23 management units in the Columbia River Interim Recovery Unit
Lower Clark Fork Core Area	One of 35 core areas in the Clark Fork River Management Unit (adjusted for 4 original core areas consolidated into one - Lower Clark Fork Core Area)
Rock Creek Local Population	One of 14 local populations in the Lower Clark Fork Core Area
East and West Fork Rock Creek	Tributaries to Rock Creek

<u>Conducting jeopardy analyses for bull trout</u>

Jeopardy determinations for bull trout are made at the scale of the listed entity, which is the coterminous United States population (64 FR 58910). This follows the April 20, 2006, analytical framework guidance described in the Service's memorandum to Ecological Services Project Leaders in Idaho, Oregon and Washington from the Assistant Regional Director – Ecological Services, Region 1 (Appendix C). The guidance indicates that if an action "impairs or precludes the capacity of a recovery unit from providing both the survival and recovery function assigned to it, that action may represent jeopardy to the species." The guidance provides an analytical framework with direction to consider the following: 1) in the status section concisely discuss the relationship between each of the interim recovery units and the survival recovery of the coterminous United States population of bull trout; 2) in the baseline section discuss the relationship between the action area and recovery function of the affected interim recovery unit(s), in addition to recognizing the importance of viable core areas within the interim recovery unit(s); 3) in the effects of the action and cumulative effects sections address the significance of adverse and beneficial effects in relation to the role of the action area in the conservation of the bull trout at the interim recovery unit scale; and 4) in the conclusion section discuss how all the effects of the proposed action are likely to influence the survival and recovery function assigned to the interim recovery unit(s) as the basis for the jeopardy determination (i.e., is the proposed action likely to appreciably reduce both survival and recovery of the coterminous United States population in the wild).

Within the context of the jeopardy analytical framework (Appendix C), the Service uses the hierarchal relationship between units of analysis (i.e., the geographical subdivisions of local populations, core areas, management units and interim recovery units) defined in the Draft Recovery Plan to characterize effects of the proposed action beginning at the lowest level or smallest scale (local population) and then progresses toward the highest level or largest scale (Interim Recovery Unit). The hierarchal relationship between units of analysis is used to determine whether the proposed action is likely to jeopardize the survival and recovery of bull trout. Should the adverse effects of the proposed action not rise to the level where it appreciably reduces both survival and recovery of the species at a lower scale, such as the local or the core population, by deduction the proposed action could not jeopardize bull trout at the higher scale of the coterminous United States (i.e., rangewide). Therefore, the determination would result in a no-jeopardy finding. However, should a proposed action produce adverse effects that are determined to appreciably reduce both survival and recovery of the species at a lower scale of analysis, then further analysis is warranted at the next higher scale.

Change In The Affected Core Area For The Rock Creek Mine Project

The Draft Bull Trout Recovery Plan (USFWS 2002) described the inherent complexity of designating bull trout core areas on the portions of the Clark Fork River in Montana in watersheds that were historically connected, but are now fragmented by dams: "For fluvial or anadromous populations, delineating core areas requires that some judgment calls be made in determining the extent of historical and current connectivity of migratory habitat, while considering natural and manmade barriers, survey and movement data, and genetic analysis." For resident populations, we must consider whether local populations are remnants from previously existing migratory bull trout and whether reconnecting fragmented habitat would restore a migratory core area since some local populations may not have a history of a migratory component and instead may have been isolated historically during the glacial retreat. At the time the draft recovery plan was written (circa 2000-2002) long-term bull trout trend monitoring data was unavailable for most local populations in the lower Clark Fork River basin (see USFWS 2002, Chapter 3, Table 1, page 27) and the fish passage projects at Cabinet Gorge and Noxon Dams were only in the initial stages. We also did not have extensive genetic information, and survey and movement data were generally not yet available. As a partial consequence of the limited data, in the Draft Bull Trout Recovery Plan (USFWS 2002) the Service took a relatively conservative approach in designating core areas within the Clark Fork drainage. Generally, we adopted a structure that reflected the existing fragmented status of bull trout populations as they were prior to 2002 (see USFWS 2002, Chapter 3, Table 2, pages 124-128).

With the further scrutiny mandated by the Court, and additional analysis presented in this biological opinion, we have reanalyzed whether connectivity provided at both Noxon and Cabinet Gorge dams in the Lower Clark Fork Core Area by the Avista fish passage program is now sufficient, in concert with other actions, to consider these fragmented core areas as no longer isolated genetically and in terms of population dynamics.

The Avista fish passage program originated as part of the 1999 Clark Fork Settlement Agreement for relicensing by the Federal Energy Regulatory Commission (FERC) of Cabinet and Noxon dams, which are owned and operated by Avista Corporation for hydropower. Under the FERC re-licensing of the dam projects, Avista is required to mitigate for the impacts to native fish, including bull trout. The dams had completely blocked migrating adult bull trout from moving upstream in the lower Clark Fork River, which has resulted in significant losses and has been identified as the major threat to bull trout in this area (USDI 2002). Restoring connectivity in the system by providing timely fish passage at the dams is a major objective under Avista's Fish Passage/Native Salmonid Restoration Plan and a mandatory term and condition in the Service's biological opinion on the Avista projects to minimize effects to bull trout. The fish passage component of the program began in 2000 and consists of trapping juvenile bull trout from tributary streams in Montana and transporting a portion of them downstream of the dams to the Lake Pend Oreille system in Idaho where historically these fish would have reared in the lake for 1-3 years before attempting to return to their stream of origin in Montana to spawn. A second aspect of the fish passage program is to capture returning adult bull trout at Cabinet Gorge Dam, install radio transmitters, and transport them around the dams to a location where they can access their stream of origin for spawning. The release location is based on genetic analysis and assignment while in captivity (a bull trout's natal stream can be identified within 48 hours through genetic testing of a fish scale). The Avista fish passage program is well-funded with full-time dedicated staff to implement the trap and transport of bull trout for the entire 45-year licensing period. Currently, Avista is planning and designing a permanent fish passage facility for both dams.

The Recovery Criteria in the Draft Bull Trout Recovery Plan placed a strong emphasis on the restoration of biological connectivity for bull trout in the Clark Fork drainage. Elsewhere in this opinion we describe the trap and transport fish passage actions undertaken by the Avista program (see *Status of the local bull trout population in the Rock Creek watershed* below). It has documented successful passage of adult bull trout upstream (174 total in 2001 through 2005, between 29 and 42 annually) of Cabinet Gorge and Noxon dams. Furthermore, the Avista program has reported that in the last few years some radio-tagged adult bull trout passed upstream over the dams have successfully spawned in tributary streams. The refinement of genetic techniques now allow the accurate assignment of bull trout to certain tributaries where they were born and as adults are attempting to return in order to spawn. Adult bull trout that are captured and radio-tagged and then transported around the dams in trucks and then released, are verifying those genetic assignments through collection of telemetry data. In short, functional biological connectivity has been and continues to be progressing through successful fish passage efforts.

While the numbers of bull trout successfully passed upstream has not been large, due to their fecundity (i.e., each fish carrying several thousand eggs) each fish potentially makes a substantial genetic contribution to the reconnected population. Numbers of juvenile bull trout captured from Montana tributaries and either transported downstream (to the Clark Fork River downstream of Cabinet Gorge Dam) or tagged and allowed to volitionally migrate were 87 in 2001, 416 in 2002, 213 in 2003, 210 in 2004, and 323 in 2005 for a total of 1,249 fish in the first five years of implementation (LaDana Hintz, Avista, pers. comm., July 6, 2006). These numbers cannot be considered trend indicators, due to unequal trapping effort by year, but they do indicate substantial progress in providing downstream as well as upstream connectivity through the dams. In 2006, for the first time, a fish trapped and tagged as a juvenile in Montana (Bull River screw trap on 6/20/02 @ 7.5 inches total length) was captured as an adult at the base of Cabinet Gorge

Dam (LaDana Hintz, Avista, pers. comm., July 5, 2006). This is significant because it demonstrates that juvenile bull trout can pass through Cabinet Gorge Dam and survive to return as an adult and are doing so. This particular fish was not transported around the dam, instead it was released back into the Bull River, which is part of the protocol for this program – all captured fish are marked, but half are transported around the Cabinet Gorge Dam and half are released back into the river.

In the Recovery Measures Narrative portion of the Draft Bull Trout Recovery Plan (see USFWS 2002, Chapter 3, pages 162-168) there are a series of lists of *actions needed* to achieve recovery of bull trout. Two of these recovery tasks, both listed as priority one actions under subheading 1.4 – *Operate dams to minimize negative effects on bull trout.* - are as follows:

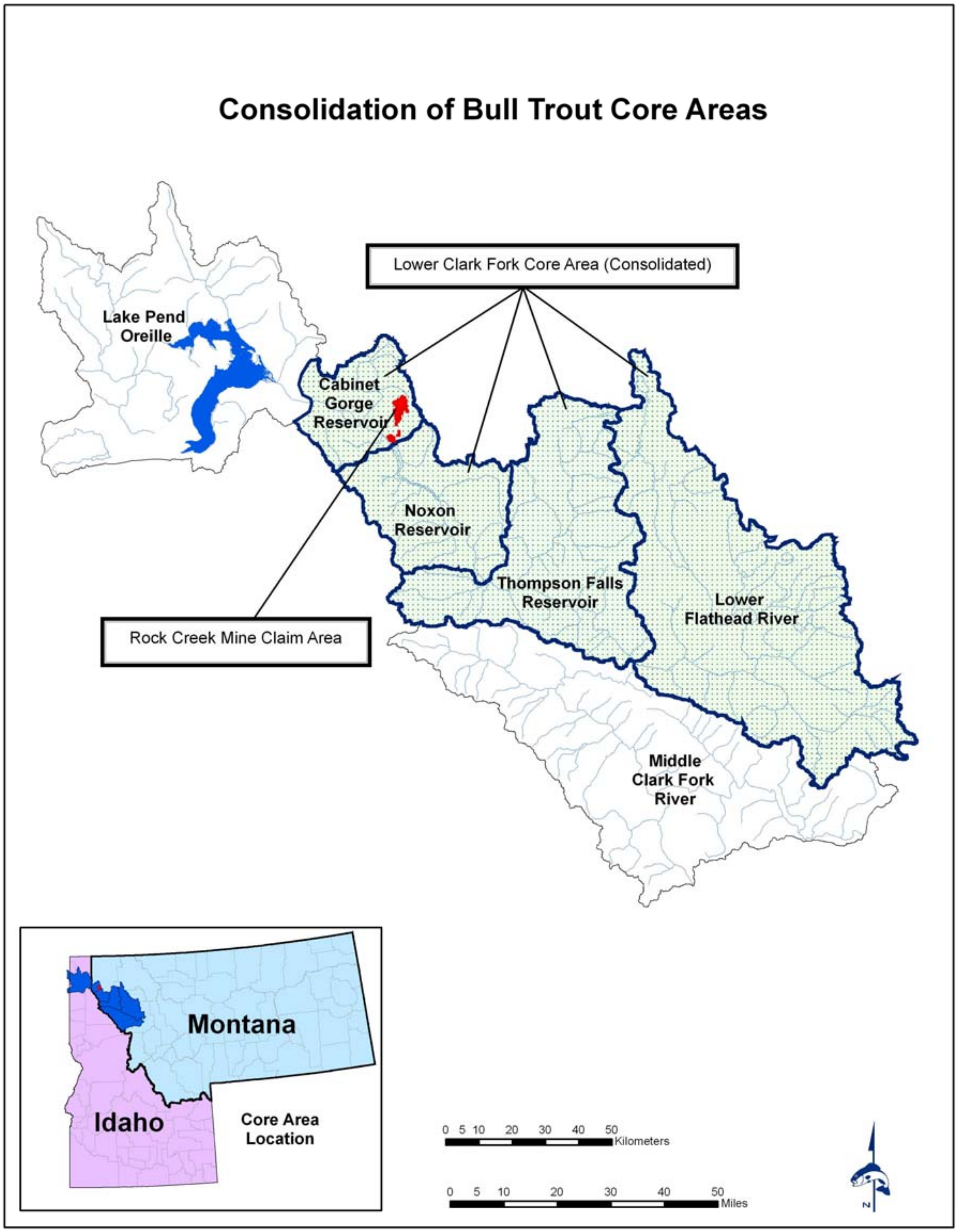
> 1.4.1 Evaluate and restore upstream fish passage at mainstem Clark Fork and Pend Oreille River dams. Investigate and implement upstream fish passage at Albeni Falls (USFWS Biological Opinion), Cabinet Gorge and Noxon Rapids (Avista fish passage protection, mitigation, and enhancement measures), and Thompson Falls Dams, as needed, to reconnect fragmented core habitat of bull trout with Lake Pend Oreille.
>
> 1.4.2 Provide safe passage downstream through dams and reservoirs. Provide safe downstream fish passage from Montana tributaries through Thompson Falls, Noxon Rapids, and Cabinet Gorge Dams and Reservoirs for juvenile and adult bull trout migrating to Lake Pend Oreille.

As described in the Draft Bull Trout Recovery Plan (see USFWS 2002, Chapter 3, Recovery Goals and Objectives, pages 129-140): "The specific goal of the bull trout recovery plan is to ensure the long-term persistence of self-sustaining, complex, interacting groups of bull trout distributed throughout the Clark Fork River basin so that the species can be delisted. Specifically, the recovery subunit teams for the four Clark Fork River subunits (Upper Clark Fork, Lower Clark Fork, Flathead, and Priest) adopted the goal of a sustained net increase in bull trout abundance, and increased distribution of some local populations, within existing core areas." Further, the Lower Clark Fork River was designated as a future primary core area under recovered conditions. As described in the draft Recovery Plan: "Lower Clark Fork River (includes four currently fragmented population segments: Lower Flathead River, Thompson Falls Reservoir, Noxon Reservoir, and Cabinet Gorge Reservoir; these segments are currently treated as separate core areas). Note that these core areas were historically connected and must be functionally rejoined under recovered conditions."

It is the judgment of the Service, that based on best available science as described above, Recovery Measures 1.4.1 and 1.4.2 are now being partially met. Successful upstream fish passage has been restored to a significant degree by the trap and transport program. The percentage of the total migrant fish that are seeking their natal spawning stream and that are passed is currently unquantifiable and the ultimate degree of effectiveness of this program under full implementation remains to be determined. However, many of the fish that have been passed appear to be contributing substantially to the production of juveniles in upstream tributaries. In combination with the downstream trap and transport program, it has been demonstrated that survival of a substantial (again unquantified) portion of the fish volitionally migrating through the turbines or spill passage is also occurring. Not all fish passing through turbines are killed and depending on the type of turbine (e.g., modern Kaplan turbines with adjustable blades), survival of small fish can range from 87 to 100 percent (Kleinschmidt Associates 1996, RMC 1994, Oligher and Donaldson 1966). Future returns will dictate whether downstream trap and transport of juvenile bull trout from Montana tributaries is effective or necessary. In conclusion, it is now evident that a significant level of functional connectivity has been reestablished in the Lower Clark Fork. Neither the upstream nor the downstream passage programs have been fully developed, but it is anticipated that gains in efficiency will continue, given the documented successes thus far and the major commitments of resources already in place.

Based in part on the above record of scientific analysis, with the imperative to reanalyze the current status of bull trout presented by the recent Court actions, the Service has reconsidered the designation of core areas in the Lower Clark Fork. We have made the determination that the four previously designated core areas in Montana that had been fragmented from their natural connectivity by the dams at Cabinet Gorge, Noxon, and Thompson Falls (Lower Flathead River, Thompson Falls Reservoir, Noxon Reservoir, and Cabinet Gorge Reservoir) should be considered rejoined to form a single contiguous core area – the Lower Clark Fork core area (memorandum to the ARD, Ecological Services, Region 1, Portland, OR, from Field Supervisor, Montana Ecological Services, Helena, MT., July 14, 2006) (Appendix D) (Figure B2). Furthermore, Region 1 of the Service (lead Region for bull trout), supported the decision to consolidate the four core areas (email from Patrick Sousa, Program Manager, Endangered Species, Region 1, Portland, Oregon to Mike Stempel, ARD, Ecological Services, Region 6, Denver, Colorado; dated 8/23/06). This action by the Service should have no significant effect in changing the emphasis or priority of any of the prescribed recovery actions in the Lower Clark Fork. Rather, it is a significant acknowledgment that, due mostly to the fish passage efforts, the recovery of bull trout resources in the Lower Clark Fork have progressed to a measurable extent toward the specific recovery goal to: "ensure the long-term persistence of self-sustaining, complex, interacting groups of bull trout distributed throughout the Clark Fork River basin so that the species can be delisted." It is also a recognition that the four previously designated core areas did not, by themselves, constitute true core areas - that is, biologically functioning units that contained all of the necessary constituent elements for the long-term security of bull trout.

Figure B2. Map of the three core areas in the lower Clark Fork River Basin. Outlined in blue are the four consolidated core areas that form the Lower Clark Fork Core Area. Estimated surface disturbance within the mine claim area is 483 acres.



In the newly designated Lower Clark Fork Core Area, the collective number of local populations currently identified is 14 (7 in the lower Flathead in Mission and Jocko drainages; 2 in Thompson River; 3 in Noxon Reservoir; and 2 in Cabinet Gorge Reservoir in Rock Creek and the Bull River). The recovery criteria presented in the Draft Bull Trout Recovery Plan (see USFWS 2002, Chapter 3, Table 3, page 131) already treated this area as a consolidated primary core area, because restored connectivity was considered by the Recovery Team to be necessary for long-term maintenance. The numeric standards that are necessary to achieve recovered abundance (Table 3 in the Draft Recovery Plan) call for a total of 1,000 adult bull trout in the consolidated Lower Clark Fork Core Area, with at least five local populations each supporting over 100 adult fish. Current population levels remain well below those standards. Current levels are estimated to be around 300 adults and no local populations with 100 adults occur in the core area (USDI 2002).

In summarizing this section, the Cabinet Gorge population of bull trout had been artificially isolated since the mid-1950s, by Cabinet Gorge Dam (downstream) and Noxon Rapids Dam (upstream). Under natural conditions (pre-dam), migratory fish found in the waters of the lower Clark Fork River were part of the Lake Pend Oreille Core Area and the two spawning streams, the Bull River and Rock Creek, represented two of many local populations of the Lake Pend Oreille Core Area (Figure B2). Currently, the long-term isolation and lack of upstream fish passage at the dams has been addressed and the functional connectivity over the three dams of the lower Clark Fork through trap and transport and eventual permanent artificial fish passage is in the process of being restored amongst the waters of Lake Pend Oreille, Cabinet Gorge Reservoir, Noxon Reservoir, Thompson Falls Reservoir, and the lower Flathead River (including the Jocko watershed and all waters downstream of Kerr Dam on Flathead lake). According to the Draft Bull Trout Recovery plan this is necessary to restore genetic connectivity and ensure the long-term persistence of the bull trout population in the Lower Clark Fork River Basin.

Jeopardy Analysis for the Rock Creek Mine Project

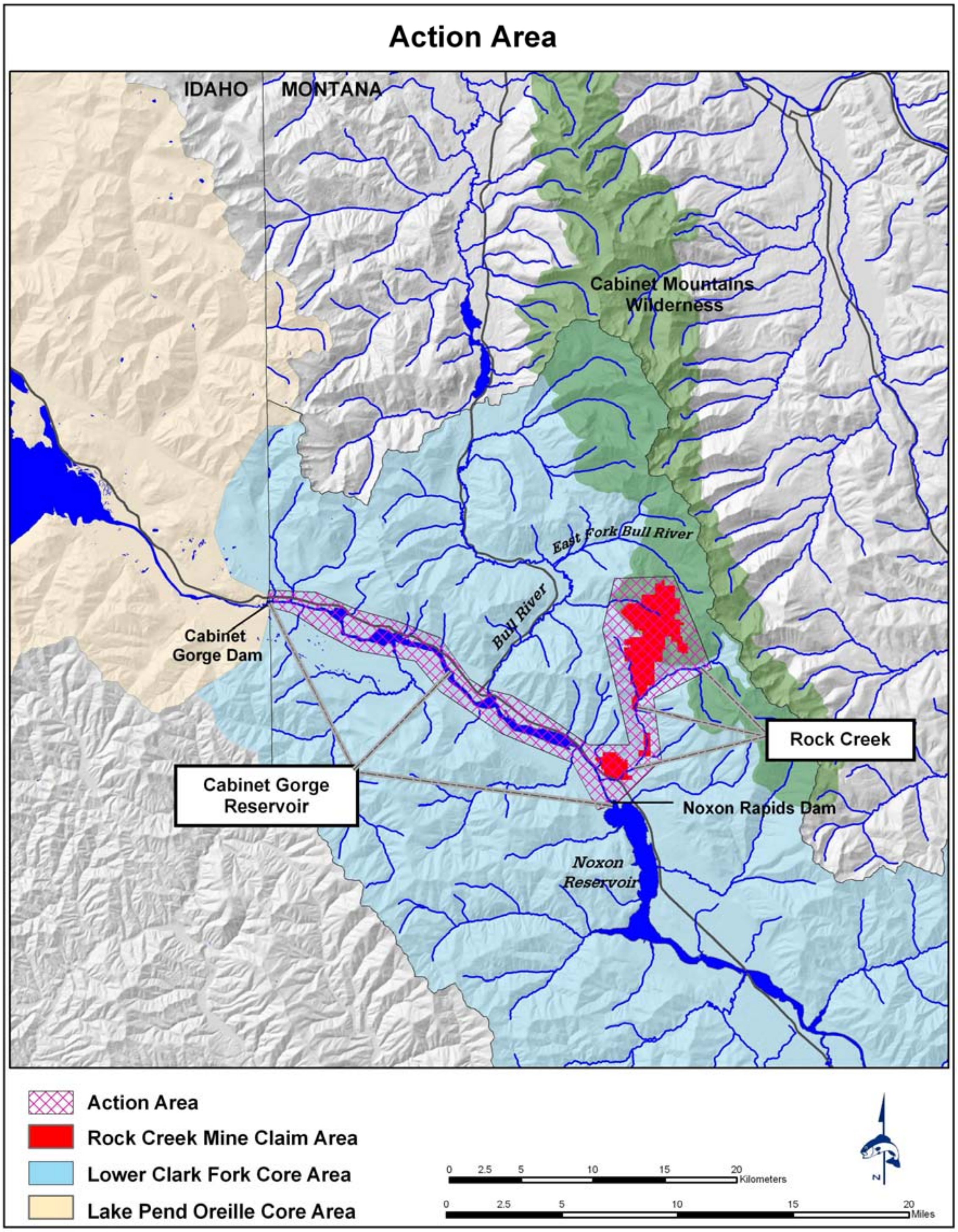
We have relied heavily on the importance of the core area population as described in the current Draft Bull Trout Recovery Plan because core areas are the classification units that relate functionally to the survival and recovery of the bull trout, as described below. The analysis not only focuses on the Lower Clark Fork Core Area population but also on the habitat conditions necessary to support it. The September 26, 2005, Final Rule Designating Critical Habitat for Bull Trout (FR 70, No 185, 56211-56311) provides guidance that indicates when a proposed action is "incompatible with the viability of the affected core area population(s), inclusive of associated habitat conditions, a jeopardy finding is considered to be warranted."

The Clark Fork River Management Unit is amongst the largest and most diverse across the species range and contains the highest number of core areas of any management unit, due in large part to the preponderance of isolated headwater lakes in the system. In the Clark Fork River Management Unit (USDI 2002d), which includes all of the Clark Fork River Basin from Albeni Falls Dam (outlet of Lake Pend Oreille) upstream to Montana headwaters, the Service described 38 core areas for bull trout. However, the recent consolidation of the aforementioned four core areas changes the total number of core areas to 35, three of which are in the Lower Clark Fork

River Basin (see Figure B2). Bull trout within the larger and more diverse core areas are typically characterized by having relatively small amounts of genetic diversity within a local population but high levels of divergence between them (see for example Spruell *et al.* 1999, Kanda and Allendorf 2001, Neraas and Spruell 2001). At the lowest rung in the hierarchical organizational level, the Draft Bull Trout Recovery Plan (USDI 2002c) describes groups of bull trout that spawn together in tributaries as local populations. There are approximately 150 local populations of bull trout currently described in the Clark Fork River Management Unit (USDI 2002d).

The jeopardy analysis in this biological opinion follows the organizational hierarchy depicted in Table B1, which identifies Rock Creek as one of the 14 local populations in the affected core area. The Lower Clark Fork Core Area (see Figure B2) is identified as the only core area potentially affected by the proposed action, and is one of 35 core areas in the Clark Fork River Management Unit. The potential effects of the proposed action are addressed in detail progressively at each higher scale as warranted. Should the detailed analysis of a particular scale result in a finding of no significant adverse effect (i.e., no-jeopardy), no further detailed analysis at the next higher scale is necessary. For the jeopardy analysis in this biological opinion, we evaluated the potential impacts from the proposed action to bull trout and bull trout habitat in the action area (Figure B3) beginning at the lowest level or scale in the hierarchy – East and West Fork Rock Creek. We found that adverse impacts to habitat and bull trout inhabiting these two tributaries are likely to occur. Consequently, we assessed the impacts at the next higher level, which includes all of the Rock Creek watershed (including all tributaries to the mainstem) and the associated Rock Creek local population occupying the mainstem and its tributaries. This assessment suggested that adverse impacts may occur at the watershed scale and have an adverse impact on the local population and its habitat. However, at this level our detailed analysis of impacts showed that the severity of the adverse effect(s) would not make the local population of bull trout highly vulnerable to loss. In addition, existing baseline habitat conditions in the watershed would not be degraded enough to cause significant impairment of essential functions of feeding, breeding, and sheltering for the Rock Creek bull trout population throughout the entire watershed. Habitat impacts were limited in terms of duration and extent - only portions of the watershed would be affected and only certain habitat parameters, primarily sediment deposition in spawning areas, and that impairment of this sediment function would be moderate and confined largely to the 5-year construction period (see Effects of the Action section below). Subsequent to this assessment in the jeopardy analysis, we determined that no further analysis at the core area scale was needed because the risk of loss of the local bull trout population was found to be small. However, we did address why at the core area scale, the impacts from the proposed action are even less consequential than at the local population scale and even less likely to appreciably reduce the likelihood of survival and recovery of bull trout.

Figure B3. Map of the Action Area, Cabinet Gorge Reservoir and major bull trout tributaries – Bull River and Rock Creek. Estimated surface disturbance within the mine claim area is 483 acres.



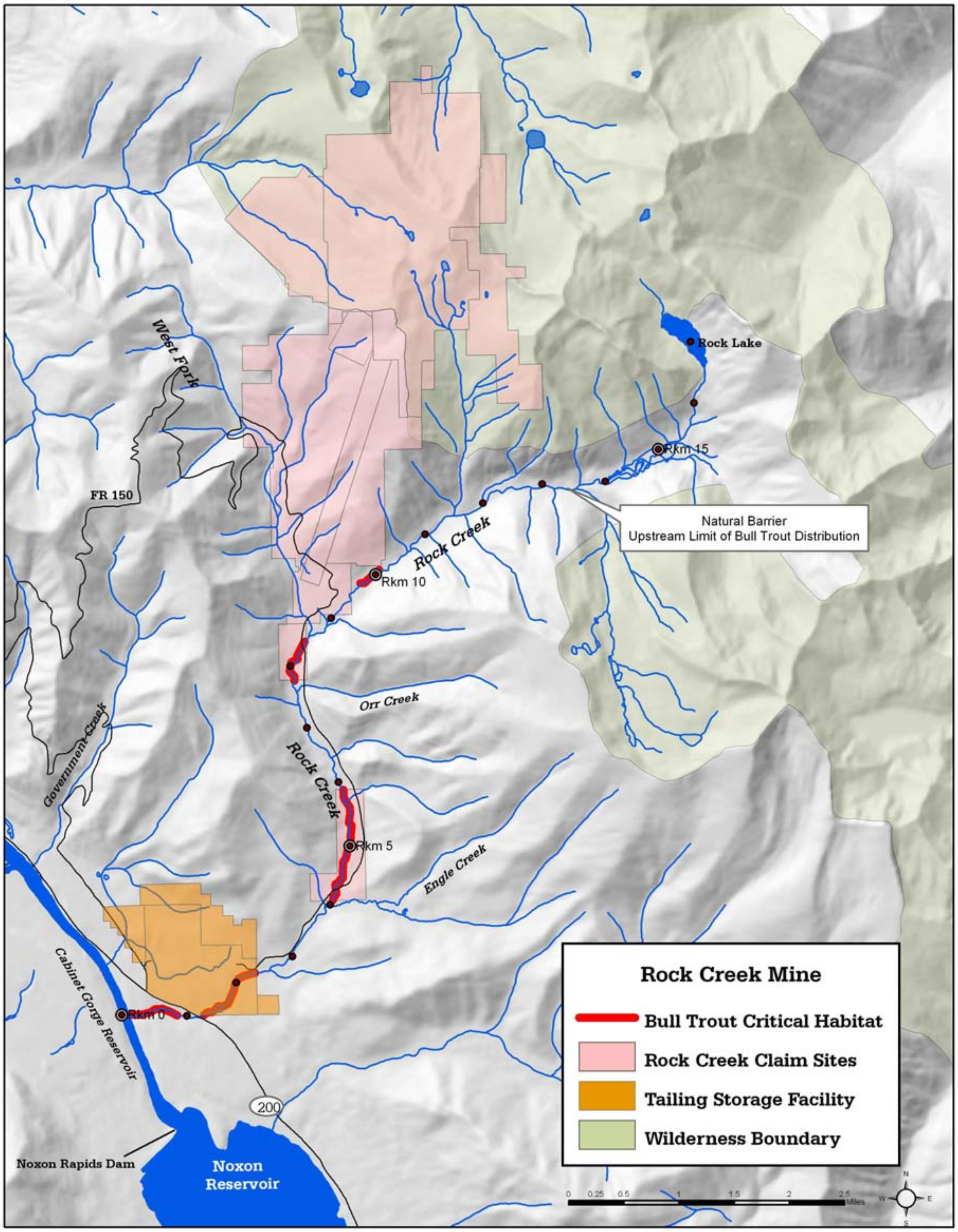
Designated Critical Habitat For Bull Trout

On September 26, 2005, the Service published the final rule designating critical habitat for bull trout for the Klamath River, Columbia River, Jarbridge River, Coastal-Puget Sound, and Saint Mary-Belly River populations of bull trout (FR 70, No 185, 56211-56311). Guidance for analysis of designated critical habitat for bull trout was provided in the final rule and in the Director's December 9, 2004, memorandum, which is in response to litigation on the regulatory standard for determining whether proposed Federal agency actions are likely to result in the "destruction or adverse modification" of designated critical habitat under Section 7(a)(2) of the Act (Appendix E). This memorandum outlines interim measures for conducting Section 7 consultations pending the adoption of any new regulatory definition of "destruction or adverse modification." Consequently, this biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

The key factor related to adverse modification determination of designated critical habitat is whether, with implementation of the proposed Federal action, the affected critical habitat would remain functional (i.e. or retain the current ability for the primary constituent elements to be functionally established) to serve the intended conservation role for the species. In general, conservation of critical habitat units supports a viable core area.

The lower Clark Fork River basin contains 355.28 stream miles and 24,065 acres of lakes/reservoirs designated as critical habitat for bull trout. Within the Lower Clark Fork Core Area there are 135 stream miles of critical habitat and of this total, 2.88 stream miles occur in five specific stream segments of Rock Creek within the action area as indicated in Figure B4. As described in the final rule, critical habitat applies only to the stream channel as defined by its ordinary high-water line according to the U.S. Army Corps of Engineers in 33 CFR 329.11. If not defined, the width of the stream channel based on the bank-full elevation will be used. Critical habitat does not extend into the floodplain or into adjacent land.

Figure B4. Map of Designated Bull Trout Critical Habitat in the Rock Creek Watershed (based on the September 26, 2005, Final Rule). Estimated surface disturbance within the mine claim area is 483 acres.



DESCRIPTION OF THE PROPOSED ACTION

Bull Trout Action Area

The action area for Part B of this biological opinion includes the Rock Creek drainage and all of Cabinet Gorge Reservoir. The Rock Creek drainage would contain all of the proposed mine activity. The Bull River drainage, which is a major tributary to Cabinet Gorge Reservoir, is excluded from the action area because no impacts are anticipated in that drainage as a result of the proposed action. Cabinet Gorge Dam is reasoned to be the downstream extent of the action area as the dam would likely block downstream transport of bedload and sediment produced by the proposed action. In other words, under normal operations, the anticipated biological effects of the proposed action would be limited to those bull trout that inhabit Rock Creek and Cabinet Gorge Reservoir downstream to the dam.

The Draft Bull Trout Recovery Plan for the Clark Fork River Management Unit (USDI 2002c) identifies one bull trout core area (Cabinet Gorge Reservoir) and two local populations (Rock Creek and Bull River) within the action area. Noxon Rapids and Cabinet Gorge dams form the upper and lower bounds, respectively. The action area is considered to be the Cabinet Gorge Reservoir and the Rock Creek drainage, which occur within the recently consolidated Lower Clark Fork Core Area (Appendix D).

Proposed Action

The proposed Rock Creek Mine would be a 10,000-ton per day underground copper and silver mine in northwestern Montana. The mine, mill, and other facilities would occur in Sanders County about 13 miles northeast of the town of Noxon (see Figure B1). The mine originally was proposed by ASARCO Incorporated, but was sold to the Sterling Mining Company in 1999. In October of 2003 the Company changed its name from the Sterling Mining Company to Revett Silver Company, a Montana Company, followed by the incorporation of its wholly owned subsidiary RC Resources, Inc (Revett), also a Montana Company and the new project proponent.

The proposed action is Alternative V, the Forest’s preferred alternative to Revett’s proposed mine plan. The complete description of Alternative V is provided in the FEIS (MDEQ and USDA Forest Service 2001). Here we summarize only major features of the proposed action. The proposed action for the mine includes the development of an evaluation adit, a 5.5- year construction period, a 27.5-year operation/production period, and a 2-year reclamation period, for a total period of approximately 35 years (Table B2).

Table B2. Estimated Annual Implementation Schedule for the Revett Silver Company Rock Creek Mine in Sanders County, Montana.

PROJECT YEAR	ACTIVITY
1 - 3	Evaluation adit construction
2 - 3	Mine development[1]
4 - 5.5	Mine development[1]/surface facilities construction[2]
5.5 - 6	Start-up/limited production
7 - 33	Production
34 - 35	Reclamation

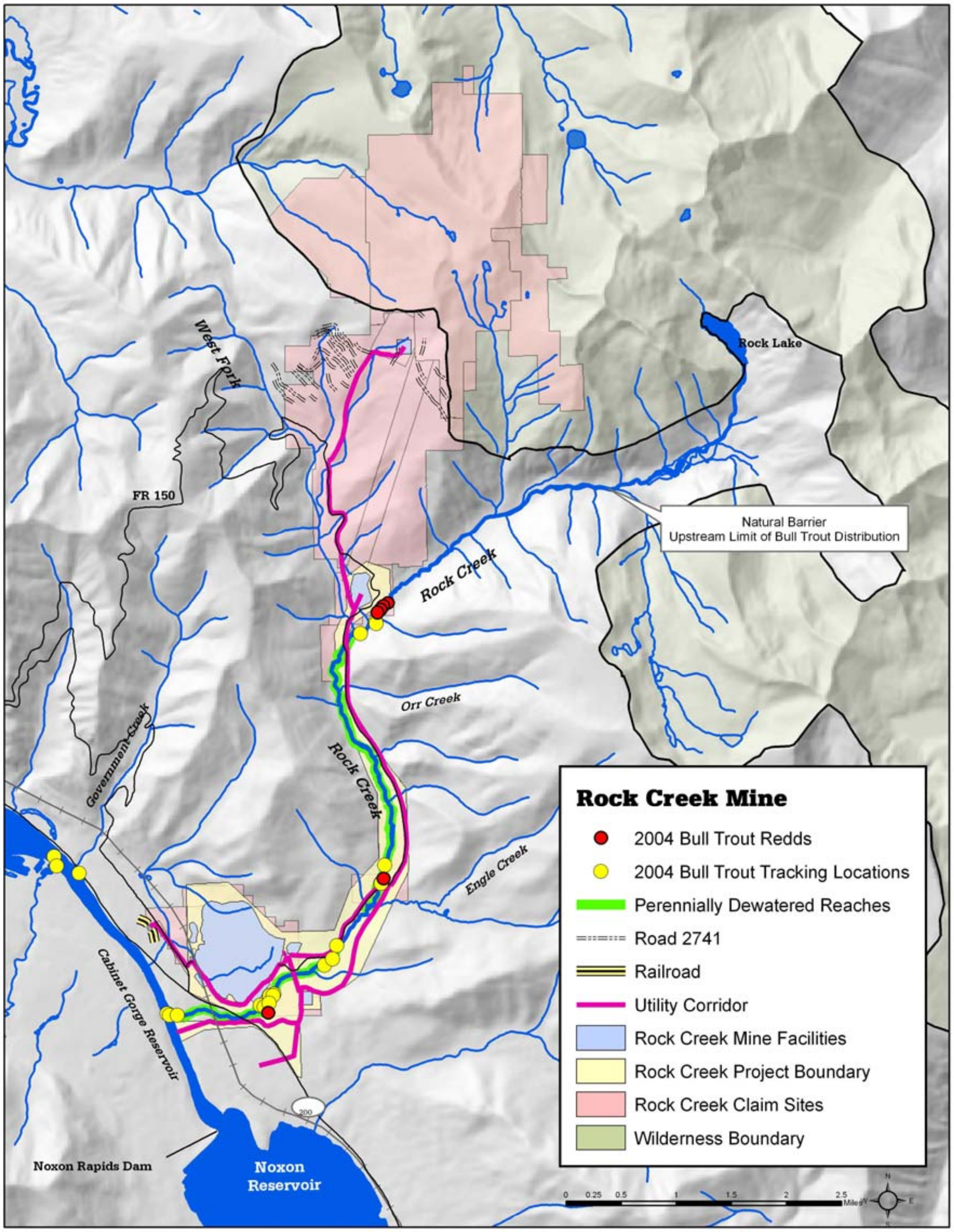
[1] Waste rock will be hauled mid-August through May during mine development period.

[2] Includes construction of the mill site, waste water treatment plant, paste plant, and utilities corridor.

The proposed action would result in construction of an evaluation adit, mine, mill, tailings paste facility, rail loadout, reverse osmosis and passive biotreatment facility, and various pipelines and access roads. A "bottom-up" construction option for the paste facility would be used and final design would incorporate measures to meet visual impact mitigation and reclamation goals. Some mine water would be stored in underground workings during mine operation, but most excess water would be treated and discharged to the Clark Fork River.

Several check points are built into the development of the mine to address specific conditions as they develop. For example, initial exploration involves developing an evaluation adit to further investigate and define the underground ore body. Results of the evaluation adit may result in various scenarios described in Alternative V. For example, should acid-forming rock be located, certain constraints would be required that would not be necessary if no acid-forming rock is encountered. Several similar check points and contingency plans occur throughout the life of the mine and will not be specifically addressed here [see FEIS, Alternative V (MDEQ and USDA 2001)].

Figure B5. Map of the Rock Creek mine facilities, bull trout redds, and radio-tracking locations.



The Rock Creek Mine's proposed permit boundary would encompass approximately 1,560 acres; 483 acres would directly impacted by mining activity and 1,078 would remain undisturbed (Table B3). Land encompassed by the proposed permit boundary is 48 percent private land The analysis area includes approximately 3.54 miles of road construction and 5.43 miles of road reconstruction. Land encompassed by the proposed permit boundary is 48% private land and 52% national forest lands (Table B3). As shown in Figure B3, the project area is located near the southern boundary of the Cabinet-Yaak Ecosystem (CYE), south and west of the Cabinet Mountains Wilderness area. Except for a possible ventilation adit that would disturb about 800 square feet, all ground disturbances would occur outside the wilderness. Of the total 483 acres disturbed, 342 acres (71 percent) are privately owned by Revett and 141 acres (29 percent) are on public lands administered by the Forest. The project area contains existing roads providing public access to the wilderness area and nonwilderness Forest lands for recreation and to areas logged in the past.

Table B3. Proposed Surface Disturbance and Features Associated with Rock Creek Mine Project.

PROJECT FEATURE	AREA IN ACRES
Analysis area	198,394
Hard rock mine permit area	1,561**
Total area of surface disturbance	483
Tailings impoundment	368
Mill site	41
Exploration adit and support facilities	10
Roads	64
Road construction	3.54 miles
Road reconstruction	5.43 miles
Total road construction/reconstruction	8.97 miles

* Estimated surface disturbance includes all the features associated with the tailings impoundment and mill site.

** Corrected permit area acres from MDEQ, December 2000. From Appendix A, Alternative V description.

The initial analysis for the proposed Rock Creek Mine project predicted construction of the mine would commence in 2000. Therefore, the calendar years identified during the analysis no longer correspond with the actual implementation of the project. The life of the mine may be shorter or longer than predicted, depending on the quality, quantity and accessibility of the ore body, market values of the minerals recovered and other factors that cannot be predicted at this time.

STATUS OF THE SPECIES/CRITICAL HABITAT

In response to the Court's concern regarding the consideration of relevant information in the last six years since the listing for updating the current status of the species, we address this matter in this section of the biological opinion. We provide current information on the status of bull trout range-wide and within the Clark Fork River Management Unit, Lower Clark Fork Core Area, and the Rock Creek local population. In addition, we address the Court's determination that the Service "failed to adequately explain" the aggregate effect to the status of the species of issuing over 100 biological opinions range-wide.

Listing History

In September 1985, bull trout in the coterminous United States were designated as a category 2 candidate for listing, in the Annual 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). Bull trout 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 was 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 (see additional discussion of listing history and evolution of terminology in the Introduction and Consultation Background section of this biological opinion). This coterminous listing effectively eliminated the separate DPS designations within the United States. However, the rule states that: "for the purposes of consultation and recovery, we recognize these five distinct population segments as interim recovery units." For the remainder of this analysis, we will refer to the species, and not the DPS, as the listed entity. We will also use the core area and local population structure as the basis for our analysis, and not the original subpopulation terminology, for reasons previously described.

Species Description

Bull trout have an elongated body, somewhat rounded and slightly compressed laterally, and covered with cycloid scales numbering 190-240 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 bone (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, orange, pink, or red spots on the sides. Bull trout fins are often tinged with yellow or orange, while the pelvic, pectoral, and anal fins have white leading margins. Bull trout have no black markings on the dorsal fin and no halos around their spots, which is useful in distinguishing them from brook trout (*S. fontinalis*).

Prior to 1980, bull trout and Dolly Varden (*S. malma* Girard) were considered a single species, the Dolly Varden (*S. malma* Walbaum). In 1980, the American Fisheries Society recognized bull trout (S. confluentus) and Dolly Varden as distinct species (see Cavender 1978). Bull trout are found mostly inland and Dolly Varden are found primarily in coastal drainages. Though separation of the two species based on phenotypic characteristics may be difficult (i.e., similarity of appearance), in recent years results of genetic analysis have supported the distinctiveness of these species.

Current known range in the United States and Canada

Bull trout are found throughout the northwestern United States and in British Columbia and Alberta in western Canada (Rieman and McIntyre 1993; USDI 2002a). Within Montana and Alberta, Canada bull trout also exist in the headwaters of the South Saskatchewan River basin and further north in drainages along the east side of the Continental Divide. 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). In the state of Washington, bull trout are found in coastal drainages of the Olympic Peninsula and in streams surrounding Puget Sound (USDI 2004a). In Montana, bull trout occur in the headwaters of the Columbia River basin in the Clark Fork and the Kootenai subbasins. Within the Clark Fork subbasin of western Montana and northern Idaho, the Draft Bull Trout Recovery Plan describes 38 bull trout core areas (now 35 core areas, memorandum to the ARD, Ecological Services, Region 1, Portland, OR, from Field Supervisor, Montana Ecological Services, Helena, MT., July 14, 2006) and at least 152 local populations (USDI 2002c). Within the Kootenai subbasin, four core areas and ten local populations are described (USDI 2002d).

Life History

Life history forms

Two distinct life-history types, migratory and resident, occur throughout the range of bull trout (Pratt 1992; Rieman and McIntyre 1993). Migratory bull trout live in natal tributaries for several years before moving to larger rivers (fluvial form), lakes (adfluvial form), or the ocean (amphidromous) to mature (USDI 2002b). Migratory forms return to natal tributaries to spawn (USDI 2002b). 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; USDI 2002b). They 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 186 miles (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).

Habitat Requirements

Common predators and competitors of juvenile bull trout are larger bull trout and introduced fish species of the same genus, namely lake trout (Fredenberg 2002a) and brook trout (Pratt and

Huston 1993; Rieman and McIntyre 1993). Other piscivorous species such as brown trout, northern pike, and walleye are also considered potential threats in some core areas (USDI 2002a, 2002b, 2002c and 2005a). Disease is not believed to be a major factor in the long-term health and survival of bull trout populations (USDI 1999), although whirling disease has been detected in wild bull trout (USDI 2005a) and may have unpredictable effects on species complexes.

Hybridization with brook trout poses a threat to the persistence of isolated or remnant populations. These hybrids are likely to be sterile and may experience developmental problems, but could play a role in eliminating local populations of bull trout (Leary et al. 1993; Rieman and McIntyre 1993; USDI 2005a). The degree of hybridization, other interactions, and distribution of the two species is likely influenced by habitat condition (Rieman and McIntyre 1993). Bull trout are rare, if present at all, in many streams supporting large numbers of brook trout (Buckman et al. 1992; Ziller 1992; Rich 1996). Rich (1996) found brook trout occupied more degraded stream reaches than bull trout. Leary et al. (1993) documented a shift in community dominance from bull trout to brook trout in Lolo Creek, Montana, and expected the trend to continue until bull trout are displaced from the stream. Habitat degradation appears to give brook trout a competitive advantage over bull trout in streams where water temperature and/or sediment levels increase.

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: water 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 temperatures and substrate types are especially important to bull trout.

Temperature

Bull trout are relatively 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 59^0 F (15^0 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 50^0 F (10^0 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 upwellings 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 69.6^0 F (20.9^0 C) and peak growth to occur at 55.8^0 F (13.2 ^{0} C). Goetz (1994) reports juvenile bull trout in the Cascade Mountains were not found in water temperatures above 53.6^0 F (12^0 C).

Substrate composition

Bull trout are more strongly oriented to the stream bottom and substrate than most 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; USDI 2002b). Fine sediments fill spaces between the gravel needed by incubating eggs and fry, lowering incubation survival and emergence success (Everest et al. 1987, USDI 2002a). 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 (e.g., 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 over wintering cover (Goetz 1994; Jakober 1995). Sub adults and adults tend to occupy deep pools with boulder-rubble substrate and abundant cover (MBTSG 1998).

Migratory corridors

Migratory bull trout ensure regular interchange of genetic material between local populations within core areas (USDI 2002a), and sometimes facilitate genetic interchange among core areas on an evolutionary time scale (Whitesel et al. 2004), thereby promoting genetic variability. Intact migratory corridors also allow for the potential reestablishment of extirpated local populations (USDI 2002b). 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 tie seasonal foraging, migrating and overwintering habitat (USDI 2002a, 2002b) to spawning and rearing habitat (USDI 2002a, 2002b) for anadromous, adfluvial, and fluvial forms. Such corridors could potentially allow for dispersal of resident forms for recolonization of recovering habitats (Rieman and McIntyre

1993), though evidence indicates that resident fish are naturally less likely to disperse (Nelson et al. 2002). Dam and reservoir construction and operation have altered major portions of migratory bull trout habitat throughout the Columbia River Basin (USDI 2002a, 2002b, 2002c, 2002d, 2005a). 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). In addition, reservoirs sometimes do not contain suitable bull trout habitat during certain portions of the year when temperature or other factors may be limiting (USDI 2002b, 2002c, 2005a).

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 also are 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 also can 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; USDI 2002a). 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; USDI 2002a and 2002b). 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). Large migratory bull trout typically spawn in small streams during low flow periods, the combination making them exceptionally vulnerable to humans and other predators. Jakober (1998) observed bull trout over wintering 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.

Population Dynamics

Population size

Bull trout have 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; USDI 2002b). The Service recognized 121 bull trout core areas; with consolidation of four core areas, this number is now 118 within the coterminous U.S. range (USDI 2002b). Due to the high concentration of isolated lakes in the headwaters a significant portion of those (35) are located in a single subbasin in western Montana and northern Idaho. The ensuing baseline and effects analysis uses the core area and its component local populations as the unit of biological organization (USDI 2002b) to demonstrate the influences of land management activities on population persistence at several scales.

The concept of establishing core areas "that contain bull trout populations with the demographic characteristics needed to ensure their persistence and with the habitat needed to sustain those characteristics" (Rieman and McIntyre 1993) for the purposes of bull trout conservation is reflected in the scientific literature (e.g., Rieman and McIntyre (1993); MBTSG (1998); Morita and Yamamoto (2002); Frissel et al. 1993). Further, quite a bit of specific information on bull trout presence, population status, migratory behavior, spawning behavior, and habitat relationships has been developed since the 1998 listing action (USDI 2002b, Whitesel et al. 2004, USDI 2005a). This scientific literature suggests that core areas do not contribute equally to the regional persistence of bull trout due to the wide differences between local populations that result from the variability of habitat quality and population conditions found in individual watersheds that comprise the core areas. Core areas that have large, stable bull trout populations and high quality habitat are the primary sources for re-colonization if other areas fail and are the mainstay to ensure a high probability of persistence despite deterministic and stochastic threats. In terms of management, it is these “stronghold” core areas where conservation should be emphasized (Rieman and McIntyre 1993). In other core areas, the likelihood of persistence is not as strong and the probability of persistence is less than desired. These core areas may require more intensive management and monitoring to ensure that desirable demographic and habitat characteristics are protected, enhanced, or restored (Rieman and McIntyre 1993). The Lower Clark Fork Core Area falls into this later category of needing intensive management to reach recovery goals as evidenced by the major threat to connectivity caused by dams and the extensive efforts to provide artificial fish passage at all three dams (Thompson Falls, Noxon Rapids, and Cabinet Gorge) in the lower Clark Fork River.

As a result of the availability of new information, as well as a reconsideration of the scientific literature, the Draft Bull Trout Recovery Plan (USDI 2002b) defined core areas and their local populations as the population units more appropriate for the purposes of assessing the current status of bull trout and tracking progress towards recovery.

Public comment on the Draft Bull Trout Recovery Plan for the Klamath River and Columbia River populations (USDI 2002b) was closed on February 27, 2003. Public comment for the Jarbidge and Coastal-Puget Sound populations closed on October 29, 2004. Peer review was also conducted on all of the draft Recovery Plan documents in approximately the same respective time periods. Although suggestions to more accurately identify the delineation of specific local populations and their relationships to identified core areas were received, no issues were raised relative to the general concept of the local population/core area definitions or relationships. There were, however, substantial concerns with the definition of "recovery unit". As a result, the Service's current draft of the recovery plan for all populations of bull trout has substituted the term "management unit" for "recovery unit" (i.e., because "recovery unit" is a unique term relative to Section 7 consultation and listing programs).

The Service recognizes that the existing management units have no consistent biological significance across the range, but they do provide an orderly avenue for management and coordination with other stakeholders. The final resolution of how management units will be described has not been fully completed. Pending completion of the ongoing bull trout five-year review that was initiated in March 2005 and decisions forthcoming from that process, additional resolution of the recovery unit structure is anticipated. Regardless, we do not anticipate that the basic structure of major genetic groupings, core areas and local populations will be modified, except in response to new biological information that causes refinement within individual core areas, such as the recent consolidation of four core areas in the lower Clark Fork River (memorandum to the ARD, Ecological Services, Region 1, Portland, OR, from Field Supervisor, Montana Ecological Services, Helena, MT., July 14, 2006). As previously mentioned, Region 1 of the Service (lead Region for bull trout), supported the decision to consolidate the four core areas (email from Patrick Sousa, Program Manager, Endangered Species, Region 1, Portland, Oregon to Mike Stempel, ARD, Ecological Services, Region 6, Denver, Colorado; dated 8/23/06).

To evaluate the current status of bull trout distribution and abundance for the five-year review, the Service analyzed the most recent information on bull trout relative to core areas and local populations (USDI 2005a).

Some core areas are considered at inherently higher risk of extirpation from naturally occurring or human-caused events, especially where the core areas are:

1. Unlikely to be reestablished by individuals from another core area (i.e., functionally or geographically isolated from other core areas);

2. Limited to a single spawning area (i.e., spatially restricted); and either

3. Characterized by low individual or spawning numbers; or

4. Primarily of a single life-history form.

For example, a core area that is isolated in a small watershed upstream of an impassable waterfall (e.g., several of those found in Glacier National Park) would be considered at elevated risk of extirpation from naturally occurring events, especially if the core area had low numbers of fish that spawn in a restricted area. In such cases, an event such as a fire or flood affecting the spawning area could eliminate bull trout from the core area, and the impassable waterfall would prevent reestablishment from fish downstream. However, a core area residing downstream of the waterfall might not be considered at the same level of risk of extirpation from naturally occurring events because there would be potential for immigration of fish from adjacent core areas either upstream or downstream.

In the process of reviewing information relative to the bull trout listing process, the status of core areas (previously called subpopulations in the listing process) 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. In the listing, the Service considered a "core area" (i.e., subpopulation) "strong" if 5,000 individuals or 500 spawners likely occurred in the subpopulation, abundance appeared stable or increasing, and life-history forms were likely to persist. The Service considered a subpopulation "depressed" if less than 5,000 individuals or 500 spawners likely occurred in the subpopulation, abundance appeared to be declining, or a life-history form historically present had been lost. The complete review of this evaluation is found in a status summary compiled by the Service (USDI 1998c).

Based on abundance, trends in abundance, and the presence of life-history forms, bull trout were considered strong in 13% 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% 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; USDI 2002b and 2002c; Fredenberg 2002a).

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 (a covered gravel nest constructed by adult spawning bull trout where eggs are deposited) 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, USDI 2002b, USDI 2005a). Habitat preferences or selection is likely important (Rieman and McIntyre 1995; Dambacher and Jones 1997; Baxter and Hauer 2000), but more stochastic extirpation and colonization processes may influence distribution even within suitable habitats (Rieman and McIntyre 1995).

Population stability

The best available information indicates that bull trout are in widespread decline across their historic range (USDI 1998b) and are characterized by numerous, often reproductively isolated core areas in the Columbia River basin with evidence of recent local extirpations (Rieman et al.

1997; USDI 2002b). The largest contiguous areas supporting bull trout are in central Idaho and western Montana. Many bull trout core areas are characterized by declining trends, but a few are increasing and in most the status is unknown (USDI 2005a).

The viability of functioning core areas for bull trout depend on the habitat quality and population characteristics of the multiple local populations that comprise the core area. Rieman and McIntyre (1993) reported that the extinction rate of small local populations was high when testing hypothetical populations during a 30 year timeframe and increased fivefold when migrating bull trout were restricted to low numbers. It appeared the more isolated and independent the local population, the higher the risk of extinction. In contrast, even with moderate amounts of immigration (i.e., connectivity) to the local population, the risk of extinction was one-fourth as high in these connected environments. Some populations will be stable and more robust than and may act as "sources" while other less stable and less robust populations may act as "sinks." Further, these roles may switch at different times (Rieman and McIntyre 1993).

Some local populations will persist in habitat conditions that are less than optimal. In these cases, Rieman and McIntyre (1993) propose that managers create core areas so that any seriously degraded local population could be re-colonized from other core areas (i.e., opportunities should exist within larger river basins that allow some natural connection whenever possible). The Lower Clark Fork Core Area is such a case, where recolonization is highly possible from the healthy bull trout population in the Lake Pend Oreille Core Area as a result of re-establishing connectivity by artificial fish passage pass the dams in the lower Clark Fork River.

What is evident is that the stability of a rangewide population of bull trout depends on the maintenance of protecting those habitats in the best condition with the strongest populations. Fragmentation and disruption of bull trout habitat will increasingly isolate local populations and life history forms, thus reducing survival, growth, and resilience of individual local populations. As long as there are multiple, robust local populations to support several widely distributed healthy functioning core areas within the range of bull trout, the higher the likehood bull trout will be able to survive catastrophic events, normal environmental variation, and the effects of human activities (Rieman and McIntyre 1993), including fragmentation and disruption.

Population structure

Whitesel et al. (2004) noted that although there are multiple resources that contribute to the subject, Spruell et al. (2003) best summarized genetic information on bull trout population structure. Spruell et al. (2003) analyzed 1,847 bull trout from 65 sampling locations, four located in three coastal drainages (Klamath, Queets, and Skagit Rivers), one in the Saskatchewan River drainage (Belly River), and 60 scattered throughout the Columbia River Basin. They concluded that there is a consistent pattern among genetic studies of bull trout, regardless of whether examining allozymes, mitochondrial DNA, or most recently microsatellite loci. Typically, the genetic pattern shows relatively little genetic variation within populations, but substantial divergence between populations. Microsatellite loci analysis supports the existence of at least three major genetically differentiated groups (or lineages) of bull trout (Spruell et al. 2003).

They were characterized as:

- "Coastal", including the Deschutes River and all of the Columbia River drainage downstream, as well as most coastal streams in Washington, Oregon, and British Columbia. A compelling case also exists that the Klamath Basin represents a unique evolutionary lineage within the coastal group.

- "Snake River", which also included the John Day, Umatilla, and Walla Walla Rivers. Despite close proximity of the John Day and Deschutes Rivers, a striking level of divergence between bull trout in these two systems was observed.

- "Upper Columbia River" which includes the entire basin in Montana and northern Idaho. A tentative assignment was made by Spruell et al. (2003) of the Saskatchewan River drainage populations (east of the continental divide), grouping them with the upper Columbia River group.

Spruell et al. (2003) noted that within the major assemblages, populations were further subdivided, primarily at the level of major river basins. Taylor et al. (1999) surveyed bull trout populations, primarily from Canada, and found a major divergence between inland and coastal populations. Costello et al. (2003) suggested the patterns reflected the existence of two glacial refugia, consistent with the conclusions of Spruell and the biogeographic analysis of Haas and McPhail (2001). Both Taylor et al. (1999) and Spruell et al. (2003) concluded that the Deschutes River represented the most upstream limit of the coastal lineage in the Columbia River Basin.

Status And Distribution

<u>Historic and current distribution</u>

The historic range of bull trout was restricted to North America (Cavender 1978; Haas and McPhail 1991). Bull trout were historically recorded from the McCloud River in northern California, the Klamath River basin in Oregon and throughout the Columbia River basin in much of interior Oregon, Washington, Idaho, northern Nevada, and western Montana. They also occurred in coastal and interior Canada in much of British Columbia, with populations extending along the east slopes of the Rockies in Alberta and including a small area in northern Montana (Rieman et al. 1997).

Bull trout distribution has probably contracted and expanded periodically with natural climate change (Williams et al. 1997). Genetic variation (presence of unique alleles) suggests an extended and evolutionarily important isolation between populations in the Klamath basin 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 at least two common glacial refugias in recent geologic time (Williams et al. 1997; Haas and McPhail 2001; Whitesel et al. 2004).

Despite bull trout 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% and unknown or unclassified in 28% of the subwatersheds within the potential historic range. Strong populations were estimated to occur in only 6% of the potential historic range (Rieman et al. 1997). Bull trout are now extirpated in California and only remnant populations are found in portions of Oregon (Ratliff and Howell 1992). A small population still exists in the headwaters of the Jarbidge River, Nevada, which represents the present southern limit of the species' range.

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 occupancy by bull trout. While temperatures are probably suitable throughout much of the northern and mountainous portions 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).

Status of bull trout in the Columbia River Basin

Range-wide, local populations of bull trout within their respective core areas are often isolated and remnant. Migratory life histories have been lost or limited throughout major portions of the range (Ratliff and Howell 1992; Pratt and Huston 1993; Rieman and McIntyre 1993, 1995; Goetz 1994; Jakober 1995; MBTSG 1998; USDI 2002b; USDI 2005a) and fluvial bull trout populations in portions of the upper Columbia River basin appear to be nearly extirpated (USDI 2002b, 2005a).

At this time, the Service recognizes 118 bull trout core areas range-wide in Idaho, Montana, Oregon, Nevada and Washington (USDI 2002b). This represents a partial consolidation of some of the 188 subpopulations originally described in the various bull trout listing documents (USDI 1999), and is based on the use of more consistent and updated terminology as well as specific information regarding connectivity and consolidation between some populations previously considered autonomous. For example, radio telemetry information from some recent studies has been particularly useful in further describing the movements of bull trout. Core areas were previously defined as approximating interacting biological units for bull trout. Hence, as more information is obtained and recovery proceeds, we would anticipate the number of core areas and the boundaries that describe them will continue to be somewhat fluid.

Within the Columbia River basin, a total of 95 core areas are described (USDI 2002b). Generally, where status is known and population data exists, bull trout populations throughout the Columbia River basin are at best stable and more often declining (Thomas 1992; Schill 1992; Pratt and Huston 1993; USDI 2005a). In the Lower Clark Fork Core Area, the status and trend is still largely unknown, but ongoing monitoring of local populations may help determine the status as more information becomes available in the next few years. Bull trout in the Columbia basin have been estimated to occupy about 45% of their historic range (Quigley and Arbelbide 1997). Many of the bull trout core areas occur as isolated watersheds in headwater tributaries, or in tributaries where the migratory corridors have been lost or restricted. Few bull trout core areas are considered strong in terms of relative abundance and core area stability (USDI 1998c; USDI 2005a). Strong core areas are generally associated with large areas of contiguous habitat.

Aggregate effects of previous range-wide section 7 consultations

In response to the Court's concern about the Service's alleged disregard of the aggregate effects on bull trout throughout the Columbia River basin from over 100 biological opinions (completed from 1998-2001) on Federal actions that may adversely affect bull trout, we offer the following.

In this section we explain why all biological opinions do not result in permanent adverse effects to the species. In fact, many are intended to allow some short-term adverse effects in order to achieve a permanent benefit that supports recovery of the species. Consequently, all adverse effects are not additive, and therefore, the species is not subject to "death by a thousand pinpricks" because many of these individual projects are explicitly recovery activities for bull trout, or at worst de minimis effects because of the small scale or very short duration of the action. Further, we discuss the requirement that a section 7 consultation must consider previous biological opinions in determining the environmental baseline conditions of an affected population of bull trout. Also, we note that each biological opinion should have mandatory requirements to reduce impacts if the federal action is anticipated to result in incidental take. We clarify the analyses and information used to support our determination that the addition of the proposed Rock Creek mine would not have an appreciable effect on survival and recovery of the species range-wide. The significant sources of information that we have utilized to arrive at this determination include, but are not limited to the following: 1) Analysis of Actions that have Undergone Section 7 Consultations; 2) Five-year status review (April 2005)(including core area assessments); 3) Draft Recovery Plan for Bull Trout; 4) Science team report – Bull Trout Recovery Planning: A review of the science associated with population structure and size (Whitesel et al. 2004); and 5) relevant technical reports prepared by Avista regarding the local Rock Creek bull trout population. Finally, we explain the Service's ongoing efforts to develop a data based mechanism designed to track effects of authorized incidental take.

The Service conducted a rigorous analysis of the effects of projects that have been analyzed through section 7 consultations in biological opinions on bull trout from the time of listing until August 2003 (137 total)(Appendix B). Also, we examined all the additional biological opinions (total 30) that have been issued in the Clark Fork River Management Unit since August 2003 through July 2006 (Appendix F). This brings the total number of biological opinions issued in the Clark Fork River Management Unit in Montana since the time of listing to 67. Of the 67 biological opinions issued in the Clark Fork River Management Unit, 14 biological opinions were issued within the Lower Clark Fork Core Area. The result of examining all the biological opinions issued within the Lower Clark Fork Core Area and the Clark Fork River Management Unit (i.e., recovery unit) since the time of listing is central to objectively characterizing and evaluating the effects of previous biological opinions range-wide. The analysis of biological opinions issued within the affected core area is especially noteworthy because the analysis of effects of a proposed Federal action on the core area population is the first indication of whether a proposed action may jeopardize bull trout. The next level to evaluate a jeopardy determination is the management unit.

Other relevant information to characterize the overall status of the species range-wide is the five-year status review on bull trout, which considered all available population information over the entire range of the species in order to determine whether the status of the species has changed, including whether it should continue to be federally listed under the ACT. The five-year status review conducted from February 2005 through April 2005 was an intensive evaluation conducted individually at the core area population level as well as comprehensively at the scale of the listed entity. We relied on this information as well to help support our finding that previous opinions were not adding to a perceived downfall of the bull trout range-wide.

<u>Consulted-on effects analysis of previous biological opinions issued range-wide from the time of listing to August 2003</u>

To assess the effects of previous actions/projects on bull trout for this biological opinion the Service reviewed all of the biological opinions received by the Service from the time of listing in June 1998 until August 2003; this summed to 137 biological opinions (USDI 2003)(Appendix B contains this analysis). Of these, 124 biological opinions (91%) applied to activities affecting bull trout in the Columbia River population, 12 biological opinions (9%) applied to activities affecting bull trout in the Coastal-Puget Sound population, 7 biological opinions (5%) applied to activities affecting bull trout in the Klamath River population, and 1 biological opinion (<1%) applied to activities affecting the Jarbidge and St. Mary Belly populations (Note: these percentages do not add to 100, because several biological opinions applied to more than one population). The geographic scale of these consultations varied from individual actions (e.g., construction of a bridge or pipeline) within one basin to multiple-project actions occurring across several basins.

The 137 actions were categorized into 24 different activity types (e.g., grazing, road maintenance, habitat restoration, timber sales, hydropower, etc…). Twenty actions involved multiple projects, including some of which are restorative actions for bull trout. Within each river basin, the number of actions, type of actions, and a brief description of the action was provided. Furthermore, each individual action was identified as to the cause of the effect and the anticipated effect on a spawning stream and/or migratory corridor if known (in most cases this effect was known). An attempt was made to further define the anticipated effect by duration (e.g., "short-term effects" varied from hours to several months) and a determination was made, when possible, to identify those projects with long-term benefits. Actions whose effects were "unquantifiable" numbered 55 in migratory corridors and 55 in spawning streams.

An example of the above analysis summarized here and presented in more detail in the report (Appendix B) is the evaluation of the Clark Fork River basin from the time of listing to August 2003, which includes the affected core area (Lower Clark Fork Core Area) of the Rock Creek mine project. Of the 37 actions in this river basin during this period, the majority (35) involved habitat disturbance with unquantifiable effects. Sixteen actions are ongoing and 21 actions have been completed and effects are no longer occurring. Hydropower actions had unquantifiable effects, but likely cause entrainment and possible detrimental effects; however, it is known that bull trout do get entrained in the Avista projects and survive to later return to the dams. Research and management actions can have detrimental effects to bull trout at times, but these effects are anticipated to be low in magnitude and ultimately result in long-term benefits to the population. Six resource and land management plans were anticipated to have largely short-term degradation effects from sediment increases associated with 280 miles of stream reach. The single water diversion project identified probably entrains fish, but whether it would impact bull trout was unquantifiable. Below, under "Biological Opinions with Beneficial Actions and Unquantifiable Effects," we explain why so many actions that may affect bull trout result in unquantifiable effects.

Consulted-on effects analysis of all previous biological opinions issued in the Clark Fork River Management Unit and Lower Clark Fork Core Area from listing to July 2006

The total number of biological opinions issued for the Clark Fork River Management Unit since listing to July 2006 is 67 (37 from listing to August 2003 and 30 from August 2003 to July 2006). Thirty-nine indicated that long-term benefits for bull trout were anticipated and 28 showed no benefits (see Appendix F). Fourteen (21.5 percent) of the 67 biological opinions were issued for the Lower Clark Fork Core Area during this period and 11 showed long-term benefits to bull trout while three were not beneficial. None of the 14 biological opinions were for activities found to adversely affect the local population of bull trout in Rock Creek. As clarified below, the analysis of the 67 biological opinions revealed some actions are ongoing (e.g., forest management), some re-occur each year on a seasonal basis (e.g., recreational suction dredging in July-August), which is about 10-15 days each summer; others occur all season long (90 days or more)(e.g., on-going research such as weir trapping, electro-fishing, radio-tagging); others are continuous for several consecutive years (e.g., Milltown dam removal), and some actions have been completed (e.g., Essex bridge replacement). Of the total 67 Federal actions that have occurred in the Clark Fork River Management Unit since listing, 23 actions have been completed and their effects are no longer occurring. Forty-four actions are ongoing and effects of the action may be presently occurring (e.g., cattle grazing), or effects are indeterminate because minimization measures have not yet been employed (e.g., fish screens being designed but not yet installed in an irrigation diversion). Thirty-eight actions were identified as having long-term beneficial effects such as dam removal, streambank stabilization, and habitat restoration.

Of the 14 biological opinions issued for the Lower Clark Fork Core Area since listing, 11or 79.1 percent, were expected to have long-term benefits mainly through improvements from road decommissioning, culvert removals, streambank stabilization, improved fish passage, increased water quality, and riparian vegetation restoration. For example, under the Avista program, in the Lower Clark Fork Core Area 27 habitat restoration projects have been completed from 1999-2004 and three are currently in progress (2005 to present). The Forest Service's White Pine Creek Project, a 10-year activity (2002-2012) involves primarily timber management, but in conjunction with 32 miles of road decommissioning, 12 culvert removals, and potentially approximately 8.5 miles of fisheries habitat improvement on White Pine Creek. The Plum Creek Native Fish Habitat Conservation Plan, a 30-year agreement on private timberland, includes five miles of riparian vegetation restoration in the Thompson River and ongoing planning for fisheries habitat improvement activities in lower Fishtrap Creek. The ongoing Jocko River watershed restoration project is a Confederated Salish and Kootenai Tribe comprehensive phased-action plan that involves habitat acquisition and restorative actions over a 20 year period and currently has completed over 2,000 acres of riparian habitat acquisition and 13.5 miles of stream restoration and protection. These are three examples of the 11 projects in the Lower Clark Fork Core Area that required biological opinions because of the effects to bull trout and, in general, provide mitigation which results in long-term benefits to the species primarily through improved habitat conditions.

As stated in the previous subsection, the 137 biological opinions issued rangewide were considered in the most recent technical and status information, taking into account all of the previously issued biological opinions to update baseline conditions for bull trout. Updating environmental baselines based on previously proposed actions and associated incidental take is a requirement in preparing a biological opinion (see the Service's Consultation Handbook, pg 4-1 and pg 4-22, March 1998), and as previously mentioned, routinely done when a federal agency is preparing a biological assessment. The Service regularly checks to make sure the environmental baseline is updated when preparing a biological opinion. The Service has provided this guidance to federal land management agencies (Forest Service and Bureau of Land Management in particular because of the extensive area over which these agencies have jurisdiction within the range of bull trout) to help document baseline conditions and effects of actions when assessing the affects of their activities on bull trout (*A Framework to Assist in Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale)*(Framework)(USDI 1998)(Appendix G). It is clearly required in the Framework that these agencies use when preparing biological assessments. Nevertheless, when assessing potential impacts at the local population scale the Framework impact assessment approach evaluates 19 specific habitat parameters and four population parameters for bull trout. Quite often, the determination of risk to each of these parameters from a proposed action rests on the professional judgment of the action agency's project fish biologist because technical site data is generally lacking for most bull trout. However, the Service should agree with the action agency on baseline conditions as part of the section 7 consultation process prior to this information being used in a biological opinion.

As expected, each biological opinion had incorporated mandatory terms and conditions to reduce the impact of any anticipated incidental take. Terms and conditions were designed to minimize impacts from the effects of the anticipated incidental take and were binding on the action agency. Even though incidental take was anticipated in all these opinions, the Service reasonably concluded that the viability of a core area population (or subpopulation) would not be significantly affected by the level of anticipated take, and that the terms and conditions issued to reduce the anticipated incidental take would adequately lessen the potential to affect the core area population.

In summary, the Service's analyses of biological opinions (range-wide assessment from listing to August 2003 and the analysis of biological opinions in the Clark Fork River Management Unit from August 2003 to July 2006) showed that we consulted on a wide array of actions, which had varying level of effects with various timeframes for completion, or that continue to be ongoing either seasonally or continuously at some level throughout the entire year. Even when accounting for previous actions that have been subject to consultation, the analyses revealed that no actions that have undergone consultation were found to appreciably reduce the likelihood of survival and recovery of the bull trout in any core area, including the Lower Clark Fork Core Area, or result in the loss of any subpopulations (USDI 2003)(Appendix A and F).

At the time of preparing this Rock Creek biological opinion we are not aware of any existing biological opinion within the range of bull trout with other than a no-jeopardy determination. As a consequence, we conclude that these actions do not adversely affect any bull trout populations to the extent of loss of a core area. Our recent review of the range-wide assessment from listing to August 2003 and the analysis from the Clark Fork River Management Unit biological opinions from August 2003 to July 2006 have demonstrated that the conclusions reached in the May 9, 2003, biological opinion were correct and should be used as a basis for this analysis in this biological opinion.

Biological opinions with beneficial actions and unquantifiable effects

Some biological opinions are prepared for projects that result in significant potential gains for bull trout. However, usually these projects have a short-term or temporary harmful effect on existing habitat conditions during construction, and therefore, require formal consultation to address the temporary change in habitat conditions. In many of these cases there could be permanent substantial benefits to the species and that result in restoring habitat to historical level or near-historical conditions. A typical example would be the removal of a culvert that has blocked fish from several miles of historic spawning and rearing habitat. During the removal of the culvert from the streambed, the sediment produced in the stream channel travels downstream a certain distance depending on the amount of sediment delivered and site conditions. These conditions may temporarily impede feeding behavior or displace bull trout immediately in the affected downstream reaches. Because there is much scientific evidence that total sediment and suspended sediment can have negative impacts to fish and fish habitat, we can anticipate some adverse effect. However, it is much more difficult to determine the extent or to quantify this effect because it depends on many interacting site variables. To name a few: 1) presence of fish and particular life stage [(eggs, juveniles, subadults, adults (migratory or resident)]; 2) proximity, type, and habitat quality downstream (spawning and/or rearing habitat); 3) amount and type of fill being removed (shallow fill or deep fill; coarse or fine materials); 4) stream gradient and channel type; 5) erodibility of the fill and associated native soils; 6) steepness of the hillslope or incised stream channel; 7) effectiveness of sediment abatement measures; 8) duration and timing of the construction; 9) size and type of the culvert removed; 10) weather conditions; and 11) professional experience of the contractor conducting the work. The risk of a minimal amount of incidental take is high enough to warrant an incidental take statement in a biological opinion and to ensure that measures will be in place to reduce the amount of sediment potentially delivered to the stream. Clearly however, the substantial gains for the species far outweigh the relatively minor and temporary harmful effect to the species or its habitat.

An example of a beneficial project is the Jocko River restoration project (programmatic biological opinion issued in 1998, revised in 1999), which is a long-term phased project that has resulted in 13.5 miles of stream channel restoration for bull trout, more than 2,000 acres of riparian and upland habitat acquisition, and greater than 30 miles of road upgrades and decommissioning. Similarly, since the listing of bull trout, Montana Fish, Wildlife, and Parks (MFWP) has conducted numerous projects through their department's management and monitoring activities that have benefited bull trout through activities conducted under section 6 of the Act. The effects to bull trout from these annual activities are addressed in a programmatic biological opinion (revised section 7 programmatic consultation on issuance of section 10(a)(1)(A) scientific take permits and section 6(c)(1) exemption from take for bull trout, *Salvelinus confluentus*, June 29, 1999). The activities addressed are actions like habitat restoration and enhancement, population surveys, capture and handling, tagging and marking, tissue sampling (genetic and disease research), outreach and education, and other activities necessary to conduct various ecological studies aimed at the recovery and conservation of bull trout. For example, in one year (2003) MFWP completed 49 habitat improvement projects, 92 electrofishing projects,72 redd surveys, seven trapping and tagging activities, and four telemetry studies to benefit the conservation and recovery of bull trout (MFWP letter to the Service on the State's Bull Trout Assessment, 1/3/2005). The vast majority of these actions occur in the Clark Fork River Management Unit. A list of these annual section 6 activities is on file with the Service.

Under section 6 of the Act (and its associated conservation plan and programmatic biological opinion), the Service has closely cooperated with MFWP to monitor and evaluate three populations of bull trout (Swan Lake, Hungry Horse, and Lake Kookanusa) where state regulations allow a restricted recreational fishery in western Montana. At present, the bull trout populations in these subbasins are strong enough to support a limited angler harvest. Western Montana is currently the only region within the entire range of bull trout that can support three recreational fisheries on bull trout, two of which occur within the Clark Fork Management Unit.

Biological opinions on adverse actions with mitigation having beneficial actions

As previously mentioned, within the Lower Clark Fork Core Area there were 14 biological opinions issued since bull trout were listed. Eleven federal actions have mitigation activities that provide some degree of offsetting beneficial actions. Many of the mitigation activities have already been completed since the biological opinion for a specific federal action was issued. For example, the biological opinion for the re-licensing of the Avista hydroelectric dams, issued in 1999, addresses habitat restoration projects that are proposed and funded annually throughout the 45-year license period. From 1999-2004, 27 fish restoration habitat projects have been completed and their short-term adverse impacts have past while fish benefits from habitat improvements are accruing. Three habitat restoration projects are currently ongoing. Under the Avista program each year new habitat restoration projects are proposed and are implemented as funding allows. As a result of the completed habitat restoration under the Avista program, at minimum, 2.4 stream miles have been restored in 14 different watersheds, and conservatively, 8.5 miles of additional stream have been opened to fish migration through culvert removals, and greater than 2,000 riparian trees and shrubs have been planted for revegetation and bank stabilization along several important bull trout streams

Another example is the 30-year native fish habitat conservation plan (NFHCP) agreement with the largest private landowner in western Montana (biological opinion issued in 2000). As a commitment in this agreement, Plum Creek Timber Company is undergoing an intensive multi-year effort to restore native riparian vegetation along five miles of an important bull trout stream habitat in the core area, the Thompson River. The relative success of the various riparian planting treatments is intended to guide restoration projects in the streams and rivers within the 1.4 million acre NFHCP area. The actual improvement to the species from all the completed habitat restoration projects are not yet quantified, but it is expected that redd counts and electro-fishing surveys will document the likely increase in bull trout use of these sites.

In summary, the analysis of the 11 bull trout biological opinions that occurred in the Lower Clark Fork Core Area, revealed a total of 30 habitat restoration projects that were completed and that resulted in 10 miles of improved habitat conditions for bull trout.

Stream channel restoration, streambank stabilization, installation of fish passage/fish screens, and research projects are other examples of federal actions with biological opinions where potential gains to the species are significant, but require formal consultation. Intuitively, a bull trout present in the affected stream reach could be temporarily subjected to a minor harmful effect, but the long-term benefits of permanently improved habitat conditions is likely to increase its survival significantly, thus outweighing the short-term risk. Some would argue there may not be a harmful effect at all because these fish have adapted and evolved intrinsic mechanisms to deal with naturally occurring small events of sediment-laden water and that it is *excessive* sediment generated as anthropogenic waste that often damages biological components of a stream (Waters 1995). Most often it is difficult to know positively whether an adverse effect will occur, and therefore it becomes somewhat subjective to determine the risk of take and the associated effect to the species or its habitat. For projects where risk of incidental take is uncertain, but would clearly result in benefits to a species, the Service errs on the side of the species (U.S. Fish and Wildlife Service 2004; see Box 3, providing the benefit of the doubt to listed resources).

Five-year status review

In 2005, the Service assessed the conservation status of bull trout and the vulnerability for each of 121 bull trout core areas (now 118 core areas)(USDI 2005b). We reviewed the Bull Trout Core Area Conservation Assessment (Appendix H) and concluded that that the original threats to bull trout still existed for the most part in all core areas, but no substantial new and widespread threats were discovered during this review or in the review of previous biological opinions on bull trout. This finding indicates the baseline conditions overall range-wide had not changed substantially in the last five years and that the trend and magnitude of the range-wide population had not worsened nor did it improve measurably.

The risk assessment or ranking portion of the status review was modeled (see Appendix H) to assess the relative status of each of the 121 core areas. The model used to rank the relative risk to bull trout was based on the Natural Heritage Programs' NatureServe Conservation Status Assessment Criteria, which had been applied in previous assessments of fish status, including bull trout (Master *et al.* 2003; MNHP 2004). The model integrated four factors: population abundance, distribution, population trend, and threats. For a complete understanding of the ranking process, a more thorough review of the report which describes the model and the output (USDI 2005b) is required (Appendix H). Results of the 2005 Status Assessment indicated that each of the four core areas in the Lower Clark Fork, because they existed in isolation from one another by Cabinet Gorge, Noxon, and Thompson Falls dams (i.e, Lower Flathead River, Clark

Fork River Section 3, Noxon Reservoir, and Cabinet Gorge Reservoir) were considered to be at "High Risk" of extirpation.

Following consolidation of the four fragmented core areas into a single Lower Clark Fork Core Area (see Figure B2), as described elsewhere in this biological opinion (see previous section and Appendix D), we then applied the same Nature Serve model. The score for the combined Lower Clark Fork Core Area resulted in an "At Risk" ranking, which is one step reduced from the "High Risk" rankings of the status the core areas achieved under the previously fragmented condition. The action of rejoining the core areas through restored connectivity of bull trout migratory corridors, as called for in the Draft Bull Trout Recovery Plan, demonstrated an incremental improvement to the vulnerability status for the Lower Clark Fork Core Area. Full and complete connectivity over all three dams remains the longer term objective.

Development of range-wide tracking system of effects of consulted-on activities

As previously mentioned, the Service recognizes the importance of tracking the effects of consulted-on activities on bull trout and its critical habitat in order to assess conservation and regulatory efforts for the species. To that end, in 2005 the Service formed a "Bull Trout Consultation Coordination Team" charged with developing and implementing a system to accomplish this task. This coordinated effort is on-going and in 2006 the team developed and formalized a team charter with clearly defined duties and tasks as well as obligated funds specifically allocated to the process and development of work products (Memorandum dated June 14, 2006, from ARDs in R-1 and R-6 and Assistant Manager, California-Nevada operations to all R-1 and R-6 Field Offices within the range of bull trout).

The Coordination Team is currently working on a model that will help the Service more accurately track the effects of take, which in turn would help us better estimate the impacts of projects on local populations and core area populations (i.e., status of bull trout). As currently proposed, the model is an integrated and interactive database that comprehensively addresses tracking consulted-on effects of various actions with baseline conditions, extent of take at appropriate scales, and status of the species. The process is well underway and model development in the design and testing phase. The process should be completed in summer 2007. If this model suggests our current analyses are flawed, we would use this as new information and that may trigger reinitiation of consultation. However, we have confidence that at this point in time, the best available information is being used in this biological opinion and will produce conclusions that are consistent with the outputs from the effect-of-take tracking model when it is available.

Status of bull trout populations at the local and core area level

Having discussed the broader aspects of the overall status of bull trout at the range-wide and Columbia River basin scale in the preceding sections, we now analyze the status of bull trout at the finer hierarchical levels of core areas and local populations. First, we describe the status of bull trout in the Rock Creek local population. Rock Creek is one of 14 local populations in the Lower Clark Fork River Core Area. However, as we have indicated, artificial fish passage is being enhanced at the three dams in this core area and the natural connectivity within the Clark

Fork River basin is being restored. Rejoining the Lower Clark Fork Core Area into a single functioning entity with the Lake Pend Oreille Core Area greatly reduces the reliance on single or multiple local populations in the network of artificially fragmented core areas as had occurred in the past half-century. Even partial functional connectivity has greatly enhanced the overall welfare of bull trout in the entire lower Clark Fork River system. Because bull trout, unlike terrestrial or avian species, are constrained in their movements to connected watersheds, it is the ongoing restoration of this connectivity which is fundamental to the long-term survival and status of the species in this portion of the Clark Fork River system. A reconnected system will have a measure of resiliency and redundancy beyond that which is achievable in any single core area under an artificially fragmented condition.

Status of the local population of bull trout in the Rock Creek Watershed (HUC 170102131101)

In the Rock Creek watershed two bull trout life history forms are known to occur – stream resident and migratory forms. In 1996, the Montana Bull Trout Scientific Group (1996) reported that "large fish have been observed (presumably migratory)" and that "smaller redds, presumably from the resident population" were found in the Rock Creek watershed. Since then, through implementation of tasks associated with the Avista fishery program, much has been learned about the bull trout population inhabiting this drainage; however, there is still insufficient data to reveal any trend indication (USFWS 2005a). Information on this local population has been collected in recent years from trapping, electrofishing, redd counts, and radio-telemetry work (USFWS 2005b).

Information gathered from radio-tracked fish in 2003 and 2004 (see Figure B5) has shown that Rock Creek, despite its chronically dewatered condition, supports migratory bull trout in at least some years (Lockard, Carlson, and Hintz 2004). In 2003, four migratory-sized adult bull trout were captured or radio-tagged in the Rock Creek drainage (Lockard et al. 2004), and during 2004 that number increased to ten (Lockard and Hintz 2005). This information strengthens the hypothesis that the Rock Creek drainage is utilized by large, migratory adult bull trout during the spawning season. Further, six of the migratory bull trout tracked in Rock Creek in 2004 were believed to have spawned there (Lockard and Hintz 2005). Two of the six moved upstream to the confluence of the West Fork Rock Creek and the remaining four were located further downstream in the Canyon reach section. We note that 2004 was the first year that the Avista program documented bull trout entering Rock Creek and reported observed spawning in this stream.

Lockard and Hintz (2005) observed that the presence of the ten migratory adult bull trout observed in Rock Creek in 2004 was dependent on stream flow conditions. To enter Rock Creek from Cabinet Gorge Reservoir, these large pre-spawning fish must migrate before spring stream flows drop too low or after rains increase streamflow in the fall. Upstream passage in Rock Creek was facilitated with nearly ideal stream flow conditions during 2004, which do not occur in most years. Thus, spawning activity of migratory fish may be reduced or absent in most years because of unsuitable stream flows. The stream was seasonally de-watered prior to spawning season in 2001 through 2003, when presence of large fish was not typically noted (Lockard et al. 2005). Lockard and Hintz (2005) surmised five of the six radio-tagged adult bull trout that spawned in Rock Creek in 2004 did so because they could not pass Noxon Rapids Dam to get upstream to their stream of origin. This was based on genetic assignment tests which assigned these fish to tributaries upstream of Noxon Rapids Dam, which suggested to the authors that bull trout may spawn in nonnatal tributary streams near to where upstream movement encounters a passage barrier or obstruction.

Native salmonid abundance monitoring through electrofishing methods provides an indicator of relative bull trout density estimates for certain sections of the Rock Creek drainage (Liermann and Tholl 2005). In 2003, electrofishing depletion estimates were completed in two sections of Rock Creek. At site two, 20 bull trout were sampled and at site four, 21 bull trout were sampled. Based on these samples, densities of bull trout were estimated at 15.1 fish per 328 feet (100 m) at site two and 20.4 bull trout per 328 feet at site four. Both sites were located in the East Fork Rock Creek. Lengths of these fish ranged from 2 to 14 inches. Four sites were monitored in Rock Creek in 2001 and three sites in 2002. Both years combined, density estimates ranged from a low of 7.0 fish per 328 feet (site two) to a high of 28.4 bull trout per 328 feet (site three)(Liermann et al. 2003). Bull trout densities showed considerable annual variation at the same sampling sites, but no distinguishable trend between years (Liermann et al. 2003).

Annual redd count surveys have been conducted in the Rock Creek drainage for the past 5 years. In some years the surveys were incomplete. While informative, the surveys have low confidence as a trend indicator because positively identifying clean gravel in under-scour areas as bull trout redds is difficult (Moran 2004). For example, in the West Fork Rock Creek Moran (2005) reported that no definitive migratory bull trout redds were observed during redd counts conducted in 2001 and 2002. Therefore, this method for determining spawning use of this tributary was ineffective and was discontinued in 2003. Because of the discovery of two radio-tags, apparently from radio-tagged fish that were in the area in fall of 2004, redd counts were re-instated. Further, redd count surveys were expanded in 2004 to cover lower areas of the Rock Creek drainage, where definitive redds were located. Moran (2005) concluded that these newly discovered redds in the lower section of the drainage should require future surveys to encompass larger areas of the channel, especially during years of favorable stream flow.

- Total 2005 count: 1 bull trout redd.
- Total 2004 count: 6 bull trout redds.
- Total 2003 count (not surveyed).
- Total 2002 count: 1 (possible) bull trout redd (low confidence).
- Total 2001 count: no bull trout redds (low confidence).

In general, it is known that the Avista trap and transport program has enhanced the number of bull trout spawning in the Lower Clark Fork Core Area, particularly in the Bull River. The 2004 and 2005 (Moran 2006) results indicate enhanced spawning specific to the Rock Creek drainage.

The Avista Downstream Juvenile Bull Trout Transport Program began in 2001 and is intended to study survival of downstream migrating juvenile bull trout leaving Montana tributary streams for Lake Pend Oreille, Idaho. Juvenile bull trout are trapped annually in Montana tributaries, including Rock Creek, and then transported directly to Lake Pend Oreille, thus avoiding the vulnerability of increased predation in the reservoirs and the Clark Fork River or entrainment through the turbines. For the past five years a portion of the total juvenile bull trout migrating downstream in Rock Creek have been trapped before reaching Cabinet Gorge Reservoir and then transported to Idaho where they are released. In order to prevent depletion of certain size/age classes and to be conservative due to the possibility of high trapping efficiency, not all trapped fish are transported. It is anticipated that the "trap and haul" program will eventually become a permanent component of the overall Avista fish passage program (Lockard et al. 2002b).

In 2001, 87 juvenile bull trout were captured in Montana tributaries in the Lower Clark Fork Core Area. Thirty of these fish came from Rock Creek and 23 of those were transported while seven were released on site (Lockard et al. 2002b). In 2002, a total of 416 juvenile bull trout were captured in fish traps while migrating downstream in Rock Creek, Bull River, Graves Creek and the Vermilion River. Only 11 juvenile bull trout came from Rock Creek in 2002 and 9 were transported and 2 released (Lockard et al. 2003). In 2003, a total of 221 juvenile bull trout were captured and 24 came from Rock Creek, with 10 being transported and 14 being released (Lockard et al. 2004).

In 2004, the trapping conditions occurred during a year when the mainstem of Rock Creek had perennial stream flow conditions, which resulted in significant capture rates. A total of 56 bull trout were captured in upstream and downstream trapping efforts in Rock Creek, 55 juveniles and one adult (Lockard et al. 2005). The number of juvenile bull trout captured (19 upstream and 36 downstream) was the highest in Rock Creek since trapping began in 2001 and was probably due to the increased trapping efficiency from the favorable flow conditions throughout the trapping season. In summary, cumulative numbers of juvenile bull trout captured in Rock Creek (upstream and downstream trapping) in 2001, 2002, 2003, and 2004, were 30, 17, 35, and 55, respectively (Lockard et al. 2005).

The month of August showed the greatest downstream movement of juvenile bull trout in Rock Creek in 2003 and 2004, followed by the month of July (Lockard et al. 2005, Lockard et al. 2004). For all Montana tributaries, in 2004, downstream movement occurred from April through December, with a noticeable peak in late August and tapering off from September through November. Lockard et al. (2005) noted that peak juvenile migration in these tributaries might occur in the spring or at other times during high flows when trapping efficiency drops off.

Resident bull trout are more abundant in the East Fork Rock Creek and West Fork Rock Creek than in the mainstem (MDEQ and USDA Forest Service 2001). Overall, the local population of resident bull trout inhabiting the Rock Creek drainage appears to exist at relatively low densities, but has been persistent under current habitat and population conditions (see B3 below). However, most of the 19 habitat variables that are important indicators of watershed conditions for bull trout are functioning at risk in Rock Creek. Of these, three are functioning appropriately and the two at most risk – streamflows and refugia – are related to the chronic dewatering in the mainstem (MDEQ and USDA Forest Service 2001) (Table B3). The limiting factor for fish in this drainage may be the two lengthy reaches of the stream that dewater in most years during summer or fall. Consequently, the threat to the population of resident bull trout inhabiting Rock Creek is relatively high due to these current habitat conditions and relative isolation in most years. Recent summer drought years (2001 – 2003) have caused the dewatered sections of the mainstem to expand significantly in length, which has further limited habitat availability during the critical low flow summer season. Another threat whose impacts are uncertain is hybridization from brook trout.

At present, brook trout are found in low numbers and only in the very lower reaches of the mainstem of Rock Creek and not in the upper watershed where most of the resident bull trout reside. Ironically, the chronic dewatering of the mainstem is probably limiting brook trout distribution to primarily the lower sections of the mainstem (Larry Lockard, pers. comm., U.S. Fish and Wildlife Service, 2005). Nevertheless, this threat exists because of this species presence in the watershed and its known adverse effects on small resident populations of bull trout elsewhere.

As described, the migratory component of the bull trout population utilizing Rock Creek is small and current use of Rock Creek by migratory spawners is sporadic. However, use may increase in the future as fish passage around Cabinet Gorge Dam continues under the Avista program. Genetic evidence suggests that there is a component of returning adult bull trout that migrate to Cabinet Gorge Dam from Lake Pend Oreille that has a strong genetic association with Rock Creek as their stream of origin. If the downstream Avista juvenile transport program is successful in terms of increasing juvenile survival, and more juvenile bull trout are transported to Lake Pend Oreille in the future, this may increase the possibility of additional adult migratory bull trout returning to the Rock Creek drainage in the future.

However, despite the future likelihood for migratory bull trout to return to the Rock Creek drainage, the risk to the migratory component of the Rock Creek bull trout population currently remains high due to the small annual number of these returning fish and the uncertainty in most years of adequate streamflows allowing access to spawning areas.

Status of bull trout in bull trout core areas in the Lower Clark Fork River Subbasin (see Figure B2):

Lake Pend Oreille Core Area: The Lake Pend Oreille watershed is one of the largest, most complex, and best-documented bull trout core areas in the upper Columbia River watershed, encompassing 95,000-acre Lake Pend Oreille (the largest and deepest natural lake in Idaho). An extensive redd count monitoring program was devised by Idaho Department of Fish and Game and has been in place since 1983 (USDI 2005a). These redd counts accurately reflect the population trend. Data is collected from six index tributary streams: two in the lower Clark Fork River (downstream of Cabinet Gorge Dam) and four other tributaries to the lake. Index counts average about two-thirds to three-fourths of the known spawning in the contiguous Pend Oreille basin. Bull trout index redd counts have ranged from about 300-700 throughout the 22-year period of record (averaging 505). In 8 years post-listing (1998-2006), index redd counts have ranged between 462 and 691, averaging 581, and the most recent (2005) count was 580. There is some indication that numbers have been more robust since 1998 than they were in the prior years.

The status and trend of bull trout in this core area was considered "depressed" and "declining" based on information available at the time of listing (USFWS 1998). However, based on recent analysis, there are as many as 5,000 adult bull trout in this core area and the recent trend is considered stable or increasing. In fact, the Lake Pend Oreille Core Area may have reached the Service's recovery objectives outlined in the Draft Bull Trout Recovery Plan (USFWS 2002) since it was considered very close to that level in 2004 (Downs and Jakubowski 2004). These findings reflect improved monitoring and expanded knowledge about population demographics in this core area. There is potential for increased bull trout recruitment to this core area from the Clark Fork River watershed as a result of artificial upstream passage of spawning bull trout over the dams (Lockard et al. 2003). The range of this core area has also been expanded to include the lower portions of the Priest River watershed, based on results of bull trout radio telemetry studies. The precarious status of kokanee (the primary forage fish) and apparent expansion of the lake trout population, which may currently exceed bull trout abundance in Lake Pend Oreille, are the biggest threats to recovery; and therefore, the magnitude and imminence of the nonnative species threat remains high.

Possible Consolidation of the Lake Pend Oreille Core Area with the Lower Clark Fork Core Area: The potential consequences (see Draft Bull Trout Recovery Plan) of increasing connectivity and bull trout migration through the Lower Clark Fork Core Area include returning the Clark Fork River to a state closer to its natural configuration prior to the dams and expanding important aspects of population size, replication, and distribution, thus improving the overall viability of a consolidated Lower Clark Fork /Lake Pend Oreille consolidated core area. In such a consolidated core area configuration, Rock Creek is one of 20 local populations. The importance of Rock Creek to bull trout is neither increased nor diminished as a result, but the resiliency and stability of the reconnected core area(s) exceeds the sum of its individual parts as discussed below and in the Draft Bull Trout Recovery Plan. The Draft Bull Trout Recovery Plan (USDI 2002c) places strong emphasis on reconnecting the Lake Pend Oreille Core Area with the Lower Clark Fork Core Area in order to achieve bull trout recovery in the lower Clark Fork River system.

The foregoing discussion in the Introduction and Consultation Background section of this biological opinion clearly emphasizes that the Lower Clark Fork Core Area is part of a larger entity with the Lake Pend Oreille Core Area. Unlike some headwater core areas that function with complete independence from migration of bull trout from upstream or downstream waters, the future status of bull trout in the Lower Clark Fork Core Area is integrally linked to Lake Pend Oreille. The current status, with successful upstream fish passage since 2003, and tracking of fish from Lake Pend Oreille to spawning tributaries through the efforts of the Avista project, in the near future Lake Pend Oreille Core Area should be combined with the Lower Clark Fork Core Area. The basic definition of a core area (given under Population Dynamics heading in this document) includes that it: "represents the closest approximation of a biologically functioning unit for bull trout. Local populations within a core area have the potential to interact because of connected aquatic habitat." Given the existing levels of biological function and connectivity established through the trap and transport program, any future revision to the core area map should seriously consider treating the Lower Clark Fork Core Area as part of the Lake Pend Oreille Core Area (Wade Fredenberg, pers. comm., U.S. Fish and Wildlife Service, 2006).

Lower Clark Fork Core Area (formerly the Cabinet Gorge Reservoir, Noxon Reservoir Thompson Falls Reservoir and Lower Flathead River): The action area falls within this core area (See Figures B2, B3, and B5). Following consolidation of the four fragmented core areas into a single Lower Clark Fork Core Area (See figure B2), as described elsewhere in this biological opinion (see previous section and Appendix D), we then scored the newly combined Lower Clark Fork Core Area following the assessment criteria applied in previous assessments of fish status (Master et al. 2003; MNHP 2004). This resulted in an "At Risk" ranking, which is one step improved from the "High Risk" rankings of the status the core areas achieved under the previously fragmented condition. The action of rejoining the core areas through restored connectivity of bull trout migratory corridors, as called for in the Draft Bull Trout Recovery Plan, is an incremental improvement to the risk of extirpation for the Lower Clark Fork Core Area population. Full and complete connectivity over all three dams remains the longer term objective.

A large amount of recent data has been collected, characterizing both bull trout abundance and demographics in this core area, since the Avista Native Salmonid Restoration Program began conducting surveys in 2000 (USDI 2005a). Prior to that there was only limited and partial monitoring of bull trout in this core area. Results of redd counts since 2000 indicate approximately 10-50 redds per year have been constructed in portions of the Bull River drainage (Lockard, Carlson and Hintz 2004, Moran 2004, MFWP 2004a). Per our previous discussion, additional limited spawning has been confirmed in Rock Creek (Lockard and Hintz 2005). Passage of radio-tagged fish over Cabinet Gorge Dam has contributed to the annual spawning total since 2003. Extensive radio tracking of fish has led to many important observations of timing and movement patterns related to spawning. Preliminary conclusions are that the abundance of adult bull trout in Cabinet Gorge Reservoir is around 100 fish. The determination is complicated by movement patterns over two dams (Cabinet Gorge and Noxon Rapids) and the influx and egress of adult bull trout that has been documented to occur in this core area. There is insufficient data to reveal any trend indication, though it is known that the trap and transport program has enhanced the number of bull trout spawning in the core area.

Spruell et al. (2000) reported on the findings of a scientific panel that investigated the genetic structure of bull trout in the Lake Pend Oreille – Lower Clark Fork system, with particular attention to strategies for retaining genetic connectivity of bull trout in Lake Pend Oreille with upstream portions of the Clark Fork River drainage in Montana, including local populations isolated in Cabinet Gorge Reservoir. The panel endorsed strategies, which would restore connectivity (including trap and transfer of migratory bull trout over dams) to allow the full expression of bull trout life histories and maximize the potential for natural gene flow. Genetic data supported the hypothesis that bull trout migrating to the base of Cabinet Gorge Dam were individuals that hatched in upstream tributaries, reared in Lake Pend Oreille, and were blocked by the dams from returning to their natal tributaries to spawn (Neraas and Spruell 2001). More recent work has lent credibility to the use of genetic markers as an accurate indicator of which source populations fish are derived from, allowing managers to transport individual trapped fish to the general vicinity of their stream of origin (Ardren and Campton 2003). It is important to note that the findings to date support previous conclusions that upstream and downstream connectivity to this core area should continue at, or preferably above, existing levels and so that under recovered conditions it should function as part of a larger core area with Lake Pend Oreille (USFWS 2002c).

Many of the actions conducted under the Avista Fish Passage and Native Salmonid Restoration Program of the Clark Fork FERC Settlement Agreement have been directed at transporting bull trout upstream and downstream over Cabinet Gorge and Noxon Rapids dams, with a goal of establishing functional connectivity for migratory bull trout between Lake Pend Oreille and upstream watersheds blocked by the dams. In 2002, a total of 416 juvenile bull trout were captured in fish traps while migrating downstream in Rock Creek, Bull River, Graves Creek and the Vermilion River (Lockard et al. 2003). Of that total, about 40% (167 fish) were transported to Idaho and released in the Clark Fork River below Cabinet Gorge Dam. All were marked for future identification. In 2003, 221 juvenile bull trout were captured migrating downstream and 88 were successfully transported below Cabinet Gorge Dam (Lockard et al. 2004).

A second phase of the Avista Native Salmonid Restoration Program involves capture and transfer of adult bull trout migrating upstream to the base of Cabinet Gorge Dam. In 2003, a total of 42 adult bull trout were captured and transported from the Clark Fork River around Cabinet Gorge Dam and released into Cabinet Gorge Reservoir (Lockard et al. 2004). Seven of those were fish that had been captured and transported over the dam in previous years (2001 or 2002). Of 36 bull trout that were implanted with transmitters and radio tracked in 2003, upstream movements of 20 were detected in the Bull River drainage, two were detected in the Rock Creek drainage, and 14 staged below Noxon Rapids Dam, the next upstream barrier on the Clark Fork River (Lockard et al. 2004). Tracking of bull trout to the spawning areas, combined with redd counts, led to the conclusion that most (73-89%) of the potential bull trout egg deposition in the Bull River drainage in 2003 was from migratory fish transported over Cabinet Gorge Dam. Additional information gathered from radio tracked fish in 2003 and 2004 (see Figure B5) has also shown that Rock Creek, despite it's chronically dewatered condition, continues to support migratory bull trout (Lockard, Carlson, and Hintz 2004).

Extensive information is being collected on the overlap with and potential superimposition of brown trout redds in important bull trout drainages (Moran 2004). Studies that are ongoing relate to concerns that northern pike negatively interact with bull trout and predate on juvenile bull trout in Cabinet Gorge Reservoir (Bernall and Moran 2004). There are also concerns about negative interactions with high densities of brook trout in many watersheds and the potential for an increasing population of recently illegally introduced walleye that are reproducing in Noxon Reservoir. To date, control actions on these species have not been initiated, pending further analysis.

In 1997 and 1998 a total of 780 fish were collected among nine sites in Montana above Cabinet Gorge Dam and 384 fish from four sites in Idaho below the dam for pathogen surveys. Only one fish was a bull trout, but the study was conducted in response to concerns that transport of bull trout over the dam might introduce new fish pathogens upstream. The soluble antigen of *R. salmoninarum*, the causative agent for bacterial kidney disease, was detected in fish from all sample sites across the study area, though no clinical cases of the disease were found. *F. psychrophilum*, the bacterium that causes cold water disease, was isolated from samples below the dam, but not above. However, the pathogen is generally regarded as a widely distributed organism and because it's ubiquitous it was not determined to be an agent of concern for the fish transport program. IPN virus was also isolated from brook trout in the Mosquito Creek drainage, but previous cases had already occurred in the drainage and this pathogen was also known from upstream waters in Montana. No evidence of *M. cerebralis*, the parasite that causes whirling disease, was detected in any of the samples. With these findings, the fish transport program moved forward.

The potential for increased bull trout recruitment beyond the existing levels to this core area from Lake Pend Oreille as a result of artificial upstream passage of spawning bull trout over the dams is promising given the current fish passage that is occurring through the trap and transport program and the planning for permanent fish passage facilities at all three dams. Suitability of Cabinet Gorge Reservoir habitat for adult bull trout remains limiting, thus the emphasis on connectivity to restore this core area as a functioning portion of a larger core area. The current approach of restoring functional connectivity to allow upstream and downstream migration will benefit the entire Lake Pend Oreille / Lower Clark Fork ecosystem. Some obstacles remain to achieving that goal, though a long-term funding and implementing mechanism (Avista FERC settlement) is in place and has been successful so far.

Similar to the conservation efforts directed at Cabinet Gorge Reservoir bull trout as described above, intensively focused monitoring and research efforts have occurred for Noxon Reservoir as part of the Avista Native Salmonid Restoration Program (USDI 2005a). Based on recent analysis, we conclude that the abundance of adult bull trout in Noxon Reservoir is greater than 100 fish. The determination is complicated by movement patterns over the two dams (Noxon Rapids and Thompson Falls) and the influx and egress of adult bull trout that has been documented to occur in this area. There is insufficient data to reveal any trend indication, though it is anticipated that expansion of the trap and transport program will further enhance the number of bull trout spawning in the Noxon Reservoir area. Suitability of Noxon Rapids Reservoir habitat for adult bull trout remains somewhat limiting though it is better than for Cabinet Gorge. The establishment of a reproducing walleye population in Noxon Reservoir is one element that elevates the magnitude and imminence of the nonnative species threat. Currently, MFWP is studying the growth of the walleye population and in the future could address control measures through specific management actions.

The determination of approximately 100 adult fish in the Thompson Falls Reservoir reach is complicated by losses that may occur over Thompson Falls Dam, which forms the lower bound of this reach. Additionally, if efforts to restore bull trout populations in the Jocko River watershed on the Flathead Reservation (upstream of this reach) are successful, some of those fish will use a portion of this reach as overwintering and migratory habitat. Influx and egress patterns of adult bull trout in this area are not documented. There is insufficient data to reveal any trend indication, though it is anticipated that the trap and transport program currently occurring at Cabinet Gorge and Noxon dams will be expanded to Thompson Falls Dam, further enhancing the number of bull trout spawning in this area. The potential for increased bull trout recruitment to this area from the Clark Fork River watershed as a result of artificial upstream passage of spawning bull trout over the dams is promising, but untested. Suitability of the Clark Fork River habitat for adult bull trout is partially limiting, due to thermal and water quality concerns. Similarly, portions of the Thompson River watershed experience warm summer water temperatures. Thus, the emphasis has been placed on connectivity to restore this core area as a functioning portion of a larger complex of core areas.

Kerr Dam blocks fish passage between the lower Flathead and Clark Fork rivers and Flathead Lake. As a consequence, with the exception of occasional downstream migrants from these systems, it is unlikely that the status of the Flathead Lake Core Area and upstream waters bears much relevance to the future of the bull trout populations in the Lower Clark Fork Core Area. Additionally, dams constructed to create irrigation reservoirs isolate tributaries of the Jocko River drainage from the lower Flathead River. The lower Flathead River is almost entirely on the Flathead Reservation of the Confederated Salish and Kootenai Tribes (CSKT). Data from Tribal monitoring programs is typically not available as public information, but to our knowledge redd counts are not being routinely conducted in this area (USDI 2005a). Extensive bull trout restoration activities are occurring in the Jocko River watershed, which is where most of the bull trout habitat exists in the upper portion of this core area (CSKT 2000). Information from informal discussion with Tribal representatives indicates that numbers of adult bull trout in the area are generally low, on the order of 100 adult fish or fewer in the entire migratory population. There is no available information on the population trend. With fish passage now provided over lower Clark Fork dams and additional habitat restoration efforts, the past fragmentation in the upper portion of this core area is being improved. However, significant habitat limitations remain (e.g. dewatering, thermal enrichment, nonnative species, impacts of whirling disease, expanding recreational use) before reconnection to the Lake Pend Oreille Core Area is a likely prospect. Full recovery of bull trout in the lower Flathead River is at best an uncertain prospect. Potentially, this area should be able to support at least several hundred migratory adult bull trout. Thus, the emphasis has been placed on connectivity to restore this upper portion of the Lower Clark Fork Core Area as a functioning portion of the Lake Pend Oreille Core Area.

Middle Clark Fork River (Section 2 – Flathead River to Milltown Dam) Core Area: More intensive bull trout surveys have been conducted in recent years in this core area, which is just upstream of the Lower Clark Fork Core Area, primarily by MFWP in the portion of the Clark Fork River drainage from the Flathead River to Milltown Dam. (Figure B2). Local spawning populations in Cedar Creek, Fish Creek, Rattlesnake Creek, and the Saint Regis River have been monitored sporadically (MFWP 2004a). The surveys have identified up to 17 redds in Cedar Creek (2002), 20 redds in Fish Creek (2003), 33 redds in Rattlesnake Creek (2003), and 18 redds in the Saint Regis River (2003). These results indicate adult bull trout numbers in this core area range from roughly 100-200 fish, although there's uncertainty in that estimate. No trend is indicated by the short period of record. Most local populations are well below historical levels of natural abundance and inadequate to maintain long-term genetic viability.

Milltown Dam, which has blocked fish passage at the upper boundary of this core area since 1908 (Schmetterling and McEvoy 2000), is slated for complete removal as early as 2006 (Missoulian *in litt.* 12/21/04). While benefits are more likely to accrue to the next core area upstream by allowing fluvial bull trout to return to natal headwaters, tangible benefits to this core area will accrue as well. Benefits of restoring fish passage throughout the system over four major dams, as a result of both the Avista and Thompson Falls projects as well as the Milltown Dam removal, cannot be fully anticipated nor fully realized for several bull trout generations.

<u>Status of bull trout in the Clark Fork River Management Unit</u>

Bull trout are found in 35 core areas (following consolidation as previously stated in the Status of the Species section of this biological opinion) within the Clark Fork River drainage (USDI 2002c). The Lower Clark Fork Core Area is currently considered to be one of those 35. At least 152 local populations of bull trout have been identified associated within these core areas (USDI 2002c). Rock Creek is one of those 152 local populations.

The Service considers many of the core areas in the Clark Fork River drainage to be at risk of extirpation due in part to natural isolation, single life-history form, and low abundance. Expansion of nonnative lake trout into headwater lakes is the single largest human-caused threat in most of the 25 primarily adfluvial core areas, and dams and degraded habitat have contributed significantly to bull trout declines in the four core areas centered primarily in fluvial habitat in the Clark Fork subbasin.

Reconnection of fragmented core areas within the Clark Fork River Management Unit is a high priority identified in the draft Recovery Plan (USDI 2002c). The progress made in reconnecting the lower mainstem corridor is a direct measure of the recovery of bull trout in the Clark Fork River Management Unit. Due to its location, the health and stability of bull trout in the Lower Clark Fork Core Area is important. Perhaps more importantly the passage of bull trout both upstream and downstream through this area is an essential component of recovery.

Status Of Designated Critical Habitat

In November 2002, the Service proposed designation of critical habitat for the Klamath River and Columbia River, pursuant to the Endangered Species Act of 1973, as amended. For the Columbia River basin the proposed critical habitat designation totaled approximately 29,251 km (18,175 mi) of streams and 201,850 ha (498,782 ac) of lakes and reservoirs, which included--approximately 14,416 km (8,958 mi) of streams and 83,219 ha (205,639 ac) of lakes and reservoirs in the State of Idaho; 5,341 km (3,319 mi) of streams and 88,051 ha (217,577 ac) of lakes and reservoirs in the State of Montana; 5,460 km (3,391 mi) of streams and 18,077 ha (44,670 ac) of lakes and reservoirs in the State of Oregon; and 4,034 km (2,507 mi) of streams and 12,503 ha (30,897 ac) of lakes and reservoirs in the State of Washington (USDI 2002a).

In October, 2004, the Service published a final rule designating approximately 1,748 miles of streams and 61,235 acres of lakes and reservoirs in the Columbia and Klamath River basins of Oregon, Washington, and Idaho as critical habitat for bull trout under the Act (USDI 2004c). All 3,319 miles of proposed streams and 217,577 acres of proposed lakes in Montana were excluded from the final designation, based primarily on the existence and presumed adequacy of the State of Montana’s Bull Trout Restoration Plan. Lake Pend Oreille, the Clark Fork River, and Priest Lakes were also excluded, but portions of thirteen tributaries to Lake Pend Oreille or the Clark Fork River in Idaho, as well as 14 tributaries to Priest Lake and Priest River were included in the final designation. The final critical habitat designation amounted to less than 10% of that originally proposed range-wide and on December 14, 2004, a lawsuit was filed by a Montana environmental group challenging the final designation.

On May 24, 2005, the Service published notice in the Federal register that it would accept further public comment for a period of 30 days, through June 24, 2005, on the adequacy of the exclusions in the October, 2004 final rule. On June 27, 2005, District Judge Redden of Oregon granted the Service request to voluntarily remand the October, 2004 final rule for a new decision. As a result, a voluntary remand went into effect which reinstated the November 29, 2002, proposed rule and the Service engaged in preparing a new analysis by September 15, 2005.

On September 26, 2005, the Service published notice in the Federal Register the final rule designating critical habitat for bull trout for the Klamath River, Columbia River, Jarbridge River, Coastal-Puget Sound, and Saint Mary-Belly River populations of bull trout (FR 70, No 185, 56211-56311). This final designation totals approximately 3,828 miles (6,161 kilometers) of streams, 143,218 acres (57,958 hectares) of lakes in Idaho, Montana, Oregon, and Washington, and 985 miles of shoreline paralleling marine habitat in Washington. There are three critical habitat units located in Montana: 1) Clark Fork River Basin with 1,136 miles of streams and 31,916 acres of lakes/reservoirs; 2) Kootenai River Basin with 56 miles of streams and 1,384 acres of lakes/reservoirs; and the Saint Mary-Belly River Basins with 37 miles of streams and 4,107 acres of lakes/reservoirs (note that a portion of the Clark Fork River Basin is in northern Idaho, so the numbers do not add up to the totals previously listed for Montana).

Guidance for analysis of designated critical habitat for bull trout was provided in the final rule and previously in the Director's December 9, 2004, memorandum, which is in response to litigation on the regulatory standard for determining whether proposed Federal agency actions are likely to result in the "destruction or adverse modification" of designated critical habitat under Section 7(a)(2) of the Act (Appendix E). This memorandum outlines interim measures for conducting Section 7 consultations pending the adoption of any new regulatory definition of "destruction or adverse modification." Consequently, this biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

Summary of analysis of bull trout critical habitat likely to be affected

The proposed action would occur in Cabinet Gorge Reservoir in a portion of the lower Clark Fork River watershed (USDI 2002c), portions of which are designated as critical habitat. Designation of bull trout critical habitat was identified in the Rock Creek watershed and published in the September 26, 2005, final rule (FR 70, No 185, 56211-56311). Bull trout critical habitat in the Rock Creek drainage is designated at five individual locations and totals 2.88 miles. This biological opinion analyses the potential effect the proposed action would have on designated critical habitat for bull trout in the Rock Creek watershed and the Lower Clark Fork Core Area.

Pursuant to our regulations, the Service is required to identify the known physical and biological features (primary constituent elements or PCEs) essential to the conservation of the bull trout. All areas designated as critical habitat for bull trout are occupied, within the species historic range, and contain sufficient PCEs to support at least one life history function. Watson and Hillman (1997) concluded that bull trout watersheds must have specific physical characteristics to support spawning and rearing, but that these characteristics are not necessarily present everywhere throughout the drainage.

Based on the current life history, biology, and ecology information of bull trout, the Service has identified the bull trout's PCEs (FR (FR 70, No 185, 56211-56311). The following are the PCEs for bull trout: 1) stream temperatures from 32 to 72^0 F; 2) complex stream channels influenced by large woody debris, pools, and undercut banks that result in various depths, velocities, and instream habitat structures; 3) substrates of sufficient size, amount, and composition for juvenile and egg survival; 4) natural stream flows or artificial flows that are regulated in order to support bull trout; 5) springs, seeps, and groundwater sources, and subsurface flow that contributes to the water quantity and quality as a cold water source; 6) migratory corridors that support unimpeded movement between spawning, rearing, foraging, and over-wintering areas; 7) adequate food base of terrestrial and aquatic insects and forage fish; and 8) permanent water sufficient to provide the quality and quantity for normal reproduction, growth, and survival.

ENVIRONMENTAL BASELINE

Regulations implementing the Act (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 leading to the current status of the species, its habitat (including designated critical habitat), and ecosystem 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 consultations and the impacts of State and private actions which are contemporaneous with the consultations in progress.

Status Of The Species Within The Action Area

Lower Clark Fork Core Area Population

The action area (areas potentially affected directly or indirectly) for this biological opinion includes the Rock Creek drainage (local population) where the most direct effects may occur and Cabinet Gorge Reservoir, which functions as rearing and over-wintering habitat for migratory fish and part of the larger Lower Clark Fork Core Area population of bull trout (see Figure B3). The local population of bull trout that spawns and rears in Rock Creek is the smaller of two local populations that are found in tributaries to Cabinet Gorge Reservoir; the other being in the Bull River drainage. Prior to Cabinet Gorge Dam the downstream extent of the action area would have historically extended further in the riverine environment, most likely down the Clark Fork River to Lake Pend Oreille. However, we conclude that potential direct and indirect effects of this project are not likely to extend downstream of Cabinet Gorge Dam, due to the storage capacity of Cabinet Gorge Reservoir. The water impounded by Cabinet Gorge Dam (i.e., Cabinet Gorge Reservoir) is held significantly longer than the fast-flowing water in the Rock Creek drainage. The storage time of water in the reservoir may vary from hours, to days, to weeks, but this period of storage will, to a large degree, modify temperature, dissolved gases, and suspended solids in the reservoir. An immediate result of Rock Creek inflows into the reservoir is the reduction in velocity of water. As the inflowing water meets the more quiescent water of the reservoir, it loses some of its capacity to carry suspended solids, and these solids are deposited in the reservoir (e.g., suspended sediment from Rock Creek). Thus the longer residence time of the slow-moving water of the reservoir caused by the impoundment would not convey effects beyond Cabinet Gorge Dam.

Pre-impoundment population estimates for migratory adult bull trout range between 2,000 and 10,000 for the lower Clark Fork River (Pratt and Huston 1993). This would have included primarily adfluvial fish from Lake Pend Oreille, but perhaps some fluvial fish as well. There has been a decrease in the relative abundance of bull trout upstream of Cabinet Gorge Dam. Since the Pratt and Houston (1993) investigations, other studies (WWP 1995a, 1995b, 1996) have confirmed the limited abundance and tenuous nature of bull trout associated with Cabinet Gorge Reservoir (Neraas and Spruell 2001, Lockard et al. 2004). Bull trout numbers within the project area "are small enough to prompt concern about both available genetic diversity and population persistence" (MDEQ and USDA Forest Service 2001). In Cabinet Gorge Reservoir tributary reaches accessible to migratory fish, bull trout were the least abundant trout species sampled.

Until recently, fluvial and adfluvial fish were blocked from freely and extensively migrating in the lower Clark Fork River (if not further upstream) by the three dams (Cabinet Gorge, Noxon Rapids, and Thompson Falls) that are positioned in sequence immediately upstream of Lake Pend Oreille (see Figure B3). In the absence of the dams, it is likely the Lower Clark Fork Core Area population would have comprised a single Lake Pend Oreille Core Area population with local populations located in each of the watersheds. Despite these limitations, the lower Clark Fork watershed continues to support bull trout that exhibit both resident and migratory life history forms. Most of the drainages occupied by bull trout in this watershed are believed to be dependent on migratory individuals to ensure long-term bull trout persistence.

Fragmentation of the migratory corridor by mainstem dams is a major factor affecting the survival and recovery of bull trout in the lower Clark Fork River drainage (MBTSG 1996b). However, in the last five years this threat has been addressed to a large degree at the Avista dams through current fish passage programs (see previous discussions in this biological opinion, Introduction and Consultation). Fish passage planning and development is currently underway by Montana PP&L at Thompson Falls Dam. Prior to the Avista fish passage program, past fragmentation resulted in smaller, isolated groups of bull trout with decreased tributary accessibility. The migratory component of these smaller units was at a higher threat of extirpation due to their limited abundance and available range as well as the inability of fish migrating downstream over or through dams to return to natal waters. Rearing capacity in the reservoirs was greatly reduced compared to Lake Pend Oreille due to the size differential. Furthermore, the quality of available habitat for bull trout in the reservoirs was lower due to water level fluctuation, higher turnover rate of nutrients cycling through the system, and especially the much warmer water temperatures and lack of deep-water thermal refugia.

Some self-sustaining bull trout currently persist and reach adulthood in Noxon Rapids or Cabinet Gorge reservoirs. Bull trout in these two reservoirs are isolated from freely migrating to upstream and downstream reaches. As a partial result of habitat limitations, the reservoirs support relatively few adult bull trout, and populations were viewed as being at high risk of extirpation (USDI 1998c). Migratory bull trout tend to use larger tributaries to the lower Clark Fork River for spawning and rearing. Primary spawning tributaries in the system are Prospect Creek, and the Bull, Thompson, and Vermilion rivers. Movement of fish (and resulting gene flow) between the reservoirs has been previously limited to a downstream direction, although the magnitude of bull trout movement out of either reservoir is unknown. With the initiation of the Avista trap and transport program about five years ago, that situation has changed.

The Bull River supports more spawning bull trout than other tributaries in the Lower Clark Fork Core Area, with 9-32 bull trout redds located in the East Fork Bull River in 2001-2006, 1-10 bull trout redds in the South Fork Bull River, and occasional redds in the upper mainstem (Moran 2004, MFWP unpublished data 2006, Moran 2005). The bull trout redd counts in Rock Creek indicate inconsistent spawning, likely due in part to intermittent access as a result of a reach in the midsection of the lower mainstem that is perennially dewatered (see Figure B5). In 2004, the highest number of redds were recorded since surveys began in 2001, with two redds in the mainstem below the dewatered reach and four redds just upstream of the confluence of the West Fork (see Figure B5). At least a portion of those redds were known to be constructed by fish that had been passed upstream over Cabinet Gorge Dam (Lockard et al. 2004).

Neither Cabinet Gorge, Noxon, or Thompson Falls reservoirs provide an adequate surrogate for Lake Pend Oreille. Cool water habitat conditions are limited in the reservoirs. Reservoir habitat conditions are largely unsuitable for bull trout (WWP 1995a) and are considered degraded by State of Montana standards as they pertain to supporting a cold water fishery. Bull trout growth and survival rates are likely decreased from predevelopment conditions. This shift in habitat suitability is evidenced by the highly successful bass fishery and dominance by generalist fishes in these reservoirs (WWP 1995b).

The small, isolated nature of the original four core areas, limited bull trout abundance, suboptimal habitat, and low re-founding potential from other core areas led to the listing characterization of the core areas as depressed (USDI 1998c). That, in part is why the Bull Trout Recovery Team for the Clark Fork determined that functional connectivity of the core areas in the lower Clark Fork River subbasin to upstream (and downstream) areas past the dams was important to help ensure the long-term persistence of bull trout (USDI 2002c). It noted that the core areas were an artificial designation due to the dams and that functionally for bull trout the historical core area (pre-dam development) is significantly much larger as explained above. It is believed that the relative contribution of bull trout of the Lower Clark Fork Core Area population to the overall function of the larger historical Lake Pend Oreille system is currently very small, less than 5% of known spawners, assuming 100 percent of adults returning to the three reservoirs could pass Cabinet Gorge Dam and successfully spawn (an unlikely circumstance due to natural variation in addition to man-caused obstacles). At the very best, the Lower Clark Fork Core Area may presently support 200-300 adult bull trout as compared to 5,000 in the Lake Pend Oreille Core Area. Under current circumstances, the rate of recovery of bull trout in the Lower Clark Fork Core Area has improved slightly with the Avista fish passage program. However, it is anticipated that with the development of permanent fish passage facilities and operations within the next 10 years, this rate should improve significantly.

In summary, due largely to the artificial isolation caused by the dams and the habitat unsuitability of the three reservoirs in the Lower Clark Fork Core Area, bull trout distribution and numbers have been relatively small between 1952 and present. This is evident when this core area is compared to other core areas in the Clark Fork River Management Unit and some other portions of the Columbia River basin (USDI 2005a). Local populations of bull trout in the Bull River (35.3 miles) and Rock Creek (7.1 miles) form a very small percentage (1.3%) of the 3,372 miles of important occupied bull trout habitat in the Clark Fork River watershed (USDI 2002a). With improved fish passage in the core area in the next few years, it is likely that some local populations could be strengthened and that bull trout distribution could expand.

Status of the Rock Creek local population of bull trout

The baseline conditions for the Rock Creek local bull trout population parameters and its associated important habitat indicators are summarized in Table B4 and are based largely on the biological assessment conducted by the Forest (MDEQ and USDA Forest Service 2001). Although the baseline assessment was conducted in 2001, based on discussions with the Forest Service and considering habitat and population information since 2001, the Service has determined that the baseline conditions in Table B4 have not changed for any individual indicator, and therefore, the risk ratings are current. Risk ratings for each category provide a good indication of the status of the population and of how well the habitat components function to support the existing population. Most of the habitat parameters are functioning at-risk for bull trout, which suggests that the existing habitat conditions are able to provide for persistence of the current population level of resident bull trout. Although the population level of the adfluvial component of Rock Creek bull trout is unknown, the current habitat conditions do provide for spawning and rearing adfluvial bull trout based on the adult adfluvial fish that were found in Rock Creek in 2004 (total 10 adult bull trout) and the trapping of juvenile fish migrating downstream in the spring and summer in recent years.

The level of information available on bull trout in Rock Creek has been minimal in the past, but with recent more intensive investigation additional information on fish presence, absence, migration and demographic characteristics have been generated. Bull trout in the Rock Creek drainage had been thought to be primarily of the resident life history form (MDEQ and USDA Forest Service 2001). Pratt and Huston (1993) suggested Rock Creek bull trout historically did not have a strong migratory component. Within the Rock Creek drainage, bull trout occur in the mainstem Rock Creek, West Fork Rock Creek, and East Fork Rock Creek (see Figure B5; MDEQ and USDA Forest Service 2001). Watershed Consulting (1997) reported 79% of the bull trout captured were sampled in the East Fork. Several attempts to determine the number of Rock Creek bull trout were made between 1986 and 1996. Watershed Consulting (1997) and WWP (1996) reported similar bull trout densities in East Fork Rock Creek. The WWP(currently known as Avista) (1996) population estimates extrapolated to the drainage scale from density data collected at the reach scale yielded approximately 1,900 total bull trout in Rock Creek and 743 total bull trout in West Fork Rock Creek. However, such extrapolations were viewed cautiously.

Table B4. Baseline Indicators and Documentation for Rock Creek Bull Trout Rated as Functioning Appropriately (FA), Functioning at Risk (FAR), or Functioning at Unacceptable Risk (FUR) (USDA 2001)(Appendix G).

Indicator	Rock Creek Values	Rating
Core Area Size	Greater than 2000 individuals, low habitat complexity, largely isolated system.	FAR
Growth and survival	Growth rates are low and not expected to improve within the next life cycle of bull trout. Instantaneous survival rate for bull trout was lower than for other salmonids in Rock Creek.	FUR
Life history and diversity	Absence or rarity of the adfluvial component.	FUR
Persistence and genetic integrity	Presence and threat of brook trout hybridization in the drainage.	FUR
Temperature	12°C summer, 9°C spring/fall, 5°C winter.	FA
Sediment	Range from 10% to 24%.	FAR
Nutrients and contaminants	Nutrient levels are low in the Rock Creek drainage. Productivity in the stream is phosphorus limited. Background contaminants include arsenic, cadmium, copper, lead, and zinc which are all naturally present below current detection limits with the exception of zinc at 0.5 µg/l (MDEQ and USDA Forest Service 2001).	FA
Physical barriers	Intermittent flow, culvert barrier during some flows.	FAR
Substrate embeddedness	No data specific to embeddedness however, core sampling data range from 15.4% to 43.1%.	FA
Large woody debris	Mean 6.8 pieces/100 m below the confluence of the East and West Forks (WWP 1996). Upper East Fork has high levels of LWD (MDEQ and USDA Forest Service 2001. Mean of 4.6 pieces/100 m greater than 10 ft in length in the West Fork (WWP 1996). Low numbers in mainstem Rock Creek.	FAR
Pool frequency and quality	Reduction in pool volume due to sediment loading.	FAR
Large pools	Existing pools are shallow and wide.	FAR
Off-channel habitat	Naturally limited.	FAR
Refugia	Currently not adequate.	FUR
Wetted width/ depth ratio	Ratio <10.	FAR
Streambank condition	Alluvial terraces are being undermined.	FAR
Floodplain connectivity	Has not been altered.	FAR
Change in peak/base flows	Intermittent flow during some times of the year.	FUR
Drainage network increase	Roads lack BMP standards.	FAR
Road density and location	Densities 1.5 to 3.0 mi/mi^2, riparian roads.	FAR
Disturbance history	Equivalent Clearcut Area = 15%	FAR
Riparian conservation areas	Roads and sediment are issues within the RHCA	FAR
Disturbance regime	Data inadequate	FAR
Integration of species and habitat conditions	**Minimal migratory component, low habitat complexity and low pool frequency.**	**FUR**

There have been documented occurrences of larger migratory bull trout in the Rock Creek drainage (MDEQ and USDA Forest Service 2001). Two radio-tagged bull trout transported from the Clark Fork River below Cabinet Gorge Dam to Cabinet Gorge Reservoir were relocated near the mouth of Rock Creek in 2001. This suggested these fish were attempting to enter Rock Creek to spawn (Lockard et al. 2002a). In 2002, tracking of 19 radio tagged bull trout in the Cabinet Gorge Reservoir (fish that were either captured there initially or transported over the dam from downstream) showed substantial migratory movement occurred into the Bull River drainage, particularly the East Fork Bull River, during the period surrounding the spawning season (Lockard et al. 2003).

In 2003, a total of 22 individual bull trout with radio tags were documented entering spawning streams in portions of the Cabinet Gorge Reservoir (Lockard et al. 2004). Most were located in the East Fork Bull River, with lesser numbers in the South Fork and mainstem Bull River. However, for the first time migratory bull trout from the reservoir were tracked into Rock Creek upstream of the reservoir (Lockard et al. 2004). Both fish (a 25 inch male and 26 inch female) were known to be alive in the upper end of Cabinet Gorge Reservoir in June or July 2003 and then disappeared from tracking surveys. Both tags were located outside the fish and lying in the substrate or buried in debris, approximately 1.9 miles up Rock Creek, in July 2004. The fish had presumably expired at or upstream of those locations due to unknown causes. The location where the tags were found was upstream of a perennially dewatered reach. It was unknown whether the fish were present or spawned in Rock Creek in 2003 (Lockard et al. 2004).

In 2003, weir traps located on the mainstem of Rock Creek, 164 feet downstream from the West Fork of Rock Creek confluence, operated from July 24 through August 30, at which time operations ceased due to a lack of flowing water (Lockard et al. 2004). The trap was reinstalled on October 28 and operated intermittently during a period of unseasonably high flows until November 24. In 2004, this weir trap captured a single migratory-sized adult male bull trout 18 inches in length (Lockard et al. 2004). This was the first migratory-sized bull trout to be captured since this weir trap began operating in 2001, and considered the first documented occurrence in Rock Creek since 1986. Another migratory-sized bull trout (14 inches in length) was captured in 2003 during electrofishing operations upstream of the weir site in Rock Creek (Liermann 2004). Even though few large bull trout have been captured in the drainage, the four migratory-sized adults captured or detected in 2003 suggested the persistence of a migratory form of bull trout in the Rock Creek drainage.

In 2004, radio tracking documented six radio-tagged bull trout, all of which had been transported around Cabinet Gorge Dam, in the Rock Creek drainage during the spawning season (Lockard and Hintz 2005). This was the first year the Avista project had documented migratory bull trout both entering and spawning in Rock Creek. Figure B5 shows the pattern of radio relocations and redd observations in the system. Two of the six fish moved upstream of the confluence of the West Fork Rock Creek. The other four remained in the lower 2.5-mile reach, known locally as the canyon reach. Five of the six fish were first detected in Rock Creek between September 2 and September 18, 2004, and the sixth was found on July 16. Immigration of most fish apparently followed a late August high rainfall event. Perhaps not coincidentally, the first fish to enter was located the furthest upstream, approximately 8.3 miles up the drainage. Lengths of these fish were 22.8 – 28.9 inches. Four were females and the two largest were thought to be males. Two of the fish were observed paired in the vicinity where a redd was later found and several others were also believed to have spawned (Lockard and Hintz 2005). In total ten adult sized migratory bull trout, including the six with transmitters, were located in the Rock Creek drainage in 2004. It appears that the migratory form of bull trout persists (or has rebounded) in this drainage to a greater extent than believed at the time of listing (USDI 1998c). The spawning capability of migratory bull trout in this drainage and their access to Rock Creek appears to be directly linked to two factors. First, is the availability of higher than average flows, particularly during the late summer or early Fall. Second is the availability of adult fish, which apparently could be greatly enhanced by the Avista trap and transport program. The latter circumstance directly supports the premise of the Draft Bull Trout Recovery Plan that Lake Pend Oreille Core Area and the Lower Clark Fork Core Area described in the lower Clark Fork River system must be reconnected for full recovery of bull trout to occur in this region.

Extensive effort has been expended since 2000 to capture juvenile bull trout in streams entering Cabinet Gorge Reservoir, using weirs, rotary screw traps, and electrofishing. Fish are PIT tagged, with unique individual codes, and a portion is transported downstream around Cabinet Gorge Dam while the remainder is allowed to volitionally migrate. The effort is designed to track juvenile fish through the system as well as evaluate returns as adults, in order to more efficiently manage the program. To date, one PIT tagged juvenile has been recaptured as an adult; apparently this fish survived passing Cabinet Gorge Dam and Reservoir, because it was released into Bull River and not transported around the dam. Effort and success of the juvenile capture program has been variable, with frequent high water events affecting the integrity of the traps on a seasonal basis (Lockard et al. 2005). Site suitability, streamflow, and other factors greatly affect the efficiency of the various collector systems. In 2004, a total of 211 downstream moving juvenile bull trout were captured in tributaries to Cabinet Gorge Reservoir (Bull River and Rock Creek) and Noxon Rapids Reservoir (Vermilion River and Graves Creek).

Results, though not absolutely comparable, do provide some indication of the numbers and distribution of juvenile bull trout that core area streams are contributing. Approximately 20 juvenile bull trout were captured in the upper mainstem Bull River over a four year period (2001-2004). In the East Fork Bull River between 24 and 101 juvenile bull trout were captured annually between 2000 and 2004, with a total of 327. In Rock Creek, between 17 and 55 bull trout were collected annually between 2001 and 2004, with a total of 137 over the four-year period (Lockard et al. 2005). These data support the contention that Rock Creek is secondary to the Bull River in terms of recruitment of juvenile bull trout to the Cabinet Gorge Reservoir, though Rock Creek has steadily contributed.

In addition to bull trout, the primary species captured in traps in Rock Creek is westslope cutthroat trout. A total of 462 juvenile westslope cutthroat trout were captured in Rock Creek traps in 2004 (Lockard et al. 2005). The 2004 trap catch represents the highest numbers of both bull trout and westslope cutthroat since trapping began.

Resident bull trout remain the most significant component of the bull trout population in Rock Creek. However, the Avista studies have focused on migratory fish and so have not extensively evaluated the resident portion of the population (Larry Lockard, pers. comm.,, U.S. Fish and Wildlife Service, 2005). Brook trout are present in Rock Creek and may compete or hybridize with bull trout. Brook trout are especially prevalent in the lower reaches downstream of the canyon section (see Figure B5). Risk of hybridization between brook trout and bull trout remains relatively high, though it has not been evaluated in this system.

The investigations conducted since 2000, primarily by the Avista program, have greatly advanced our understanding of the importance of migratory bull trout in Rock Creek and Cabinet Gorge Reservoir. Contrary to earlier beliefs, evidence is mounting that may show that migratory bull trout are an important component of the Rock Creek local population and appear to play a role in maintaining the persistence of the core area population. That role is apparently being enhanced and may be enhanced further by the trap and transport program and/or any eventual fish passage around Cabinet Gorge and Noxon Rapids dams. Perhaps these results are not surprising, given the known previously depressed status of the bull trout population in this core area.

Status of Habitat Conditions for Bull Trout in Rock Creek

Rock Creek is classified as a fourth order drainage (see Figure B4). The headwaters are in the southwestern end of the Cabinet Mountains. This watershed drains approximately 21,162 acres. Peak flow for Rock Creek is estimated to be between 200 and 300 cubic-feet-second (cfs). Base flow is approximately 2 cfs with a 7-day, 10-year low of 0 cfs (MDEQ and USDA Forest Service 2001). The mainstem Rock Creek consists of C and D Rosgen channel types through much of its lower reaches. The lower section is typified by low gradient, approximately 2%, through much of its length. The watershed contains several areas of sensitive landtypes, which are presently chronic sediment sources. This has resulted in a large volume of bedload and reduced transport efficiency. The trophic condition of the watershed is characterized by low overall primary and secondary productivity (USDA 2000).

The East and West Forks of Rock Creek have gradients of 10.4 and 7.3%, respectively (MDEQ and USDA Forest Service 2001). Rubble and gravel are the co-dominant substrate in the lower reaches associated with large boulders and cobble (WWP 1996; MDEQ and USDA Forest Service 2001). Steeper sections of the mainstem and the East and West Forks are dominated by cobbles (WWP 1996). Spawning habitat is limited in some reaches to isolated pockets of gravel behind stable debris or boulders.

In general, habitat conditions in the Rock Creek watershed are degraded with relatively high levels of sediments present in the spawning gravels and periods of stream flow intermittence occurring in many years (MDEQ and USDA Forest Service 2001). The past occurrences such as climate change, riparian logging, road building, geologic events, and the 1910 fire have likely degraded habitat and contributed to Rock Creek's limited habitat conditions for bull trout (MDEQ and USDA Forest Service 2001).

Riparian harvest, roads, and other management activity affect lower sections of the stream. The upper sections of the East and West Forks are less impacted. The riparian areas of mainstem Rock Creek have been harvested on much of the private land. The drainage network in Rock Creek has been altered by past road construction. Road 150 runs adjacent to Rock Creek for much of its length. There are 46.1 miles of road within the Rock Creek drainage. This is a road density of 1.5 mi/mi^2 in the Rock Creek drainage. The road density on sensitive land types is 2.2 mi/mi^2. Impacts to the riparian area in Engle Creek also are extensive.

Engle Creek has been impacted by fire and past riparian harvest throughout much of its length. There has been extensive riparian harvest in the lower reaches of Rock Creek as well. The whole watershed was affected by the fires of 1889 and 1910, and although forest vegetation has recovered to a large extent, latent effects from these fires may still be occurring in the watershed. There have been 2,484 acres of regeneration harvest on the Forest since 1970. Equivalent clearcut acres (ECA) for the drainage are approximately 12.7%.

Typically, intermittent stream flow seasonally isolates Rock Creek from the reservoir. The cause of the dewatering of segments of Rock Creek is uncertain, and therefore, it is unknown whether it is a natural or man-caused condition. Mainstem Rock Creek lacks surface flow during periods of base flow for the majority of its lower 3.4 miles. West Fork Rock Creek flows perennially from the falls, approximately 1.6 miles upstream from the confluence of the East Fork Rock Creek, downstream to about 0.2 mile upstream from the confluence. East Fork Rock Creek flows perennially, but loses water near the confluence (Watershed Consulting 1997).

The culvert under State Highway 200 has been identified as a potential barrier at some flows (see Table B3). Natural barriers have been identified including the ephemeral lower reaches of Rock Creek downstream of the canyon and a waterfall limiting upstream movement on the East Fork (see Figure B5).

Watershed Consulting (1997) identified the stream banks as a major source of sediment in their surveys. Watershed surveys have consistently identified three areas contributing sediment to the Rock Creek system. They include Engle Creek, a slump in the West Fork Rock Creek and the stream banks in the mainstem Rock Creek. Sampling done by Watershed Consulting (1997) measured mean percent surface fines at 10%, 6.8%, and 1.0% in Rock Creek, the West Fork and the East Fork, respectively. Washington Water Power measured similar levels of fines in Rock Creek with a mean of 10% (see Table B3; WWP 1996). Mean percent fines in the West Fork were higher at 24% (WWP 1996).

Off-channel habitat is naturally limited in the Rock Creek drainage. The stream has access to its floodplain but there is limited complexity and potential for backwater areas particularly in the areas of steeper gradient. Connectivity with the Rock Creek floodplain has not been altered by past management activity.

Pool frequency is low in the Rock Creek drainage (see Table B3). Most of the available fish habitat is in the form of runs and riffles (WWP 1996). This condition holds true in the low gradient portions of the mainstem Rock Creek. Given the overall low frequency of pools, pool quality also is very low. Stream surveys have consistently identified low pool frequency as a potential aspect for habitat improvement. Width/depth data for pools has not been collected. Width/depth data has been collected for riffles in the mainstem, East Fork and West Fork by Watershed Consulting (1997). The mean ratios are 29, 37, and 19 respectively. Since the dominant habitat type in the Rock Creek system is riffle and glide habitat types this is an accurate description of available habitat.

The mainstem of Rock Creek contains a relatively low amount of large woody debris (LWD) relative to other watersheds in the lower Clark Fork River drainage (see Table B3; WWP 1996). The potential for future recruitment of LWD is greatly reduced due to past riparian timber harvest and the location of existing roads. Little of the large woody material that enters the active channel is retained. Despite the low abundance of LWD, the thermal regime appears to be functioning appropriately. Low water temperatures ranged from 32 °F (0.3 °C) in November up to 54 °F (12.1 °C) in August in 1994 (see Table B3; WWP 1996).

In summary, the inherent difficulties faced by migratory bull trout persisting in a watershed such as Rock Creek, is in part a result of intermittent flow conditions, which may have been exacerbated by man-caused impacts to the habitat. Reduced complexity and quality of the instream and riparian habitat and low frequency and quality of pools are problematic for the maintenance of spawning runs of large migratory adult bull trout that are uniquely vulnerable during the low flow period in the early fall. These issues are exacerbated by competition from non-native species and increased human use (including angling, poaching, and harassment). Much of the available habitat in Rock Creek is marginally suitable for large, migratory fish. Most habitat components in the Rock Creek drainage are functioning at-risk for bull trout; however, a few important habitat attributes such as stream temperature and substrate embeddedness are functioning appropriately (see Table B4). Another reason for concern is the frequency with which the stream goes dry at low flow. As the record from 2000 through 2005 indicates, access to upper reaches of Rock Creek is likely denied for migratory bull trout in many years. This is due primarily to intermittent flows in the lowermost reach and much of the midsection in most years. In addition, loss of juvenile bull trout migrating downstream (entrainment, etc.) and blocked upstream passage for adults over Cabinet Gorge Dam, further limits productivity. Both of these issues are currently being partly overcome by the Avista trap and transport program, but the level of efficiency is unknown.

Marginal rearing conditions in Cabinet Gorge Reservoir are an additional constraint (WWP 1995a). The combined conditions support an integrated rating of species and habitat conditions of functioning at unacceptable risk (see Table B4). Though the situation may be viewed as improving, the low habitat complexity, limited suitable spawning and rearing habitat, stream intermittence, and the rarity of the migratory life history form indicate bull trout in the Cabinet Gorge Reservoir and the Rock Creek local population are still largely isolated and at high risk of extirpation due to random events (MDEQ and USDA Forest Service 2001).

Finally, fine sediment levels in Rock Creek are functioning at-risk for bull trout. It ranges from 10 to 49 percent in areas of bull trout spawning and incubation, which are limited in the watershed, particularly for adfluvial-sized adult fish. The high levels are likely due to past logging activities; however, background levels are unknown prior to intensive forest management and associated road construction. Under current baseline conditions, fine sediment levels deposited in spawning areas could be limiting reproduction. Nevertheless, it is difficult to determine if this is a limiting factor given several other habitat parameters are functioning at-risk, especially the nearly annual intermittent flows in the lowermost reach and much of the midsection in most years.

Factors Affecting Species Environment Within The Action Area (Population And Habitat Factors)

The Montana Bull Trout Scientific Group (1996b) documented the risks to bull trout in the lower Clark Fork River. That documentation was expanded in the Draft Bull Trout Recovery Plan (USFWS 2002c) and updated in the core area status assessment (USFWS 2005a). Fragmentation of the historic migratory populations in the lower Clark Fork River was considered the highest risk, but this threat has been addressed with consolidation of four core areas into one (Lower Clark Fork Core Area) as a result of the success of the Avista fish passage program. Past fragmentation has reduced potential genetic interchange and accessibility to tributary systems. The migratory component of these smaller, isolated units was at a higher risk of extirpation due to their limited abundance and available range. Other risks to restoration include environmental instability from landslides and rain-on-snow events, thermal problems related to increased summer water temperatures, rural and residential development, and illegal bull trout harvest. The MBTSG (1996b) concluded adfluvial bull trout in Cabinet Gorge Reservoir were at risk because of fragmented habitat, migration barriers, small available habitat areas, degraded habitat conditions, low predicted survival to emergence, threats of hybridization with brook trout, competition and predation from other introduce fishes, and low bull trout abundance. Subsequent analyses reinforced that conclusion (USFWS 2005b).

The Cabinet Gorge Reservoir habitat is suitable for nonnative species such as walleye (*Stizostedion vitreum*) and northern pike (*Esox lucius*). These predatory species likely compete with adult bull trout and prey on juvenile bull trout. Brown trout are another nonnative species with potential impacts on bull trout. Since bull trout and brown trout spawning areas overlap in the Bull River and brown trout spawn later than bull trout, bull trout redd disturbance may be a factor (Pratt and Huston 1993).

The FERC BA (FERC 1999) concluded, based on the licensee's studies (WWP 1995a, 1995b, 1996), "it is now highly likely that many of the adfluvial bull trout populations that historically existed in the reservoir's tributary streams, and were presumed to be maintaining a remnant population, in fact no longer exist." In other words, the bull trout observed in the tributary streams were either small resident fish or juvenile fish remaining from very few spawning adfluvial fish from the reservoir. The restoration plan for bull trout in the Clark Fork River basin in Montana (MBTRT 2000) and the conservation plan for bull trout in Lake Pend Oreille (LPOBTWAG 1999) identify the need to reconnect the Lake Pend Oreille and lower Clark Fork River areas to accomplish restoration goals. Threats and limiting factors identified in the reports included Cabinet Gorge Dam as a barrier to migratory fish movement.

Ongoing mitigation tied to the relicensing of the Avista (formerly known as WWP) Clark Fork FERC Project number 2058 includes the Native Salmonid Restoration Plan. The Native Salmonid Restoration Plan strives to address issues related to fish passage and restoration efforts for native salmonids on the lower Clark Fork River. There are two primary objectives relative to fish passage. One objective is to determine whether passage at Cabinet Gorge Dam would effectively increase the viability of bull and westslope cutthroat trout populations in the lower Clark Fork River, its tributaries, and Lake Pend Oreille. The other objective is to re-establish connectivity for migratory native salmonids. Both are essential components to restoration of native salmonids. As described in the preceding sections of this biological opinion, Avista investigations conducted since 2000 have proven that the migratory life history component of bull trout in Rock Creek and the Bull River is still viable and the trap and transport program is currently enhancing the status of migratory fish in the Lower Clark Fork Core Area (Lockard and Hintz 2005). Additional mitigation measures are being used to support the Rock Creek Watershed council and implement watershed research to describe Rock Creek bull trout and available habitat and restoration to benefit bull trout.

Cooperative efforts between Avista, MFWP, and local watershed groups are providing long-term habitat protection through land acquisition, conservation easements, and watershed restoration. Bull trout occurrence in the Lower Clark Fork Core Area could increase as a result of such activities. These efforts are highly important to the eventual recovery of bull trout in the lower Clark Fork River system once fish passage at Cabinet Gorge, Noxon, and Thompson Falls dams is attained permanently. The primary restoration actions needed to restore the original migratory life history functions of bull trout in the lower Clark Fork River system is habitat improvement and fish passage at the dams. Once this is accomplished, it will help define the biological contribution of Rock Creek bull trout to the historically larger bull trout Lake Pend Oreille Core Area.

Environmental Baseline Of Designated Critical Habitat

On September 26, 2005, the Service published notice in the Federal Register the final rule designating critical habitat for bull trout for the Klamath River, Columbia River, Jarbridge River, Coastal-Puget Sound, and Saint Mary-Belly River populations of bull trout (FR 70, No 185, 56211-56311). This final designation totals approximately 3,828 miles (6,161 kilometers) of streams, 143,218 acres (57,958 hectares) of lakes in Idaho, Montana, Oregon, and Washington, and 985 miles of shoreline paralleling marine habitat in Washington. There are 3 critical habitat units located in Montana: 1) Clark Fork River Basin with 1,136 miles of streams and 31,916 acres of lakes/reservoirs; 2) Kootenai River Basin with 56 miles of streams and 1,384 acres of lakes/reservoirs; and the Saint Mary-Belly River Basins with 37 miles of streams and 4,107 acres of lakes/reservoirs (note that a portion of the Clark Fork River Basin is in northern Idaho, so the numbers do not add up to the totals previously listed for Montana). Note that the final rule designating critical habitat for bull trout adopts the use of *local population, core area, and major genetic group* (as defined in the memorandum consistent with the draft recovery plan) (page 36258 in FR 70, No.185, 56211-56311).

Based on the current life history, biology, and ecology information of bull trout, the Service has identified the bull trout's PCEs (FR (FR 70, No 185, 56211-56311). The following are the PCEs for bull trout: 1) stream temperatures from 32 to 72^0 F; 2) complex stream channels influenced by large woody debris, pools, and undercut banks that result in various depths, velocities, and instream habitat structures; 3) substrates of sufficient size, amount, and composition for juvenile and egg survival; 4) natural stream flows or artificial flows that are regulated in order to support bull trout; 5) springs, seeps, and groundwater sources, and subsurface flow that contributes to the water quantity and quality as a cold water source; 6) migratory corridors that support unimpeded movement between spawning, rearing, foraging, and over-wintering areas; 7) adequate food base of terrestrial and aquatic insects and forage fish; and 8) permanent water sufficient to provide the quality and quantity for normal reproduction, growth, and survival.

Action agencies authorizing activities within lands occupied by bull trout are mandated by the Endangered Species Act of 1973, as amended, to consider the environmental baseline in the action area and effects to bull trout that would likely occur as a result of management actions. To that end, agency biologists use the four biological/population indicators and the 19 physical habitat indicators in the Framework for bull trout to assess the environmental baseline conditions and determine the likelihood of take per interagency guidance and agreement on section 7 consultations on the effects of actions to bull trout (USDA and USDI 1998a, 1998b). Analysis of the 19 matrix habitat indicators provides a very thorough analysis of the existing habitat condition and potential impacts to bull trout habitat.

While assessing the environmental baseline and potential effects to bull trout as a species, agency biologists have concurrently provided a companion analysis of effects to the PCEs for proposed bull trout critical habitat and related habitat indicators (Appendix I). This companion analysis shows that the matrix analysis for environmental baseline conditions thoroughly addresses the PCEs for baseline conditions of designated critical habitat for bull trout.

The proposed action would occur in a portion of the Lower Clark Fork Core Area that contains 135 stream miles and 735 lake acres of designated critical habitat for bull trout and of that total Rock Creek contains 2.88 miles.

Only the Rock Creek watershed has designated critical habitat that lies within the action area. Cabinet Gorge Reservoir, for which Rock Creek is a tributary and which provides foraging, migratory, and over-wintering habitat for Rock Creek bull trout (Pratt and Huston 1993), does not contain critical habitat. Bull River, which is a tributary to Cabinet Gorge Reservoir and which is the most important bull trout stream in the lower Clark Fork River, does contain critical habitat, but is not within the action area.

Rock Creek from its confluence with Cabinet Gorge Reservoir upstream 7.1 river miles (rmi) to a natural barrier provides spawning and rearing habitat for Rock Creek bull trout. Designated bull trout critical habitat was identified in the Rock Creek watershed and published in the final rule (FR 70, No 185, 56211-56311). Bull trout critical habitat in the Rock Creek drainage is designated at five separate locations. Four sections are located on the mainstem and one section is located on the East Fork (above the confluence with the West Fork). The total amount of designated critical habitat is 2.88 miles (see Figure B4 and below).

Designated Critical Habitat Stream Miles (2.88 miles):

	Length	**Location**
Section 1	45 rmi	0 - .46 rmi
Section 2	66 rmi	.8 - 1.45 rmi
Section 3	1.11 rmi	2.53 - 3.64 rmi
Section 4	43 rmi	4.81 - 5.25 rmi
Section 5	.23 rmi	6.05 - 6.28 rmi

All five sections listed above identified as critical habitat in Rock Creek contain some, or all, of the PCEs that support bull trout. However, the two seasonally dewatered segments of the mainstem of Rock Creek encompass all or portions of critical habitat sections 1, 2, 3 and 4. The extent of critical habitat area that is affected annually depends on year-round stream flow conditions. In most years all PCEs are negatively impacted to some degree due to the seasonal lack of connectivity preventing upstream movement of adult migratory bull trout. Annual sub-surface stream flow conditions in summer and early fall severely impact the ability of these fish to find suitable spawning areas. Consequently, it is likely that reproduction in most years is significantly limited. As expected, the functioning at-risk environmental baseline conditions for the bull trout habitat indicators in the matrix analysis (see Table B4) confirm the deficient environmental baseline conditions for designated critical habitat in Rock Creek.

Of interest, in 2004 when adult migratory bull trout were radio-tracked in Rock Creek, several relocations throughout the stream channel were documented. Of 17 relocations, 11 occurred in designated critical habitat areas and of the six bull trout redds counted in 2004, two were located in critical habitat, one in section 1 and one in section 2. The four remaining redds were located in close proximity in a non-designated reach higher in the watershed between sections 4 and 5 in the East Fork Rock Creek tributary.

Summary of environmental baseline for designated critical habitat

Based on the site specific environmental baseline habitat conditions of bull trout (see Table B4) and linkage to the PCEs considering those habitat indicators described in Appendix I and other factors as necessary, all PCEs are in less than optimal condition for all five sections designated as critical habitat for bull trout. Furthermore, not all the stream area designated as critical habitat in the Rock Creek mainstem contain all the PCEs as indicated by the overlap of critical habitat sections and the annually dewatered areas. Only in those years where stream flows in the mainstem exist year-round do PCEs (albeit degraded) function to provide for one or more of the two life history functions (resident and migratory) of bull trout. Since the listing of bull trout in 1998, only the year 2004 had year-round flows in the mainstem and this was the first year since 1986 that migratory bull trout were confirmed in Rock Creek.

EFFECTS OF THE ACTION

"Effects of the action" refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action that 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 those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consultation.

General Effects Of Mining Operations

The U.S. Congress passed the Mining Laws Act of 1872, granting top land-use priority to mineral extraction on all public lands not specifically withdrawn from mineral development. As a result, some 741 million acres (68% of all public land) are open to mining (Sheridan 1977 in Nelson et al. 1991). Extraction of minerals in the United States has frequently deleteriously affected fishery resources in the western United States, and continues to degrade salmonid habitat in many areas (Nelson et al. 1991).

Underground mining and the associated above ground development can potentially have negative effects on bull trout should water quality and quantity be altered. The five specific habitat factors that could be affected are the following:1) stream temperature and dissolved oxygen, 2) stream flow, 3) sediment, 4) large woody debris, and 5) water chemistry. Several studies have shown that underground mining operations and their facilities can increase stream temperatures, create acid discharge, and mobilize toxic heavy metals, produce sediment, create barriers to fish movement, alter stream channel morphology, and alter stream flow (Nelson et al. 1991; Lee et al.1997; Harvey and Lisle1998).

<u>Stream temperature/dissolved oxygen and stream flow</u>

Water quality (e.g., water temperature and dissolved oxygen) can be altered by activities associated with mining. Stream temperature is affected by eliminating stream-side shading, disrupted subsurface flows, reduced stream flows, and morphological shifts toward wider and shallower channels with fewer deep pools. Loss of streamside vegetation reduces the input of material to the stream that would become or create cover for fish in the future as well as result in changes in water temperature regulation (Lee et al. 1997). Dissolved oxygen can be reduced by low stream flows, elevated temperatures, and increased fine inorganic and organic materials that have infiltrated into stream gravels retarding intergravel flows (Chamberlain et al. 1991). Water quantity can be affected by direct removal of water during offstream operations (Martin and Platts 1981).

<u>Sediment</u>

Soil and site disturbance inevitably occurring during mill construction and use and other underground mining activities are often responsible for increased rates of erosion and sedimentation to streams (Martin and Platts 1981; Lee et al. 1997). The site disturbance is associated with many activities including vegetation removal from the site, vehicular access to the site, installation of stream crossing structures, removal of overburden from the site, re-routing or diversion of streams, construction of settling ponds, and removal and processing of valuable minerals. The amount of sediment actually delivered to streams will depend on site specific factors. The deposition of fine sediments in salmonid spawning and rearing habitat increases mortality of bull trout embryos, alevins, and fry (Shepard et al. 1984; Pratt 1984; Fraley and Shepard 1989; Rieman and McIntyre 1993). Sedimentation effects on salmonids can vary significantly depending on salmonid species, stream channel morphology, and stream flows (Harvey and Lisle 1998). For a substrate oriented salmonid like juvenile bull trout, deposition of fine sediments filling spaces between rubble could have a very negative effect on survival, especially overwinter survival. This could reduce the amount of rearing habitat available to juvenile and subadult bull trout as well as adult bull trout. Suspended sediment also can have both acute and sublethal effects on salmonids (Sigler et al. 1984). Suspended sediment levels have to be very high to cause lethal effects, so sublethal effects such as reduced growth are much more likely to occur. Reduction in growth in various salmonid species has been found to occur at suspended sediment concentrations of 100 to 300 mg/l (Sigler et al. 1984; McLeay et al. 1987).

Many mining projects involve road construction, re-construction and use, which results in further adverse effects. Roads built in forested watersheds can cause mass soil movement and surface erosion, resulting in soil creep, slumping, earthflows, and debris avalanches (Meehan 1991).

Roads are recognized as a long-term source of sediment for extended periods even after erosion control measures have been implemented (Furniss et al. 1991; Belt et al. 1992). Ground disturbance from road blading, particularly where the road is immediately adjacent to streams and at both intermittent and perennial stream crossings can result in elevated levels of sediment introduction. Ditch maintenance is another source of sediment delivery to streams. Increased erosion occurs within the ditch as a function of cleaning, pulling, or heeling, increased rate of slides in the cutslope (if the cutslope is undercut), and long-term risk of increased sedimentation from vegetation or ditch rock removal within the ditch. Delivery of available sediment to streams can vary substantially depending on the level of best management practices in effect on a given road (Belt et al. 1992). Installation of cross drainage structures and maintenance of buffers between the roads and the streams reduce sediment delivery to streams.

Other activities associated with road activities such as ditch maintenance, culvert cleaning, riprapping, crossing structure activities also may increase sediment delivery to streams. Snowplowing can result in increased erosion of the road surface and fill slopes as thawing occurs in the spring. Water flowing down ruts in plowed roads and water flowing off the road onto fill slopes are the primary cause of increased sediment delivery. Installation of new cross drainage features as well as cleaning existing ones can result in some short term increases in sediment delivery, but will help reduce long-term sediment delivery to streams during road maintenance activities.

Large woody debris

Because the supply of large woody debris to stream channels is typically a function of the size and number of trees in riparian areas, it can be profoundly altered by mining activities that remove vegetation in preparation for mining activities. Removal of streamside trees can greatly alter the amount of woody debris in streams over time (Sedell et al. 1988). Shifts in the composition and size of trees within the riparian area affect the recruitment potential and longevity of large woody debris within the stream channel. Large woody debris influences channel morphology, especially in forming pools and instream cover, retention of nutrients, and storage and buffering of sediment. Any reduction in the amount of large woody debris within streams, or within the distance equal to one site-potential tree height from the stream, can reduce instream complexity (Ralph et al. 1994). Large woody debris increases the quality of pools and provides hiding cover, slow water refuges, shade, and deep water areas (Hauer et al. 1999).

Ralph et al. (1994) found instream wood to be significantly smaller and pool depths significantly shallower in intensively logged watersheds. The size of woody debris in a watershed subjected to streamside tree removal in Idaho was smaller than that found in a relatively undisturbed watershed (Overton et al. 1993).

Water chemistry and contamination

Exposing rock strata to weathering and erosion through removal of vegetation and overburden can result in higher levels of metals in streams (Martin and Platts 1981). Metals such as arsenic, cadmium, zinc, copper, and mercury all pose risks for aquatic organisms depending on site-specific water chemistry. Combinations of several metals may pose greater risks despite concentrations for each being below its own toxicity threshold (Wels and Wels 1991). Generally, severe metal contamination is more associated with erosion from milled tailings and waste rock, or acid mine discharge associated with either open pit or underground mines.

Laboratory studies have shown that trout and salmon can detect low levels of metals and actively select lower metals concentrations when given the choice. Woodward et al. (1997) documented that Snake River cutthroat trout will avoid mixtures of cadmium, lead, and zinc. Additional tests documented avoidance behavior in cutthroat trout for copper (6 μg/l) and zinc (28 μg/l). Woodward et al. (1995) showed that brown trout avoided mixtures where copper and zinc were present in concentrations as low as 6.5 and 32 μg/l, respectively. Further, fish acclimated for 90 days to zinc at 55 μg/l, preferred lower concentrations (28 μg/l), when given the choice.

Field studies also have documented the avoidance of metal concentrations by wild fish. Spawning Atlantic salmon in New Brunswick displayed avoidance behavior of metals (primarily copper and zinc) at thresholds of 17-21 μg/l for copper mixed with 210-258 μg/l zinc originating from hardrock mining activities (Sprague et al. 1965; Saunders and Sprague 1967 both in Henry and Atchison 1991).

There may be effects to bull trout related to the various petroleum products commonly used in mining operations. Petroleum can cause environmental harm by toxic action, physical contact, chemical and physical changes within the soil or water medium, and habitat alteration. Oil spills have caused major changes in local plant and invertebrate populations lasting from several weeks to many years. Effects of oil spills on fish have been difficult to determine beyond the immediate losses in local populations. Drilling fluids, sometimes used in great quantities at mining sites, were found to be toxic to rainbow trout at concentrations less than 100 mg/L (Sprague and Logan 1979 in Nelson et al. 1991). Chemicals used in processing and recovery of metalliferous deposits may be toxic. Webb et al. (1976) reported the flotation reagents sodium ethyl and potassium amyl xanthate were highly toxic to rainbow trout.

While it is unlikely large numbers of fish inhabiting large, deep bodies of water would be killed by the toxic effects of spilled petroleum, fish kills may be caused by large amounts of oil moving rapidly in shallow waters such as shallow streams. Oil and petroleum products vary considerably in their toxicity, and the sensitivity of fish to petroleum varies among species. The sublethal effects of oil on fish include changes in heart and respiratory rates, gill hyperplasia, enlarged liver, reduced growth, fin erosion, impaired endocrine system, and a variety of biochemical, blood, and cellular changes, and behavioral responses (Weber et al. 1981). Therefore, a fuel spill into the stream related to a mining operation could directly poison bull trout or indirectly affect bull trout by poisoning invertebrate or vertebrate prey species.

Specific Effects Of Mining Operations On Rock Creek

Impacts related to water quality and quantity in the Rock Creek watershed because of the construction and operation of the Rock Creek mine, potentially, may adversely affect macro-invertebrates, and aquatic plants at some time during, or possibly, for some period of time following, the overall implementation of the project. Expected impacts to the aquatic community, should they occur, could include a reduction in numbers of individuals, changes in species composition, and a reduction in species diversity, primarily through alteration of the existing habitat conditions in Rock Creek.

Habitat fragmentation and isolation because of Cabinet Gorge and Noxon dams are the greatest risk to the persistence of the migratory form bull trout in the Lower Clark Fork Core Area (MBTSG 1996b), although this threat is being addressed through the Avista fish passage program (Appendix D). Currently, Rock Creek bull trout are dominated by the resident life history form and are considered at high risk of extirpation from localized catastrophic events due to the limited area inhabited by bull trout and the relatively low availability of high quality habitat in Rock Creek (MDEQ and USDA Forest Service 2001). If direct loss of individuals or indirect adverse effects from additional habitat modifications occurs, this could reduce the likelihood of persistence of both forms of Rock Creek bull trout. Such effects increase the risk of extirpation of Rock Creek bull trout; however, the effect on the Lower Clark Fork Core Area population would be minor because Rock Creek's contribution to the core area population is relatively small. Some of the more important local populations that contribute to the Lower Clark Fork Core Area population are Bull and West Fork Thompson rivers and Graves, Vermillion, Prospect, and Fishtrap creeks.

Additional risks related to the mine could further compromise the continued existence of Rock Creek bull trout. For example, changes in habitat conditions due to implementation of the mine may favor non-native brook trout. In the western United States, where brook trout have been introduced into bull trout habitat, habitat degradation generally favors brook trout, thus yielding a competitive edge over bull trout (Rieman and McIntyre 1993). When brook trout interbreed with bull trout, offspring are most often sterile; however, there has been some evidence of F2 hybrids in other drainages, an indication of successful breeding of hybrid offspring (Hansen 2001). At present, brook trout are found in small numbers only in the lower reaches of Rock Creek.

Predicting specific effects due to habitat changes that influence the stability, growth, and survival of a bull trout population is challenging. Determining what habitat factors may be limiting in a system and at what threshold is difficult when considering the influence of other variables like productivity in the watershed, climate, geology, geomorphology, dominant-life history form, competition, and predation. Rieman and McIntyre (1993) indicated it is improbable to identify a minimum habitat condition that will maintain a population, neither is it possible to identify precise tolerance limits for habitat characteristics that can be set to clearly maintain bull trout populations. Moreover, they use fine sediment as an example of a habitat characteristic that is often negative, but indicate that it's not possible to define precise tolerance thresholds in a watershed that are known to affect population levels.

Given the difficulty of predicting specific effects to a bull trout population, we have attempted to use the best information in the scientific literature and site specific technical information to set reasonable bounds or limits on fine sediment that may be delivered to Rock Creek during implementation of the proposed action. The scientific literature provides information of the negative influence of fine sediment, which causes increasing fish egg mortality as more and more fine sediment accumulates and covers the eggs. It stands to reason that efforts should be made to limit the amount of sediment delivered to the stream in order to avoid potential egg mortality. The thresholds we considered seem reasonable to us and provide initial starting points that should be verified, refined, or changed as more information on fine sediment becomes available through site-specific monitoring or through other scientific studies pertaining to this subject. Consequently, this can be viewed as an adaptive approach that measures effects through time and adjusts bull trout minimization measures accordingly in order to be more effective at minimizing potential effects.

Stream temperature and groundwater influence

As part of this project, right-of-way clearing within the riparian area is expected to facilitate road, powerline and pipeline construction and maintenance (see Figure B5). Previous logging activities have already reduced existing shading to the stream, and these activities are expected to add to that cumulative loss (USDA Forest Service 1999, MDEQ and USDA Forest Service 2001). Additional loss of riparian vegetation may affect stream temperatures within Rock Creek, which are currently functioning appropriately for bull trout. However, an unaltered vegetation zone would be left between Rock Creek and the road and utility corridors where possible to protect bull trout habitat. Further, the amount of clearing in the riparian zone is relatively minor (<1.5 acres) and related primarily to construction or re-construction of bridges and pipeline crossings. Therefore, the small incremental loss of associated shade would not cause a dramatic temperature change or even a slight change that could be measurable. In other words, stream temperature is expected to be maintained as functioning appropriately for bull trout after clearing of vegetation in the right-of-way utility corridor.

The loss of groundwater to interception by the mining activities may influence stream temperatures in Rock Creek (USDA Forest Service 1999, MDEQ and USDA Forest Service 2001). If impacts to seeps and wetlands in the area occur, it can be expected to alter groundwater flows, which may affect stream temperature. Groundwater provides a cooling effect and is important to maintaining colder stream temperatures essential for high quality spawning and rearing habitat. The loss of groundwater recharge and upwellings resulting from the removal and discharge of between 1,700 and 2,046 gallons-per-minute (gpm) during mining operations is expected to occur for the life of the mining operations and possibly after mine closure. Groundwater upwelling has been shown to be important to the success of spawning and successful incubation of eggs to larval stage (Baxter and Hauer 2000). The loss of groundwater and resulting effect on stream temperature, if any, is difficult to predict. Therefore, close stream temperature monitoring will be needed and has been proposed as a project component in order to detect any mining induced changes in the groundwater system in terms of water quantity, water temperature, and water chemistry budgets in Rock Creek.

The threat to overlying lakes and streams is associated with groundwater drainage stress. Cliff Lake and Moran Basin receive much of their inflow from groundwater and subsequently recharge the groundwater system down gradient (Gurrieri 2001). To reduce risk of groundwater drainage stress to low, a buffer zone of 1,000 feet around Cliff Lake would be maintained. In addition, monitoring subsurface hydraulic conditions would allow early detection of potential mining impacts and grouting of groundwater inflows to the mine. The Corrective Action Plan would identify measures to be taken should monitoring identify potential water resources issues. Hydrogeologic information collected during evaluation adit construction would be used to develop these measures and evaluate their effectiveness (MDEQ and USDA Forest Service 2001).

Buffer zones are assumed effective in reducing the impact to overlying lakes and down gradient streams, but mine related effects to groundwater flow and chemistry are very difficult to predict reliably. The case studies of other mines presented by Gurrieri (2001) provide evidence of the unpredictable nature of groundwater flow in fractured rocks. In this instance, the Troy mine serves as a close analog to predict impacts from mining because of its similar location, climate, geology, and structure (Gurrieri 2001). Disruptions of surrounding surface water bodies has not been documented, but lakes or perennial streams do not directly overly the Troy mine and intensive monitoring has not been conducted. Gurrieri (2001) concludes the likelihood of impact would be reduced to low for both lakes given the proposed mitigation.

An additional risk to down gradient streams is post-closure leakage of groundwater containing dissolved metals from the mine to the surface. After mine closure, groundwater from the mine could leak through rock fractures down gradient to the surface and into streams. Because of high risk of impact to North Basin and South Basin Creeks, 1,000-foot buffer zones near ore outcrops and post-closure mine dewatering would be maintained to reduce risk to these down gradient streams. Such mitigation would reduce the likelihood of impact to low risk (Gurrieri 2001).

The Forest Service also recently completed a geotechnical assessment analyzing the effectiveness of the proposed mitigation, including buffer zones, for the Rock Creek Project. Final Geotechnical Assessment Report Sinkhole Development at the Troy Mine and Implications for the Proposed Rock Creek Mine, Lincoln and Sanders Counties, Montana (USDA Forest Service 2006). This study reports that the Rock Creek Project buffer zones were "designed to protect the hydrologic integrity of the potentiometric surface near Cliff Lake (1,000-foot-buffer zone), and to prevent hydro-fracturing of bedrock in near surface (shallower than 450 feet) and near outcrop areas (nearer than 1,000 feet laterally) in order to prevent the formation of new surface seeps and springs during flooding of the mine workings at closure." (USDA Forest Service 2006, pg 18). The study also reports that "Buffer zones under lakes and near faults and outcrop zones area expected to be the most effective mitigations for reducing impacts to surface water bodies." (USDA Forest Service 2006, pg 18-19).

The only certain mitigation to avoid post-closure leakage of dissolved metals to the surface is mine dewatering after closure. However, this would have to be done in perpetuity, and mine dewatering after closure would maintain the groundwater drainage stress on overlying lakes and streams since dewatering and adit plugging are mutually exclusive. If the mine is left to passively drain from the adit, the mine would flood to the level of the adit and possibly discharge to the North Basin and Copper Gulch, tributaries to the Bull River system. Again, 1,000-foot buffer zones near ore outcrops and post-closure mine dewatering would be maintained for these down gradient streams. Such mitigation would reduce the likelihood of impact to low (Gurrieri 2001). Based on this information, the Service does not anticipate adverse impacts to bull trout in the Bull River drainage. Indeed, at the nearby Troy Mine, Revett has an excess of 20 years of water quality data showing no change in aquatic life in Lake Creek.

Sedimentation

The most obvious direct impact of the construction and operation of the Rock Creek Mine to bull trout is the potential for an increased level of fine sediment entering the stream during the 5-year construction phase. Activities associated with the development of the mine include road construction, road reconstruction, bridge and culvert replacement, alteration of existing roads to conform to Best Management Practices Standards (BMPs), and construction and development of tailings ponds, adit and mill sites, powerlines, and pipelines.

The highest levels of sediment loading are expected to occur during the 5-year construction period with significantly decreasing levels of additional sediment entering the stream over the 35-year operating life of the mine. The increase in sediment loading is estimated to be 46% in the West Fork of Rock Creek, 20% in the East Fork of Rock Creek, and 38% overall for the entire Rock Creek watershed (USDA Forest Service 1999, MDEQ and USDA Forest Service 2001). These values are probably over estimates and likely present a worse-case scenario because of the parameters used in the modeling evaluation and because the evaluation did not include the proposed sediment abatement mitigation activities, which would occur before, during, and after construction. Further, sediment loading during this period would likely happen in pulses of short duration and be mainly localized to certain segments of particular reaches. The overall area affected would be confined to the mainstem Rock Creek and West Fork Rock Creek nearest the mine facilities and utility corridors. Areas upstream, such as the above mill site, which includes most of East Fork Rock Creek, would be largely unaffected. Only a few hundred yards of East Fork Rock Creek are potentially downgradient from the mill site.

All roads used during mine operation between the mill, the mine, the paste plant, the water treatment facility, the highway, and the rail loadout facility would be upgraded and either paved or graveled. This would greatly reduce the chances of sediment delivery to Rock Creek due to the increased traffic on FDR No. 150. A portion of FDR No. 150 and the parking lot of the waste water treatment facility will be re-located away from Rock Creek in year two of the construction in order to keep mine traffic away from Rock Creek. In addition, access restrictions would be in place along FDR No. 150B to mine-related traffic only. Under-sized culverts would be replaced as needed, which should aid fish passage. A vegetation management plan and all BMPs would be detailed and would have to be approved in the permit application. A field review would be required by agency hydrologists/soil scientists to identify additional site-specific BMPs after facilities and roads have been staked in the field but prior to construction.

To mitigate for unavoidable sediment impacts, there is a requirement for 114 acres of sediment reduction work to be accomplished (MDEQ and USDA Forest Service 2001).

Sampling of sediment composition was conducted by Washington Water Power (WWP 1996) in the Rock Creek watershed and is the best available information and applicable as an indicator of potential impacts to bull trout. Fine sediment levels were sampled using McNeil hollow core samplers (McNeil and Ahnell 1964) at identified spawning sites and embryo survival to fry emergence for bull trout was estimated based on equations from Weaver and Fraley (1991). Sampling of mainstem Rock Creek was limited to one reach (reach 2) because it was not possible to follow sampling protocol as spawning gravels were restricted to small depositional areas behind boulders and stream obstructions. The East Fork was not sampled due to these same protocol requirements; however, two reaches were sampled in the West Fork Rock Creek (WWP 1996).

Results from the WWP sediment surveys in the Rock Creek watershed indicated the median percent fine sediment for spawning substrate in the mainstem was 43 percent (WWP 1996). Predicted embryo survival to emergence for bull trout was 18 percent, a relatively low value when compared to the lower Clark Fork River drainage average value of 33 percent. The West Fork Rock Creek median percent fine sediment for spawning substrate averaged 27 percent (range 24-28 percent) and predicted bull trout embryo to emergence survival averaged 40 percent, which was higher than the lower Clark Fork River average (WWP 1996).

At present, fine sediment levels in mainstem Rock Creek, West Fork Rock Creek, and East Fork Rock Creek are functioning at-risk for bull trout spawning (MDEQ and USDA Forest Service 2001), signifying that the present amount of fine sediment in spawning substrate allows the current Rock Creek bull trout population to persist under these conditions, but the population may not improve unless the levels of fine sediment decrease to a point where survival of bull trout eggs would increase. Furthermore, very little spawning habitat is available in Rock Creek; and therefore, any incremental increases in levels of fine sediment may negatively impact spawning success because high levels of fine sediment in spawning gravels are known to lower the survival of salmonid eggs to the emergence stage (Weaver and Fraley 1993). High levels of fine sediment at or above certain thresholds (more than 30% of materials less than 6.4 mm) result in embeddedness associated with sharp declines in juvenile bull trout densities (Shepard et al 1984). The mainstem Rock Creek predicted bull trout embryo to emergence survival of 18 percent is low. Very little spawning area is available in the mainstem and, at present, most bull trout redds (nests made in gravel where eggs are deposited) of the few migratory fish that have entered Rock Creek spawned in the area of the confluence with the West Fork Rock Creek, which is just downstream of the mine site. Evidence of some spawning does occur in the lower mainstem in an area known locally as the Canyon Reach (see Figure B5).

The expected increase in sediment loading during construction is estimated to be 46% in the West Fork of Rock Creek, 20% in the East Fork of Rock Creek, and 38% overall for the entire Rock Creek watershed based on the Forest's R-1 WATSED modeling outputs (USDA Forest Service 1999, MDEQ and USDA Forest Service 2001). A portion of this sediment will be fine sediment that will be deposited in these spawning areas. How much fine sediment that is deposited in these areas will be difficult to predict because some substrates are more likely to accumulate fines than others. Furthermore, the precise effect on the local bull trout population is difficult to predict because some populations are more sensitive than others. However, any significant increase in fine sediment levels in bull trout spawning areas will most likely have negative effects on productivity of bull trout (Reiman and McIntyre 1993). In order to determine the extent of increase in fine sediment due to project-related activities, annual monitoring of substrate composition will be necessary during and after the five year construction period.

Sedimentation can increase substrate embeddedness and result in decreased aquatic insect production and diversity. Juvenile bull trout feed primarily on aquatic macroinvertebrates and the distribution of aquatic macroinvertebrates inhabiting running water environments is highly dependent on substrate particle size (Cummins and Lauf 1969). Increased levels of deposited sediment reduce the quantity of the food base for bull trout resulting in slower growth rates, higher mortality, and reduced fecundity.

An indirect effect of the proposed action relates to impacts of increased levels of sediment on physical features of stream habitat and the resulting effects of those impacts on prey availability and ultimately on bull trout fitness and survival. Such indirect effects may include changes in stream channel morphology and decreased availability and quality of interstitial spaces affecting rearing habitat, which could lower juvenile survival. Any habitat changes may be aggravated by a decreased availability of water supply to the stream caused by disruption of ground water and surface drainage patterns as well as direct withdrawal of water.

The actual sediment loading that would occur is difficult to determine because of the variability in travel distances to the creeks, unpredictable amounts of sediment generated by various activities, erosivity of the soil, the timing of sediment movement which relates to precipitation and weather, severity of soil and site disturbance, and the effectiveness of the sediment abatement measures. As a result of this uncertainty, the mine plan includes measures to address sedimentation. These measures include road construction BMPs, road paving, reconstruction and resurfacing, riparian vegetation buffers along roads and around the mill site, slash filter windrows on cut-banks and around culvert openings, downslope sediment traps, immediate hydro-seeding after soil disturbance, and other measures as appropriate (see Table 1, Forest Service BA, MDEQ and USDA Forest Service 2001 for a list of sediment mitigation components). Although these measures will not prevent sediment delivery to Rock Creek entirely, they can reduce sediment loading to a large degree, which would likely reduce the percentage of sediment generated (from those derived from the modeling outputs) from reaching the creeks. Further, the sediment mitigation plan is required to reduce annual fine sediment loading to Rock Creek by 400 tons prior to the end of the project construction period by mitigating two or more fine sediment sources in the drainage (mainstem Rock Creek and West Fork Rock Creek).

It is likely habitat impacts caused by an increase in sediment loading in the Rock Creek watershed would occur sometime during the first five years when site disturbance is greatest due to construction of roads and facility development. After this 5–year period, sediment levels would probably stabilize, most likely within two years, and gradually return to near pre-project conditions over some unknown period of time. The impact to bull trout spawning and rearing would likely be highest during these first five years of construction and then decrease as conditions stabilize. Monitoring of sediment levels combined with fish population monitoring would allow an approximation of the degree of impact. The Aquatics and Fisheries Monitoring Plan should require annual substrate sampling and evaluation, as well as long-term monitoring (minimum 10 years) of fine sediment levels to determine if BMPs and other mitigation measures are effective, or if higher than expected impacts to aquatic resources are occurring cumulatively. Corrective actions would be required to address known and potential sources of sediment delivery discovered during monitoring.

Large woody debris (LWD)

Although LWD is currently functioning appropriately for bull trout in Rock Creek, it is limited on the mainstem and future recruitment in the near-term is reduced presumably because riparian stands are comprised of younger aged trees due to past riparian harvest. On the other hand, the upper reaches of the East Fork Rock Creek have high levels of LWD and the West Fork Rock Creek has average instream loading of LWD.

The biological assessment (MDEQ and USDA Forest Service 2001) determined that LWD would not be affected by the project, and therefore, the current function of LWD would be maintained. This assessment is based, in part, on the joining and location of the utility and pipelines within the same corridor away from the riparian zone whenever possible. Also, a 300-foot vegetative buffer zone would be maintained around the mill site. Further, INFISH standards and guidelines (Standard MM-2) will be met with relocation of some activities and sediment mitigation measures. This standard is designed to avoid or minimize locating facilities in RHCAs where adverse impacts could occur to streams supporting inland native fish. Given the small amount of RHCA area that would be affected by the proposed project, it is very unlikely there would be a measurable effect on instream LWD and on future recruitment of LWD. It is more likely that in the mainstem Rock Creek LWD function would improve over the term of the project as younger-aged riparian stands of trees mature and increase the probability of instream LWD recruitment.

Water quality and chemical contamination

Mining activity may release available metals and add to baseline conditions. Increasing the concentration of dissolved heavy metals in soft water environments, such as Rock Creek (Rock Creek = 10 mg/l), can result in a corresponding increase in toxicity to fish. Fish are much more susceptible to metals toxicity in soft water environments (Nelson et al. 1991), and therefore, bull trout in Rock Creek would be more susceptible to toxicity if heavy metal concentrations should increase.

Groundwater infiltration of metals contamination to Rock Creek also may result from this project. Impacts to groundwater quality from waste rock seepage, tailings seepage, tailings impoundment structures and underground mine pool, during operations and upon closure of the mine, are expected. If the metals concentrations are elevated in the groundwater and then flow to Rock Creek, aquatic organisms may be adversely impacted.

The mine water treatment system would remove suspended solids, heavy metals, and ammonia nitrogen and nitrate/nitrite nitrogen in order to meet the requirements of the Montana Pollution Discharge Elimination System (MPDES) permit. Two nitrate removal systems would be installed, a biotreatment and reverse osmosis system according to the MPDES permit. Treated mine water would discharge to the Clark Fork River (i.e., Cabinet Gorge Reservoir) through a submerged outfall located downstream of Noxon Rapids Dam. As part of the outfall system, an engineered in-stream diffuser located in the river would distribute treated water through a perforated steel pipe to allow more mixing with river water.

Discharge of treated mine water at the effluent outfall may deter upstream migration of bull trout, although this is unlikely as the diffuser pipe will be located upstream of Rock Creek. Treated effluent would be discharged into the Clark Fork River about 750 feet upstream from the mouth of Rock Creek (see Figure B5). Elevated metals levels may cause bull trout to avoid use of Rock Creek as a spawning or rearing area. The metal concentrations in the mixing zones are not expected to be detrimental to fish homing behavior. However, metal concentrations could increase near the mouth of Rock Creek as a result of groundwater seepage and surface erosion of metals from the paste storage facility. If Rock Creek metal concentrations increase to the point they exceed those in the Clark Fork River, then avoidance may be exhibited by fish wanting to reside in the cold-water refugia at the mouth of Rock Creek.

Because bull trout have not been tested for dissolved metal concentration avoidance behavior, it is uncertain how they might react to increased concentrations of copper and zinc in Rock Creek. However, the above listed criteria are considered conservative estimates for avoidance behavior associated with copper and zinc concentrations. The MPDES currently allows concentrations less than estimated avoidance thresholds, thus compliance with the MPDES standards would prevent reaching avoidance behavior thresholds for copper and zinc. Consequently, adverse effects to bull trout are not anticipated from dissolved metal concentrations.

The mine is expected to operate within guidelines established by the Clean Water Act and all applicable State of Montana water /environmental quality laws. Those guidelines are established, administered and enforced by EPA and MDEQ and consider potential impacts to cold water fisheries. Under Alternative V, mine water would continue to be treated until it met MPDES effluent limits. The Water Resources Monitoring Plan would require water quality monitoring to quantify any measurable environmental impacts due to the flow rate and water quality discharged to the Clark Fork River. The Aquatics and Fisheries Monitoring Plan would require aquatic macroinvertebrate, periphyton, and fish tissue monitoring to determine if water quality related impacts are occurring. If monitoring of water quality indicates that adverse impacts to bull trout are anticipated, reinitiation of consultation would be warranted and the Service would request it.

<u>Catastrophic failure</u>

Catastrophic failure of the contingency tailings impoundment or paste facility could have significant and long term impacts to aquatic organisms downstream of the project (MDEQ and USDA Forest Service 2001). Tailings impoundments and stormwater retention ponds can be exceeded and cause failure of the facilities located near the lower portion of Rock Creek (MDEQ and USDA Forest Service 2001, Figure BA-2, page 8,). This could result in release of tailings slurry, paste material, or untreated storm water runoff from the tailings paste facility and potential delivery to lower Rock Creek and the Clark Fork River downstream to Cabinet Gorge Dam. It is difficult to estimate or predict the probability, magnitude, or long term effects of such events; however, the impacts, should they occur, would likely be significant to bull trout.

To minimize the probability of a catastrophic failure, the agencies would institute a process to review, evaluate, and condition Revett's final tailings facility design to ensure long-term stability. The proposed Alternative V paste facility eliminates the type of catastrophic failure potential associated with tailings ponds. In addition, environmental consequences due to transport of material as a result of damage to the facility is essentially negligible due to the dewatered state of the paste. Inherent in the design of the placement of dewatered paste is the tendency for the material to be contained and able to be graded or re-worked if slumping or fracturing occurred. Even if there was a mass failure of the paste facility, the relatively high viscosity of the paste would be sufficient to retard flow over any appreciable distance. Conditions which could change the character, and hence the behavior of the paste tailings include a change in moisture content of the paste. However, there would need to be a significant increase in moisture content throughout the entire paste deposit before overall stability would be compromised. This increase in moisture would not be expected with the strict quality control program that would be implemented by the agencies (MDEQ and USDA Forest Service 2001).

The Failure Modes and Effects Analysis (FMEA) looked at a complete failure of the paste facility nonetheless. The likelihood of failure of the paste pile with underdrains under seismic loading for the Bottom-Up design was assigned a likelihood of occurrence of 1 in 10,000 to 1 in 1,000,000; the likelihood of occurrence for the Top-Down approach was estimated at a 1 in a 100 chance to 1 in 10,000 chance of occurrence. The consequences associated with a failure in both instances were designated as "high" to "extreme," which are defined as "short-term irreversible impact, long-term excursion of water quality," and "catastrophic event, long term impact," respectively (MDEQ and USDA Forest Service 2001).

Despite the estimated consequences associated with such an occurrence, there are several mitigating measures, which could be implemented to reduce this risk of a failure. These include– employ the Bottom-Up construction sequence; install blanket and finger drains beneath the paste facility; continually model and monitor the moisture content of the paste pile during operations to better understand saturation levels; and generate a detailed design of the paste plant operations and disposal system to ensure quality assurance and quality control during operation and post-closure. With these compensating factors fully employed, the FMEA analysis estimated the likelihood of failure under the Bottom-Up option as "negligible" (< 1 in 1,000,000 chance of occurring), and the confidence associated with this estimate was considered "high" (MDEQ and USDA Forest Service 2001).

Direct and indirect effects are likely to occur if a pipeline rupture or vehicle accident results in slurry or hazardous substances entering Rock Creek (USDA Forest Service 1999, MDEQ and USDA Forest Service 2001). The slurry pipeline, water reclaim line, or discharge pipeline could leak or break, potentially spilling its contents to Rock Creek and possibly the Clark Fork River depending on Rock Creek flow levels. Trucks carrying reagents or concentrate also are at risk of accidents and spill to bull trout waters. Pipeline ruptures or vehicle accidents could occur anywhere from the uppermost portion of West Fork Rock Creek downstream to the mouth of Rock Creek, but less likely, if at all, in the East Fork Rock Creek portion of the drainage (see Figure B5). Although time, location, and extent of these events are unpredictable, such events have occurred at the nearby Troy Mine in 1984 when the Troy Mine was operated by ARSARCO, and could occur during the life of the Rock Creek mine (MDEQ and USDA Forest Service 2001). Factors adding to the risks associated with spills include frequency and number of trucks hauling, weather, proximity of the road to live water, effectiveness of spill response equipment, and frequency and thoroughness of maintenance of facilities. In addition to direct effects on fish, such events may result in chronic and long-term effects on the habitat's ability to support bull trout. Monitoring and mitigation plans are expected to address the necessary requirements to minimize impacts in the event of a spill.

Emergency Action Plans would be required prior to mine operation to facilitate monitoring and mitigation in the event of accidental discharge of toxic or hazardous materials or sediments, which could adversely impact the environment. The Acid Rock Drainage and Metals Leaching and Water Resources Monitoring Plans would require testing and monitoring of the paste tailings to determine tailings and tailings impoundment facilities impacts to surface and ground water. If testing and monitoring of the paste tailings indicates that adverse impacts to bull trout are anticipated, reinitiation of consultation would be warranted and the Service would request it.

Monitoring and mitigation plans

The proposed action includes the future refinement and approval of monitoring and mitigation plans for bull trout by Revett, in cooperation with the MDEQ, the Forest, and the Service. Appendix K of the FEIS contains a complete description of the conceptual monitoring and mitigation plans for Alternatives III through V developed by MDEQ and the Forest.

Revett would be required to develop final monitoring and mitigation plans prior to project startup. The regulatory agencies have agreed to review and refine the plans as an interagency team. To minimize impacts to bull trout, the plans potentially directly affecting the fishery would be reviewed from a fisheries perspective. The Service will participate as an advisor as needed on issues related to water use, fishery monitoring plans, sediment abatement plans and monitoring, and groundwater monitoring. The Service will have approval authority for these plans and evaluations as described in the incidental take statement in this biological opinion. All plans are to identify trigger or alert levels, which would require Revett to implement a corrective action plan. Corrective action plans for the most likely scenarios would need to be developed and approved prior to project startup.

All monitoring would require an annual report unless otherwise specified. The reporting format and requirements would be reviewed and finalized by MDEQ, the Forest, and the Service. Reports would be submitted to other review agencies as identified by the Forest and MDEQ. After submittal of a monitoring report, the regulatory agencies and all other relevant agencies would review the monitoring plan and results, and evaluate possible modifications to the plan or permitted operations.

Monitoring and mitigation plans to be refined, approved and ultimately included in the plan of operations include:

- Air Quality Monitoring
- Rock Mechanics Monitoring
- Acid Rock Drainage and Metals Leaching Plan
- Evaluation Adit Data Evaluation Plan
- Tailings Paste Facility and Tailings Surry Line Construction Monitoring Plan
- Soils and Erosion Control Plan
- Reclamation Monitoring Plan
- Water Resources Monitoring Plan
- Influent and Effluent Monitoring Plan
- Monitoring of Biological Oxygen Demand Plan
- Wildlife Mitigation an Monitoring Plan
- Threatened and Endangered Species Mitigation Plan
- Aquatics and Fisheries Monitoring and Mitigation Plan
- Hard Rock Mining Impact Plan
- Wetlands Mitigation Plan

Species Response to the Proposed Action

The expected bull trout population response to the proposed mining operations is associated with impacts to the aquatic habitat and the resulting impacts to individual bull trout that inhabit the Rock Creek watershed and Cabinet Gorge Reservoir. Increased sediment from the proposed mining activities has potential to impact several life stages of bull trout within the action area during the proposed project. Increases in sedimentation affect incubation, emergence, and survival rates of eggs, fry, and juveniles. Fine sediment fills spaces between the gravel needed by incubating eggs and fry. Because bull trout eggs incubate about seven months in the gravel, they are especially vulnerable to fine sediment and water quality degradation (Fraley and Shepard 1989). Juveniles are similarly affected, as they also live on or within the streambed cobble (Pratt 1984).

Given that several important population and habitat parameters are currently functioning at risk for bull trout, including fine sediment (see Table B4), increases in sediment, decreases in base flow, and changes in habitat complexity and water chemistry due to the proposed mining operations could adversely affect production and survival of bull trout in the Rock Creek drainage, particularly in mainstem Rock Creek and West Fork Rock Creek. Increases in sediment and reduction in habitat complexity could be more than insignificant or inconsequential, especially during the period of construction. Those activities would affect aquatic habitat as well as the associated life stages of bull trout in the Rock Creek watershed. Long-term impacts associated with groundwater development, metals contamination, and catastrophic events also are inherent to a proposal of this magnitude and considered risks to bull trout.

Rock Creek bull trout are mainly resident fish and contribute relatively little to the Lower Clark Fork Core Area population because they are functionally isolated from the Lake Pend Oreille system (i.e., non-migratory) and have low reproductive potential. Reproductive potential is limited because fecundity is size-dependent and smaller resident fish produce significantly lower numbers of eggs on the order of 400-3,000 eggs per female. On the other hand, adfluvial adult female fish are considerably larger and therefore more fecund producing around 8,000 – 12,000 eggs per adult female (Fraley and Shepard 1989, Martin 1992, McPhail and Murray 1979). Even though the larger adfluvial fish have much greater reproductive potential, and are therefore, more important from a recovery perspective, resident life forms are considered to be essential in highly variable environments because they are thought to stabilize populations due to their refounding capability, especially when migrant survival is low or varies (Rieman and McIntyre 1993) as is the case with the Rock Creek local population.

With the recent onset of passing migratory bull trout from Lake Pend Oreille over Cabinet Gorge Dam, a small number of adfluvial bull trout have been observed in Rock Creek (two in 2003 and ten in 2004) during the spawning season. If the adverse effects from the proposed action were enough to suppress this use altogether and eliminate this recruitment potential, the overall effect to the Lower Clark Fork Core Area population would be negligible because of the relatively small contribution from the Rock Creek local population (less than 4 percent and this assumes adfluvial fish can access Rock Creek annually, which is unlikely due to flow conditions that typically occur each year as explained above). In addition, Rock Creek is only one of 14 local populations contributing to the core area population. At most, the rate of recovery of the core area population may slow slightly, if at all, assuming fish passage at the dams and habitat restoration continues and is successful. Furthermore, at present the Bull River system is the primary source (about 80-90 percent) of the Cabinet Gorge Reservoir migratory bull trout population (Moran 2005). Also, when considering the thousands of migratory bull trout that occupy the Lake Pend Oreille Core Area (Downs and Jakubowski 2004), the overall effect of losing the adfluvial component of the Rock Creek bull trout population at this scale would be inconsequential - much less than 1 percent, and conservatively estimated at about 0.2 percent.

No impacts related to this project are anticipated in the Bull River drainage which is considered to be the principal contributor of the core area because it supports relatively strong numbers of adfluvial, fluvial, and resident bull trout. Impacts of this project are anticipated to only affect the local population of bull trout in Rock Creek, and these impacts are expected to result from sediment delivery during the construction period and two years following. The effect of sediment intrusion into the stream channel should be minimized by the proposed sediment abatement measures and vegetation buffer zones. Monitoring will be essential to determine if anticipated sediment levels are exceeded. Risks to bull trout could increase if the mining operations cause water quality and water quantity changes that affect stream flows in Rock Creek. However, at this juncture it is difficult to determine with any certainty whether a risk to bull trout would exist under project implementation because of the lack of data or pertinent scientific information on the relationship of underground mining effects on aquatic species. The potential changes of water quality and quantity are unpredictable and the only way to determine this risk is to monitor the appropriate streamflow parameters and if new information reveals that the risk to Rock Creek bull trout is anticipated, re-initiation of consultation would be warranted, and the Service would request it. In the unforeseen event of a catastrophic failure of the tailings impoundment, bull trout in Rock Creek and Cabinet Gorge Reservoir may be at risk. However, the chances (1 in 1,000,000) of this happening are very rare; nevertheless, monitoring of the integrity of the tailings impoundment should be adequately conducted to ensure the risk to bull trout is not elevated. Should monitoring reveal an elevated risk, re-initiation of consultation would be warranted and the Service would request it. Remedial actions would likely be developed and implemented as soon as practicable to reduce the risk to bull trout.

Rock Creek is one of 14 occupied drainages in the Lower Clark Fork Core Area and if the Rock Creek local population were adversely affected by the project as anticipated, the risk to the function of the core area population would not change since the effect would be at most minimal. The functioning of the core area population would continue to be maintained and the risk from stochastic change in the environmental would be unaffected. This is largely because of the strength and stability of the remaining local populations, the relatively small contribution of Rock Creek bull trout to the core area population, and the recovery efforts now underway with fish passage and habitat restoration activities addressing the main threats to the core area population. However, there may be a slight slowing in the rate of recovery for the core area population because of the slight loss in recruitment potential, but if current efforts to recover the adfluvial component under the Avista program continue to be successful and overshadow the potential loss, the recovery rate of the core area may not be affected.

Effects of the Action to Designated Critical Habitat

Critical habitat is defined in section 3 of the Act "as the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the Act, on which are found those physical and biological features essential to the conservation of the species and that may require special management considerations or protection; and specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species." To be included in a critical habitat designation, "the habitat within the area occupied by the species must first have <u>features that are essential to the conservation of the species</u>. Critical habitat designations identify, to the extent known using the best scientific and commercial data available, habitat areas that provide essential life cycle needs of the species (i.e.; areas on which are found the primary constituent elements as defined at 50 CFR 424.12 (b))."

Designated bull trout critical habitat in the Rock Creek watershed was published in the September 26, 2005, final rule (FR 70, No 185, 56211-56311) and shown at five separate locations. Four sections are located on the mainstem and one section is located on the East Fork above the confluence with the West Fork (see Figure B4). The total amount of designated critical habitat is 2.88 stream miles in the Rock Creek watershed.

Action agencies authorizing activities within lands occupied by bull trout are mandated by the Endangered Species Act of 1973, as amended, to consider the environmental baseline in the action area and effects to bull trout that would likely occur as a result of management actions. To that end, agency biologists use the four biological indicators and the 19 physical habitat indicators in the bull trout matrix to assess the environmental baseline conditions and determine the likelihood of incidental take per interagency guidance and agreement on section 7 consultation on the effects of actions to bull trout (USDA and USDI 1998a, 1998b). Analysis of the 19 Framework habitat indicators provides a very thorough analysis of the existing habitat condition and potential impacts to bull trout habitat. While assessing the environmental baseline and potential effects to bull trout as a species, agency biologists have concurrently provided a companion analysis of effects to the primary constituent elements (PCEs) for designated bull trout critical habitat and related habitat indicators (Appendix I).

Summary of effects of mining operations on Rock Creek designated critical habitat

There is a strong relationship between PCEs and the "associated habitat indicators" for bull trout, which the Service uses to analyze site-specific impacts to the species at the project level. The Service examines the effects to individual PCEs based on the linkage between the PCEs and associated habitat indicators described in Appendix I and any other factors pertinent to the project analysis.

The Service anticipates activities associated with the proposed mining operation could potentially negatively impact some of the primary constituent elements of bull trout critical habitat in the Rock Creek drainage. It is anticipated that affected PCEs would not be destroyed or adversely modified so as not to function for bull trout, but instead the level of function would be diminished below baseline conditions to some degree and would be temporary; the duration of effects restricted to the 5-7 year construction period. Increases in sedimentation could cause degradation of water quality and changes in channel and habitat complexity, which in turn could degrade spawning habitat, rearing habitat, food supply, migratory corridors, and overwintering habitat. However, the increase in sedimentation is anticipated to be during the 5-7 years construction period and then subside thereafter returning to or near baseline conditions. The effects on other PCEs as a result of increased sedimentation are difficult to discern; however; long-term monitoring of habitat conditions and water quality parameters are likely to reveal any significant changes to these PCEs.

The Forest anticipates that effects from some proposed mining activities could continue for approximately 35 years, the life of the plan of operations (MDEQ and USDA Forest Service 2001). However, mine operation could exceed that time frame and long-term effects of mining operations would likely continue indefinitely after mine closure. Impacts associated with groundwater development, metals contamination, and catastrophic events also are inherent to a proposal of this magnitude and considered risks to proposed bull trout critical habitat. Such impacts are difficult to predict, but are not anticipated by the Service. These actions contribute to the overall risk to designated bull trout critical habitat in the lower Clark Fork River basin and reasonable and prudent measures must be taken to minimize anticipated adverse impacts.

Specific effects of mining operations and habitat response on Rock Creek designated critical habitat to the proposed action

The specific effects of mining operations on designated critical habitat are virtually the same as those described in the preceding section, *Specific Effects of Mining Operations on Rock Creek,* because the PCEs considered under designated critical habitat involve the same habitat parameters such as sediment, large woody debris, stream temperature, water quality and chemical contamination. Consequently, those discussions and analysis of effects apply here; and therefore, will not be repeated. Impacts, should they occur, related to water quality and quantity because of the construction and operation of Rock Creek mine are primarily expected to adversely affect fish, aquatic macroinvertebrates, aquatic habitat, and plants by reducing habitat quality and diversity and changing aquatic species composition.

The expected designated bull trout critical habitat response to the ongoing mining operations is associated with impacts to the aquatic habitat and the resulting impacts to individual bull trout. Increased sediment from the proposed mining activities, especially in the first five years, has potential to impact the habitat's ability (and PCEs) to support several life stages of bull trout within the action area during the proposed project. Increases in sedimentation affect incubation, emergence, and survival rates of eggs, fry, and juveniles. Fine sediment fills spaces between the gravel needed by incubating eggs and fry. Because bull trout eggs incubate about seven months in the gravel, they are especially vulnerable to fine sediment and water quality degradation (Fraley and Shepard 1989). Rearing habitat is similarly affected, as juveniles also live on or within the streambed cobble (Pratt 1984). To avoid these effects, the Rock Creek Mine development plan includes extensive sediment reduction mitigation.

Given the existing degraded conditions of the watershed, an increase in sedimentation could adversely affect all five sections of designated bull trout critical habitat in Rock Creek because they are located downstream of the proposed mine site. Increases in sediment that result in changes in habitat complexity could be considered more than insignificant or inconsequential to critical habitat in the watershed. Those changes would affect aquatic habitat as well as the associated life stages of bull trout in the Rock Creek watershed. Long-term impacts associated with groundwater development, metals contamination, and catastrophic events also are inherent to a proposal of this magnitude and can be considered risks to bull trout and critical habitat should they occur. In the event that new information found through monitoring that the risks to bull trout critical habitat have changed, it may warrant re-initiation of consultation.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions reasonably certain to occur in the action area considered 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.

Past private forestry practices and mining activities in the Lower Clark Fork Core Area have degraded existing habitat; however, habitat conditions are improving and these practices now consider potential impacts to aquatic habitat and incorporate best management practices (BMPs) and other mitigation measures to avoid harmful effects. Other risks include environmental instability from landslides and rain on snow events, illegal harvest, introduced species, thermal barriers, and rural and residential development (MBTSG 1996b).

Residential development is anticipated to increase as more areas in the Lower Clark Fork Core Area become populated, including the action area. Both commercial and residential development on private lands often occur along stream corridors, which could lead to stream channel alterations exacerbating water temperature, nutrient, and bank stability problems. Private and Montana Department of Natural Resources and Conservation (MDNRC) salvage harvest and associated road construction may increase in the future and could lead to potential woody debris contributions, increase sediment, and increase summer stream temperatures within the action area. However, preparation of a Habitat Conservation Plan (HCP) is currently under development with MDNRC to protect native fish relative to forest management and associated actions (completion of the HCP is expected in mid 2008), which should improve habitat value for bull trout on state school trust lands located in the action area.

Angler harvest and poaching has been identified as one reason for bull trout decline (USDI 2002b). It is likely that recreational fishing in and adjacent to the Rock Creek drainage will increase as the work force at the mine increases to its full level and as the general residential population of the area increases. Access to the creek from highway 200 and from Road 150 is relatively easy especially at stream crossings and where the creek runs adjacent to the road. Opportunities may also increase for poaching of large adfluvial bull trout, which are vulnerable in the fall when fish are easily observed holding in small pools or on spawning areas. Recreational fishing is known to occur in Rock Creek and poaching of bull trout has occurred in other streams in the area (Pratt and Houston 1993). In addition, misidentification of bull trout has been a concern because of the similarity of appearance with brook trout, which occur in lower reaches of Rock Creek. Although harvest of bull trout is illegal, incidental catch does occur and the fate of the released bull trout is unknown, but some level of hooking mortality is likely due to the associated stress and handling of the release (Long 1997).

The harvest of bull trout, either unintentionally or illegally, could have a direct effect on the local resident bull trout population and possibly the migratory adfluvial component of bull trout attempting to spawn in Rock Creek in the fall. The extent of the effect would be dependent on the amount of increased recreational fishing pressure, which is a function of the increased number of fishermen utilizing the fish resources each season. Illegal poaching is difficult to quantify, but generally increases in likelihood as the human population in the vicinity grows (Ross 1997). Depending on the severity of the direct losses due to fishing pressure, the Rock Creek bull trout population is likely to withstand some impact; however, over time it may show some evidence of weakening when combined with other impacts on habitat conditions.

Cumulative Effects to Designated Critical Habitat

Cumulative effects include the effects of future State, tribal, local or private actions reasonably certain to occur in the action area considered 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.

Private forestry practices and some private mining activities that occur on private lands currently and are expected to continue in the foreseeable future may degrade some designated critical habitat. Other risks to critical habitat include environmental instability from landslides and rain on snow events, illegal harvest, thermal barriers, and rural and residential development in the Lower Clark Fork Core Area (MBTSG 1996b).

Residential development in the lower Clark Fork River valley is growing at a steady pace in Sanders County. Development along stream and river corridors is highly sought after by developers and if development occurs along stream corridors that contain critical habitat for bull trout this could lead to stream channel alterations that exacerbate water temperature increases, nutrient inputs, and bank stability problems. Private and MDNRC salvage harvest and associated road construction could reduce potential woody debris contributions, increase sediment, and increase summer stream temperatures. However, the MDNRC HCP is currently under development and should protect native fish habitat, including designated critical habitat, relative to forest management and associated actions on state school trust lands located in the action area. These efforts should positively affect the habitat values associated with the primary constituent elements of designated bull trout critical habitat.

CONCLUSION

Jeopardy Analysis

Jeopardy determinations for bull trout are made at the scale of the listed entity, which is the coterminous United States population (64 FR 58910). This follows the April 20, 2006, analytical framework guidance described in the Service's memorandum to Ecological Services Project Leaders in Idaho, Oregon and Washington from the Assistant Regional Director – Ecological Services, Region 1 (Appendix C). The guidance indicates that a biological opinion should concisely discuss all the effects and take into account how those effects are likely to influence the survival and recovery functions of the affected interim recovery unit(s), which should be the basis for determining if the proposed action is "likely to appreciably reduce both survival and recovery of the coterminous United States population of bull trout in the wild."

As discussed earlier in this biological opinion in the Introduction section, the approach to the jeopardy analysis in relation to the proposed action follows a hierarchal relationship between units of analysis (i.e., geographical subdivisions) that characterize effects at the lowest level or smallest scale (local population) toward the highest level or largest scale (Columbia River Interim Recovery Unit) of unit of analysis. Table B1 shows the hierarchal relationship between units of analysis that was used to determine whether the proposed action, the Rock Creek mine, is likely to jeopardize the survival and recovery of bull trout. As mentioned previously, should the adverse effects of the proposed action not rise to the level where it appreciably reduces both survival and recovery of the species at a lower scale, such as the local or core population, the proposed action could not jeopardize bull trout in the coterminous United States (i.e., range-wide). Therefore, the determination would result in a no-jeopardy finding. However, should a proposed action cause adverse effects that are determined to appreciably reduce both survival and recovery of the species at a lower scale of analysis, then further analysis is warranted at the next higher scale.

As proposed, implementation of the Rock Creek mine is anticipated to adversely impact the majority of occupied habitat in the West Fork and mainstem of Rock Creek and to a lesser extent habitat in the lower section of the East Fork Rock Creek (only a few hundred yards of the East Fork are partially downgradient from the mill site). Activities in the action area associated with the proposed mining operation would likely result in some mortality related to expected degradation caused by sediment input of aquatic habitat including spawning habitat, rearing habitat, and food supply and the related risk to all bull trout life history stages. Sediment levels are likely to increase over the five year construction period and could reach a level to cause morphological channel changes (e.g., filling of pools, substrate embeddedness) that reduce the quality of rearing and foraging habitat for bull trout. During this same period, degradation in the quality of spawning habitat is likely due to deposits of fine sediment in spawning gravels. Increases in sedimentation (total and fine sediment), water quality degradation, and changes in channel and habitat complexity related to mining activities are anticipated to result in reduced egg, larval, and juvenile life history stages by impairing feeding, breeding and sheltering patterns of adult and juvenile bull trout. Implementation of the proposed action is likely to reduce the reproduction, numbers, or distribution of bull trout within Rock Creek for five to seven years resulting in the local population of bull trout decreasing compared to existing levels.

Following the Service's Draft Bull Trout Recovery Plan direction and the recent Service memorandum (Appendix D) regarding consolidation of the four fragmented core areas in the lower Clark River Basin into a single contiguous core area – the Lower Clark Fork Core Area - the local population of Rock Creek is one of 14 local populations contributing to the function of the core area. At present, the contribution of Rock Creek bull trout to the Lower Clark Fork Core Area is relatively minor. A very small portion of the core area bull trout population (< 4 percent) would be negatively impacted by proposed project actions. Anticipated impacts to bull trout are unlikely outside of the Rock Creek drainage and no activity is proposed in the Bull River drainage, the principal and most productive local population in the core area. Even in the unanticipated and unlikely event of extirpation of Rock Creek bull trout, Bull River fish and other local populations would remain unimpaired and would maintain the viability and functionality of the core area population. In fact, bull trout may have the opportunity to re-colonize Rock Creek because it is highly possible that migratory bull trout may spawn in a non-natal tributary stream near to where upstream movement encounters a passage barrier as was the case in 2004 when five of the six radio-tagged adult bull trout that could not pass Noxon Dam to access their "genetically-assigned" stream of origin eventually spawned in Rock Creek (Lockard and Hintz 2005). With the current success and anticipated attainment of permanent fish passage under the Avista fish passage program, there is reason to believe that recolonization of Rock Creek by migratory fish is likely especially in years where perennial stream flow takes place. Furthermore, the loss of the Rock Creek local population would only reduce core area resiliency a small degree, if at all. However, to ensure the function of the core area for migrating adfluvial bull trout, the Lower Clark Fork Core Area is largely dependent on continued success of artificial passage of adult bull trout over Cabinet Gorge and Noxon dams in order to restore and maintain, at least partially, the historical connectivity that allowed adfluvial migrating adults from Lake Pend Oreille to reach spawning areas in their stream of origin.

As indicated in the previous section, the relative contribution of Rock Creek bull trout to the lower Clark Fork River bull trout population is small and limited in distribution – one of 14 tributaries. In turn, the overall contribution of Rock Creek bull trout to the genetic and phenotypic diversity of the overall Lower Clark Fork River Core Area population is minor. Further, Lake Pend Oreille, which is the primary core area of the lower Clark Fork River basin system, currently contains large numbers of bull trout and several healthy local populations (approximately 5,000 adult bull trout), and are now re-connected with the Lower Clark Fork Core Area through fish passage programs, which would help offset the low resiliency to stochastic events of the Lower Clark Fork River Core Area population. Also, it is reasonable to assume that connectivity will be improved significantly and permanently between the two core areas (see Figure B2) in the lower Clark Fork River system and Lake Pend Oreille Core Area because fish are now being captured at all three dams (Cabinet Gorge, Noxon, and Thompson Falls dams) and planning efforts to establish permanent fish passage facilities at all three dams are now underway.

The connectivity to Lake Pend Oreille should be emphasized because a portion of the adfluvial bull trout rearing in this lake return to the Lower Clark Fork Core Area. Consequently, the probability of persistence of the species would not be appreciably affected even if the Rock Creek local population were lost when considering this re-connected system especially since empirical evidence shows that the Lake Pend Oreille Core Area is at or near the established recovery goal and the population is either stabilized or increasing.

The information and analysis presented in this biological opinion indicates that adverse impacts to the local Rock Creek population of bull trout are likely, but these effects on the core area population are minor. As a result, the Service concludes that implementation of this project is not likely to jeopardize the continued existence of bull trout at the scale of the Lower Clark Fork Core Area, and by extension not likely to jeopardize at the Clark Fork River Management Unit and the larger scale of the Columbia River Interim Recovery Unit. Therefore, the Service concludes that this project will not appreciably reduce both the survival and recovery of the coterminous United States population of the bull trout in the wild (64 FR 58910; April 20, 2006. memorandum to Ecological Services Project Leaders from Assistant Regional Director – Region 1, subject line, Jeopardy Determinations under Section 7 of the Endangered Species Act for the Bull Trout).

This conclusion is further supported by the following:

- The Clark Fork River basin consists of major river drainages including the Blackfoot, Clark Fork, Swan, Flathead, and Bitterroot rivers.

- Bull trout populations are considered strong in the South Fork Flathead, Blackfoot, and Swan rivers (USDI 1998c) and trends in abundance of bull trout are apparently stable in these rivers.

- The Lower Clark Fork Core Area contains 308 of approximately 3,369 miles of key bull trout recovery habitat in the Clark Fork River basin upstream of Albenai Falls Dam (USDI 2005b). As such, this core area contains a relatively minor portion (about 9 percent) of the important distribution in the Clark Fork River basin.

- The probability of persistence of bull trout in the lower Clark Fork River basin would not be significantly reduced even if the local population of Rock Creek bull trout core area was lost because the Lower Clark Fork Core Area would be largely unaffected.

- The Clark Fork River watershed is only 1 of at least 20 major watersheds forming the Columbia River basin, though it is amongst the largest (USDI 2002b). This demonstrates the small fraction of bull trout abundance, reproduction, and distribution of the Columbia

River basin bull trout represented by this core area.

- The probability of persistence of bull trout in the Columbia River basin would not be significantly reduced even if the Rock Creek local population were extirpated due to the remaining unaffected 13 local populations in the Lower Clark Fork Core Area.

- Significant progress has been made in fish passage over the lower Clark Fork River Avista dams and several habitat restoration projects in the Lower Clark Fork Core Area have been implemented and more are likely in the near future.

- Bull trout conservation is being implemented through Habitat Conservation Plans (HCP) in place on private land (Plum Creek Timber Company Native Fish HCP) and more plans are being developed on non-Federal ownership within the lower Clark Fork River basin (under development is the Montana Department of Natural Resources HCP, which currently identifies lands covered under the HCP in the lower Clark Fork River area).

- Lake Pend Oreille Core Area of the lower Clark Fork River system is at, or near, recovery goals of the Service's Draft Bull Trout Recovery Plan and the population is stabilized or increasing.

- Extensive mitigation to reduce sediment input and ensure water quality is included with the Rock Creek Project.

After reviewing the current status of bull trout, the environmental baseline (including effects of Federal actions covered by previous biological opinions) for the action area, the effects of the proposed mining operations, and the cumulative effects, it is the Service's biological opinion that the actions as proposed, are not likely to jeopardize the continued existence of bull trout. This conclusion is based on the magnitude of the project effects (to reproduction, distribution, and abundance) in relation to the listed population. 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."

Conclusion for Designated Critical Habitat

<u>Adverse modification of designated bull trout critical habitat analysis</u>

After reviewing the current status of bull trout, the environmental baseline for the action area, the effects of the proposed mining operations, and the cumulative effects, it is the Service's biological opinion that the actions as proposed, are not likely to destroy or adversely modify bull trout critical habitat. This conclusion is based on the magnitude of the project effects in relation to the designated critical habitat at the Columbia River basin scale. Guidance for analysis of designated critical habitat for bull trout was provided in the final rule (FR 70, No 185, 56211-56311) and in the Director's December 9, 2004, memorandum and was promulgated in response to litigation on the regulatory standard for determining whether proposed Federal agency actions are likely to result in the “destruction or adverse modification” of designated critical habitat under Section 7(a)(2) of the Act (Appendix E). The Director’s December 9, 2004, memorandum outlines interim measures for conducting Section 7 consultations pending the adoption of any new regulatory definition of “destruction or adverse modification.” Consequently, we have relied upon the statutory provisions of the Act to complete the following analysis with respect to critical habitat. Critical habitat is defined in section 3 of the Act “as the specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the Act, on which are found those physical and biological features essential to the conservation of the species and that may require special management considerations or protection; and specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species.”

As proposed, implementation of the Rock Creek mine is anticipated to negatively impact designated critical habitat in Rock Creek by diminishing the function of some of the PCEs due to increases in sedimentation in the West Fork and mainstem of Rock Creek and to a lesser extent critical habitat in the East Fork Rock Creek. Activities in the action area associated with the proposed mining operation would likely degrade aquatic habitat including spawning habitat, rearing habitat, and food supply and impact all bull trout life history stages during the 5-year construction period and likely for two years after construction is completed. Thereafter, the effects from sedimentation should subside and levels of sedimentation are expected to return to those observed before construction. Increases in sedimentation, water quality degradation, and changes in channel and habitat complexity related to mining activities are anticipated to reduce the functional ability of critical habitat to a small degree below baseline conditions temporarily, for about five to seven years associated with the construction period. The areas of critical habitat mostly affected in Rock Creek would be small localized stream segments in close proximity to the project area. All the primary constituent elements in Rock Creek are expected to remain functional, albeit at a lower level.

Anticipated impacts would be confined to the 2.88 miles of designated bull trout critical habitat in the Rock Creek drainage, and only to localized segments within the five sections identified as critical habitat (see Figure B4). Therefore, by extension the overall impact on the abundance and quality of designated critical habitat in the Lower Clark Fork Core Area and the Clark Fork River Management Unit would be diminutive, and therefore, not likely to be appreciably affected. The following reasons are the basis for our conclusion:

- The function of designated critical habitat in the Clark Fork River basin would not be significantly reduced because none of the PCEs in Rock Creek would be eliminated. It is anticipated that at most, affected PCEs would be diminished functionally only a small degree.

- Clark Fork River basin consists of major river drainages occupied by bull trout and with hundreds of miles of designated critical habitat including the Blackfoot, Clark Fork, Swan, Flathead, and Bitterroot rivers.

- The Lower Clark Fork Core Area contains 308 of approximately 3,369 miles of key bull trout recovery habitat in the Clark Fork River basin upstream of Albenai Falls Dam

(USDI 2005b). As such, this core area contains a relatively minor portion (about 9 percent) of the important distribution in the Clark Fork River basin.

- The Lower Clark Fork Core Area contains 135 miles of stream and 735 acres of lake surface area of designated critical habitat for bull trout. As such, the value of designated critical habitat within the action area (Rock Creek) is relatively small (about 2 percent) compared to the designated critical habitat distribution in the core area.

- The Clark Fork River watershed is only 1 of at least 20 major watersheds forming the Columbia River basin, though it is amongst the largest (USDI 2002b).

- Critical habitat in the Lower Clark Fork Core Area comprises 4 percent (135 stream miles) of the total Columbia River basin (3,096 stream miles) stream miles of critical habitat, and comprises only 0.1 percent of the total Columbia River basin stream miles when considering critical habitat in Rock Creek (2.88 miles). For critical habitat of lakes and reservoirs in the core area (735 acres), critical habitat comprises .8 percent of the total for the Columbia River basin (89,466 acres).

- Significant progress has been made in passing adult bull trout over the lower Clark Fork River Avista dams, as well as several successful habitat restoration projects in the lower Clark Fork River basin have been implemented and more are likely in the near future.

- Bull trout conservation is being implemented through Habitat Conservation Planning and more plans are being developed on non-Federal ownership within the lower Clark Fork Core Area.

This demonstrates the relatively small amount of designated critical habitat distribution located in the Rock Creek watershed in comparison to the Lower Clark Fork Core Area, and even smaller fraction when compared to the entire Columbia River basin. Based on the small amount of designated critical habitat exposed to potential project effects in the Rock Creek watershed in relation to the Lower Clark Fork Core Area and the fact that the impacted area will still support the PCE's, it is the Service's conclusion that the proposed action is not likely to destroy or adversely modify designated critical habitat of the Columbia River basin.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit 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 Forest so that they become binding conditions of any contract or permit issued to any party, as appropriate, for the exemption in section 7(o)(2) to apply. The Forest has a continuing duty to regulate the activity covered by this incidental take statement. If the Forest (1) fails to assume and implement the terms and conditions or (2) fails to require any party to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Forest 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)].

The biological assessment (MDEQ and USDA Forest Service 2001) describes actions anticipated to occur during implementation of the proposed Mining Plan of Operations of the Rock Creek Mine and proposes actions that, when implemented, are likely to adversely affect bull trout. The Service anticipates that implementation of the proposed Mining Plan of Operations of the Rock Creek Mine as described in the biological assessment would likely impart a level of adverse effect to individual bull trout to the extent that incidental take occurs.

Proposed Mining Plan of Operations in Lower Clark Fork River Basin-Rock Creek Mine

The proposed action includes the future refinement and approval of monitoring and mitigation plans for bull trout by Revett in cooperation with the MDEQ, the Forest, and the Service. Appendix K of the FEIS contains a complete description of the conceptual monitoring and mitigation plans for Alternatives III through V developed by MDEQ and the Forest.

Revett would develop final monitoring and mitigation plans prior to project startup. The regulatory agencies would review and approve the plans as an interagency team. To minimize impacts to bull trout, the plans potentially directly affecting the fishery would be reviewed from a fisheries perspective. The Service will participate as needed on issues related to water use, fishery monitoring plans, sediment abatement plans and monitoring, and groundwater monitoring. The Service will have approval authority of these plans and evaluations as described in the incidental take statement in this biological opinion. All plans would need to identify trigger or alert levels, which would require Revett to implement a corrective action plan. Corrective action plans with appropriate triggers for the most likely scenarios need to be developed and approved by the interagency team prior to project startup.

All monitoring would require an annual report unless otherwise specified. The reporting format and requirements would be reviewed and finalized by MDEQ, the Forest, and the Service. Reports would be submitted to other review agencies as identified by the Forest and MDEQ. After submittal of a monitoring report, the regulatory agencies and all other relevant agencies would review the monitoring plan and results, and evaluate possible modifications to the plan or permitted operations.

Monitoring and mitigation plans to be refined, approved and ultimately included in the plan of operations include:

- Air Quality Monitoring
- Rock Mechanics Monitoring
- Acid Rock Drainage and Metals Leaching Plan
- Evaluation Adit Data Evaluation Plan
- Tailings Paste Facility and Tailings Surry Line Construction Monitoring Plan
- Soils and Erosion Control Plan
- Reclamation Monitoring Plan
- Water Resources Monitoring Plan
- Influent and Effluent Monitoring Plan
- Monitoring of Biological Oxygen Demand Plan
- Wildlife Mitigation and Monitoring Plan
- Threatened and Endangered Species Mitigation Plan
- Aquatics and Fisheries Monitoring and Mitigation Plan
- Hard Rock Mining Impact Plan
- Wetlands Mitigation Plan

Amount or extent of take anticipated

The Service anticipates certain activities associated with the proposed mining operation would result in some incidental take of bull trout in the form of harm, harassment or mortality related to expected degradation of aquatic habitat conditions including spawning habitat, rearing habitat and food supply and the related risk to bull trout life history stages. Increases in sedimentation, degradation of water quality, and changes in channel and habitat complexity related to mining activities are anticipated to adversely affect and likely result in a take of the egg, larval and juvenile life history stages by harming or impairing feeding, breeding and sheltering patterns of adult and juvenile bull trout.

The Forest anticipates that adverse impacts could last for the life of the plan of operations, approximately 35 years (USDA Forest Service 1999, MDEQ and USDA Forest Service 2001). Further, it is possible long term effects of mining operations would continue indefinitely after mine closure. Impacts associated with groundwater development, metals contamination, and catastrophic events also are inherent to a proposal of this magnitude and considered risks to bull trout. Although these impacts are not expected, such impacts are difficult to predict. These actions, should they occur, could contribute to the overall risk to bull trout in the Lower Clark Fork Core Area and Reasonable and Prudent Measures must be taken to minimize take.

The amount of take expected in the Rock Creek watershed is difficult to quantify because of the wide ranging distribution of bull trout, identification and detection of dead or impaired species at the egg and larval stages is unlikely, losses may be masked by seasonal fluctuations in numbers and aquatic habitat modifications are difficult to ascribe to particular sources, especially in already degraded watersheds. In addition, the effects of management actions associated with some mining operations are largely unquantifiable in the short term and may only be measurable in the long-term effects to the species or population levels. However, where the effects can be measured and the amount of take quantified, the Service has identified particular approaches and metrics to measure those effects.

The amount of take that may result from implementation of the proposed action is difficult to quantify for the following reasons:

- The duration and magnitude of sediment delivery is a function of weather conditions and the effectiveness of the mitigation measures.

- The amount and location of sediment deposition depends on numerous factors (flow regime, size of stream, channel roughness).

- Losses to bull trout in any life stage may be masked by wide seasonal fluctuations in numbers of individuals present and increases in natural sediment.

- The measures proposed by the Forest to minimize the delivery of additional sediment to bull trout habitat would likely be effective to varying degrees.

- Brook trout distribution in the action area appears to be limited to the lower portions of the drainage. If a change in brook trout/bull trout species composition does occur, impacts of increased competition and or hybridization would be difficult to quantify with the current levels of information.

- Chemical contamination of groundwater may undiscernibly adversely affect surface water in Rock Creek and not reach lethal levels for bull trout for some time, but continue to gradually increase and eventually affect long-term survival.

- The natural hydrograph of stream flow in Rock Creek may be changed or shifted imperceptibly over time through interruption of groundwater flow that supports or contributes to natural peak and base flow duration, timing and magnitude.

<u>Anticipated Take Due to Sediment Loading</u>

As mentioned above, the Service can use surrogates to measure the amount or extent of incidental take. In this biological opinion, the amount of sediment loading to the stream and the amount of fine sediment in spawning substrate will be used as a surrogate to determine the level of anticipated take that may result from sediment impacts. Baseline information does exist to compare pre-project levels of both parameters with post-construction project levels; however, the baseline should be updated prior to construction. The amount of sediment delivered to the stream and the amount of fine sediment levels in spawning areas are reasonable biological predictors of project impacts. Habitat for bull trout degrades when a change in the amount and composition of sediment delivered to the stream results in such changes as reducing pool depth, filling of interstitial space, and causing channels to braid. When this happens, cover, food supply, reproduction, and security for bull trout are diminished. Levels of fine sediment deposited in spawning areas during sediment loading reflect the quality of spawning habitat since increasing fine sediment deposits reduces survival of bull trout embryos and fry, and therefore, negatively impacts productivity (Weaver and Fraley 1991, Weaver and White 1985, Furniss et al.1991, Bjornn and Reiser 1991, Tappel and Bjornn 1983, Bjornn et al. 1977, Bjornn et al.1974).

The amount of total sediment delivered to the stream from proposed project activities is expected to increase and peak during the five year construction period, and the percentage of this total that constitutes fine sediment (less than 6.35 mm or .25 inches) is expected to increase as well. Both sediment parameters (total sediment and percent fines in spawning gravel) can be measured and changes detected by conventional substrate sampling methods during this period. Moreover, it is reasonable to expect to observe a measurable reduction in total sediment delivered to the stream and a reduction in fine sediment levels in spawning gravel within two years following project construction, assuming implementation of the proposed sediment abatement measures and BMPs continue throughout this period and are effective (Ketcheson and Megahan 1996). As a result, the duration of anticipated incidental take from sediment impacts is seven years. Consequently, intensive post-construction annual sediment monitoring will be necessary for at least seven consecutive years, and preferably ten years, to assure the magnitude in fine sediment levels is declining and trend toward pre-project conditions.

The anticipated take level for total sediment delivered to the affected areas of the Rock Creek watershed will be limited to a numeric threshold. The numeric threshold is based on modeled outputs generated from the Forest's R-1 WATSED modeling as described in the Forest's biological assessment (MDEQ and USDA Forest Service 2001). Outputs of the modeled sediment loading are the predicted percent increase above baseline sediment levels at the height of the construction period. The "incidental take" thresholds for total sediment delivered are based on these outputs and are as follows: 1) 46 percent in the West Fork Rock Creek; 2) 20 percent in the East Fork Rock Creek; and 3) 38 percent overall for the entire Rock Creek watershed. To determine the extent of incidental take, actual measurements of sediment loading will be compared annually to the established pre-construction baseline level each year during the five year construction period and for two consecutive years immediately following the construction period. If the actual (as measured annually) percent increase above the pre-construction baseline level exceeds the modeled outputs (i.e., thresholds) in any one year during this seven year period, then anticipated take has been exceeded and the Service should be consulted per the terms and conditions in the Incidental Take Statement and Re-initiation Clause of this biological opinion.

In addition to the above, a second numeric threshold will be evaluated annually to determine project-related impacts to spawning areas. This metric is the average median percent fine sediment as measured in bull trout spawning substrate and is based on values measured from sediment core sampling conducted by Washington Water Power (1996) and as described in the Forest's biological assessment (MDEQ and USDA Forest Service 2001). Note that this value is not a percent increase over baseline conditions, but a fixed numeric value that is derived as a percent of substrate composition found in spawning areas that can be compared to those levels before the project is constructed. In this biological opinion, the values for the metric "average median percent fine sediment" were adjusted conservatively upward from the values found in the Washington Water Power study in order to account for anticipated project-related increases in fine sediment. The increases are 13 percent (increased from 27 to 40 percent) for West Fork Rock Creek, (anticipated to be the most heavily impacted spawning areas) and 7 percent (increased from 43 to 50 percent) for mainstem Rock Creek. Fine sediment in spawning areas was not measured in the East Fork Rock Creek because the predominant substrate material was boulders and large cobble and what little spawning area existed was limited to isolated pockets of gravel behind stable debris or boulders (Washington Water Power 1996).

The Service anticipates that fine sediment in spawning gravels will likely increase during the construction period and have an adverse impact on embryo survival. The threshold limit for anticipated take will be preset based on a level of tolerance for embryo survival and the expected duration of this impact. As measured annually by the metric "average median percent fine sediment," the threshold limit is 40 percent fine sediment in spawning areas in the West Fork Rock Creek and 50 percent fine sediment in spawning areas in the mainstem Rock Creek below the confluence of the East Fork and above the confluence of Engle Creek. Each year during the five year construction period and for two years immediately following the construction period these data will be collected and compared to the pre-construction baseline values to determine the extent of incidental take. If annual monitoring of fine sediment levels shows that the increase in percent fines has surpassed these pre-set values in any one year during this seven year period, then the amount of anticipated take has been exceeded and the Service should be consulted per the terms and conditions in the Incidental Take Statement and Re-initiation Clause of this biological opinion.

The amount of anticipated take due to changes in sediment loading is based on the modeling estimates of the WATSED outputs (USDA Forest Service 1999, MDEQ and USDA Forest Service 2001) and the likelihood that increasing amounts of sediment loading during the construction period will increase the probability of habitat changes detrimental to bull trout. Consequently, monitoring of a suite of habitat variables will be required (e.g., pool depth, channel width/depth ratio, substrate embeddedness, channel braiding, etc.) to determine the actual effects of stream channel changes due to the sediment loading and to determine which habitat parameters may change in function to a higher risk level for bull trout. Pre-construction monitoring of these habitat parameters for at least three years would yield the most accurate baseline information for comparison to future habitat change attributable to the project. The Service will require that the Aquatic and Fisheries Mitigation Plan provide for sampling of pre-project habitat parameters to more accurately measure baseline conditions for a period of three years, including measurements of fine sediment in bull trout spawning gravel.

Should the amount of fine sediment deposited in bull trout spawning areas progressively increase up to 40 percent, embryo survival could progressively decrease to 20 percent in the West Fork Rock Creek. Fine sediment is not expected to reach this level during the seven year period; however, it is expected to increase to some extent. If monitoring shows that this level has been reached or exceeded, immediate corrective measures will be necessary. If percent fines in bull trout spawning areas in the mainstem Rock Creek progressively increase up to 50 percent, embryo survival could progressively decrease to 10 percent during this seven year period. However, this level is not expected to be reached, but if monitoring shows it has been reached or exceeded, immediate corrective measures will be necessary.

Mitigation measures are expected to be effective to reduce sediment loading; however, it is difficult to predict how effective the measures will be and how much change in substrate composition will affect survival for bull trout or any salmonid (Weaver and Fraley 1991, Chapman 1988). Consequently, collecting accurate baseline information before construction of the project is essential for comparison purposes and will be required as part of the Aquatic and Fisheries Mitigation Plan.

The development and approval of the Aquatic and Fisheries Mitigation Plan will incorporate appropriate sediment/substrate metrics to measure, detect, and evaluate each year project-related changes in habitat conditions that can be related to changing population parameters. In turn, this information can be used to assess impacts and gage whether the amount of incidental take is being minimized as anticipated and whether corrective actions are needed to address incidental take concerns. In this biological opinion, incidental take from potential sediment impacts has been assessed based on the best technical information available; however, through the development of the Aquatic and Fisheries Mitigation Plan, there may emerge a better means to calculate this incidental take or to refine this approach to better reflect the potential impacts. Because the Service will participate in the development and approval of this Plan, the Service may re-evaluate this assessment in this incidental take statement based on new technical information to help better refine its incidental take assessment and to ensure that sediment impacts are being minimized accordingly.

To ensure protection for a species assigned take due to mining related activities, re-initiation is required if the Terms and Conditions are not adhered to or the magnitude of the mining activities exceed the scope of this opinion.

<u>Effect of the take</u>

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to bull trout or destruction or adverse modification of critical habitat.

Reasonable And Prudent Measures

The Service believes the following reasonable and prudent measure(s) are necessary and appropriate to minimize impacts of incidental take of bull trout:

1. To better assess and quantify incidental take of bull trout, Revett shall complete a pre-project watershed assessment of the Rock Creek watershed which characterizes the Rock Creek bull trout population, habitat conditions, and existing sediment sources in the basin. This is to be done in consultation with the Rock Creek Watershed Council, the Forest, and the Service. Incorporate, as appropriate, any additional findings into monitoring and mitigation plans.

    a. Implement a fish monitoring program to document the current status of Rock Creek bull trout and the effect of mitigation activities on Rock Creek bull trout.

Define bull trout distribution, densities, age class structures, genetics, growth rates, fecundity, and status of life history forms.

b. Implement a fish monitoring program to document the current status of brook and brown trout distribution and the effect of project activities on Rock Creek brook and brown trout. Determine feasibility of reducing risk of hybridization and interspecific competition by removing brook and brown trout from the Rock Creek drainage using accepted methodology.

c. Implement an assessment of existing instream habitat conditions for bull trout. Include assessment of spawning, rearing and overwintering conditions for resident and adfluvial bull trout. Also include temperature and sediment monitoring to establish baseline conditions for bull trout.

d. Implement a stream habitat enhancement program that improves the ability of bull trout to move throughout the year in Rock Creek and increases habitat availability and diversity for migratory and resident bull trout. Include an assessment of alternatives and designs for stream diversion to be constructed around the paste facility.

e. Identify sediment sources currently impacting Rock Creek and plan, design, and implement sediment abatement measures to reduce sediment input to the stream <u>prior to initiation</u> of any ground disturbing activities not related to adit exploration and development. This plan should identify existing sediment sources such as culverts, road impacts, bridges, past bank stabilization efforts and utility right of way impacts. Complete a road systems analysis to define existing and future road uses and closures.

f. Implement a sediment monitoring program to document the ongoing condition of Rock Creek and the effect of mitigation activities on sediment levels, and the actual effect of project activities and proposed mitigation actions on sediment levels in the drainage.

2. Evaluate all possible operations of the existing effluent location or relocating the effluent outfall discharge pipe to a location eliminating any potential impacts to bull trout related to project effects on migrating or holding fish moving into Rock Creek from the Clark Fork River.

3. Implement a metals monitoring program that includes monitoring levels of metal concentrations in groundwater, surface water, sediments, macroinvertebrates, and fish tissues. This could be incorporated in several conceptual monitoring plans including, but not limited to, the Aquatics and Fisheries Monitoring and Mitigation Plan.

4. Identify key spawning areas and implement a monitoring program of changes in groundwater influence for spawning and rearing bull trout. This would be incorporated into the groundwater monitoring program.

5. Complete a risk assessment of road failure related to haul routes and mine related vehicle traffic. Incorporate any additional measures identified to minimize the risk of road failures and the associated impacts to bull trout.

6. Incorporate any additional measures identified to minimize the risk of failure of the paste pile or facility and the associated impacts to bull trout.

7. Implement reporting and consultation requirements as outlined in the following terms and conditions.

<u>Terms and Conditions</u>

In order to be exempt from the prohibitions of section 9 of the Act, the Forest 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.

1. The following terms and conditions are established to implement reasonable and prudent measure No. 1:

   Upon the of issuance of the letter of approval for the Rock Creek mine, the Forest would require the applicant to initiate baseline studies for use in a complete watershed assessment of Rock Creek. The Forest would require the applicant to complete and submit a comprehensive watershed assessment to the Forest and Service prior to surface disturbance activity *not* related to the evaluation adit stage of the project.

   The comprehensive watershed assessment would include information to characterize the Rock Creek bull trout population, instream and riparian habitat conditions and existing sediment sources in the basin and would address the following issues for bull trout:

   a. A monitoring plan to document the prevalence of Rock Creek bull trout. That monitoring plan would include studies to define bull trout distribution, densities, age class structures, genetics, and status of resident and migratory (adfluvial) bull trout.

   b. An assessment and subsequent monitoring to define the prevalence and distribution of brook and brown trout. In conjunction with Montana Fish, Wildlife and Parks, determine the feasibility of removing brook and brown trout from Rock Creek using accepted methodology. Evaluate the potential reduction of hybridization and competition risk by non native species and benefit to bull trout. If determined feasible and needed, subject to agreement with Montana Fish, Wildlife and Parks, remove brook and brown trout from the Rock Creek drainage using accepted methodology.

c. An assessment of current instream and riparian habitat conditions for bull trout. The assessment would include information on quantity and quality of spawning, rearing and overwintering conditions for resident and adfluvial bull trout. It would include a pre-and post-project assessment of riparian conditions including floodplain and channel migration zone areas, and fish passage barriers (natural and man-made).

d. An assessment of possible sediment mitigation and reduction projects within the Rock Creek watershed as outlined in the proposed action. Recommendations of stream enhancement projects should be included in that assessment.

e. A feasibility assessment (including engineering options, conceptual designs, estimated costs and expected sediment load effects) for sediment abatement measures that would reduce sediment levels in the Rock Creek drainage. This assessment would include any designs for the proposed stream diversion around the proposed paste facility and a complete roads analysis and recommendations associated with mine activities and proposed mitigation projects. This assessment will identify all potential sources of sediment (natural and man-caused) such as mass wasting areas and drainage from road surfaces.

    (1) The sediment abatement program shall implement sediment mitigation actions designed to reduce sediment levels in Rock Creek by 38% (the projected increase in sediment levels attributable to development of the mine as described in the BA) <u>prior to</u> surface disturbance activity not related to the evaluation adit stage of the project.

    (2) Upon completion of the feasibility assessment (1. d., above), the Forest would require the applicant to complete design and permitting requirements, in consultation with MDEQ, the Forest, and the Service, and begin construction of such sediment abatement measures as agreed to by the Forest and the Service.

f. Upon the issuance of the letter of approval for the Rock Creek Project, the Forest would require the applicant to complete and submit to the Forest and the Service a sediment monitoring plan that would adequately assess the current (i.e., baseline) and long-term status of sediment levels in Rock Creek. The sediment monitoring plan would be developed in consultation with MDEQ, the Forest and the Service and would address the entire Forest permit time period. This also would include a complete assessment of the effectiveness of the sediment abatement program in the Rock Creek drainage. If the assessment concludes, and the Service agrees, that the sediment abatement program failed to substantially reduce sediment levels in Rock Creek, then the applicant would prepare an assessment of other measures that could be implemented in the Rock Creek drainage and would be completed in a time frame agreed to by the Service.

g. Establish and document the natural hydrograph conditions prior to the mine becoming fully operational. Install a system of stream gages, as necessary, in order to record various stream flow conditions throughout the Rock Creek drainage before, during, and after mine operations. Consult a hydrologist to help establish the stream gage locations.

2. The following terms and conditions are established to implement reasonable and prudent measure # 2:

   a. Prior to surface disturbance activity not related to the evaluation adit stage of the project, the Forest would require the applicant to complete, and submit to the Forest and the Service, an evaluation of operational options with existing diffuser location and alternative locations for siting the diffuser entering the Clark Fork River below Noxon Dam. The evaluation would be prepared in consultation with the Forest, MDEQ, and the Service and would focus on recommendations that would minimize potential effects on migrating or resident bull trout utilizing the Clark Fork River habitats adjacent to the mouth of Rock Creek and the spring area immediately upstream. The Service would have the authority to ultimately approve the evaluation.

   b. If the evaluation identifies a more appropriate operation or location for the diffuser (2. a., above), the Forest would require the applicant to modify the plan of operations, as agreeable to the Service, to incorporate the alternative most likely to minimize impacts to bull trout.

3. The following terms and conditions are established to implement reasonable and prudent measure #3:

   a. Prior to surface disturbance activity not related to the evaluation adit stage of the project, the applicant shall submit a plan to the Forest and the Service for metals monitoring as it relates to bull trout habitat requirements that includes monitoring in water samples, sediment samples, and fish samples. This monitoring would start prior to mine development to establish the baseline, and continue during operations and post operations as determined necessary by the Forest and the Service. The Service would have the authority to ultimately approve the plan.

4. The following terms and conditions are established to implement reasonable and prudent measure #4:

   a. Prior to surface disturbance activity not related to the evaluation adit stage of the project, the Forest shall require the applicant to submit a plan to the Forest and the Service for monitoring of groundwater effects as they relate to bull trout habitat requirements. This monitoring would start prior to mine development to assess the baseline, and continue during operations and post operations as determined necessary by the Forest and the Service. The Service would have the authority to ultimately approve the plan.

5. The following terms and conditions are established to implement reasonable and prudent measure #5:

   a. Prior to surface disturbance activity not related to the evaluation adit stage of the project, the Forest shall require the applicant to submit a risk assessment of accidents related to haul routes for mine related vehicle traffic to the Forest and the Service for evaluation. The assessment would determine areas most at risk for bull trout and make recommendations for additional measures and responses to minimize risk. If any additional measures can be incorporated to minimize the risk of catastrophic failures, the Forest, MDEQ, and the Service would determine the timeline and mechanism for implementation of those identified measures.

6. The following terms and conditions are established to implement reasonable and prudent measure # 6:

   a. Minimization of paste pile or facility failures includes: employing the Bottom-Up construction sequence, installing blanket and finger drains beneath the paste facility; continually modeling and monitoring the moisture content of the paste pile during operations to better understand saturation levels, generating a detailed design of the paste plant operations and disposal system to ensure quality assurance and quality control during operation and post-closure. If any additional measures can be incorporated to minimize the risk of catastrophic paste pile or facility failures, the Forest, MDEQ, and the Service would determine the timeline and mechanism for implementation of those identified measures.

7. The following terms and conditions are established to implement reasonable and prudent measure # 7:

   a. The Forest would require the applicant to annually prepare and submit to the Service a report of the mining year activities as well as the next year’s proposed activities.

   b. Upon locating dead or injured bull trout or upon observing destruction of redds, notification by the Forest or applicant must be made within 24 hours to the Montana Field Office at 406-449-5225. 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.

   c. During project development and operation the Forest or applicant shall notify the Service within 24 hours of any emergency or unanticipated situations arising that may be detrimental for bull trout relative to the proposed activity.

   d. Within 90 days of the end of each year, the Forest or applicant would provide a written report or letter to the Service indicating the actual number of bull trout taken, if any, as well as any relevant biological/habitat data or other pertinent information on bull trout that was collected.

e. The Forest shall assure consistent implementation of measures and standards specified in the Aquatic Conservation strategies as indicated in the 1998 Biological Opinion for the Effects to Bull Trout from the Continued Implementation of Land and Resource Management Plans and Resource Management Plans as Amended by the Interim Strategies for Managing Fish-producing Watersheds in Eastern Oregon and Washington, Idaho, Western Montana, and portions of Nevada (INFISH), and the Interim Strategy for Managing Anadromous Fish-producing Watershed in Eastern Oregon and Washington, Idaho and portions of California (PACFISH).

f. To better monitor mitigation measures identified, the Forest would provide summaries to the Service of all INFISH compliance, water quality and fish population monitoring conducted in conjunction with these mining operations.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. With implementation of these measures, the Service expects that incidental take of bull trout would result from changes stream channel characteristics associated with increases in sediment, modifications in water quality, and modifications of instream habitat features (e.g. pool depths, channel width, substrate embeddedness) for the life of the mining operations and reclamation activities. Some long term effects of mining operations would likely continue indefinitely after mine closure. If, during the course of the action, the proposed project design and operations are not adhered to, the level of incidental take anticipated in the biological opinion may be exceeded. Such incidental take represents 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 results in take exceeding that considered here, and whether consultation should be re-initiated. This may require suspension of mining operations. The Federal agency must immediately provide an explanation of the causes of the taking 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 utilize 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. The Service recognizes the impacts of past mining, roading and logging actions on watersheds on the Forest. For the benefit of the watershed and listed bull trout, the Service encourages the Forest to seek appropriate levels of funding to reclaim and restore

impacts from previous actions and to have in reserve contingency funds for offsetting environmental damage to public lands caused by mining accidents.

2. The Service recognizes and appreciates the Forest and Revett's involvement with the Rock Creek Watershed Council. We encourage continued participation and development of actions to further restore native fish populations in the Rock Creek drainage.

3. To address the concern about increased recreational angling pressure and poaching, the Service recommends the Forest support a creel census survey to determine pre- and post project changes in levels of fishing pressure in Rock Creek. This effort should be coordinated with MFWP and the Service recommends that the survey be included in the Aquatic and Fisheries and Mitigation Plan.

4. To progress toward bull trout recovery in the Clark Fork River Management unit, the Service encourages the Forest to consider incorporating recommended recovery tasks of the bull trout draft recovery plan (USDI 2002c).

5. The Service encourages the Forest and Revett to coordinate and cooperate with local planning groups such as the Rock Creek Watershed Council, and regional efforts such as the Avista Native Salmonid Restoration Program, whose efforts are targeted for conservation of bull trout in the lower Clark Fork River and to ensure the mine's project activities and mitigation plans are not in conflict with these efforts.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the actions 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.

Heavy Metal Contamination

The Service is concerned that the proposed mining activities in post-implementation years 1 through 35, or beyond, could increase the risk of incidental take of bull trout due to dissolved concentrations heavy metal contamination in Rock Creek. These changes are not anticipated at this time, due in part, to Revett's commitment to the Project's water treatment plant.

However, it is reasonable to assert that, over the long-term, new information from monitoring water quality may reveal changes in water chemistry. Specifically, the gradual accumulation of heavy metals that could occur over the 35 year life of the project and that may persist for some period after the project ends. To address the chemical contamination concern, the Service will depend on the heavy metal concentration standards and intensive monitoring under the MPDES permit system. The MPDES standards of allowable concentrations of heavy metals are adequately restrictive whereby these standards would be out of compliance well in advance of anticipated adverse impacts to fish resources, including bull trout. It is likely the MPDES permit requirements would necessitate corrective actions before incidental take to bull trout would occur. For the Service to determine whether the risk of incidental take is elevated in Rock Creek due to project implementation, frequent long-term intensive monitoring and reporting is crucial. If monitoring results during project implementation indicate incidental take is anticipated, this would constitute new information of anticipated effects and reinitiation of consultation would be required.

Groundwater Influence

The proposed mining activities may intercept sources of groundwater that enter into Rock Creek through springs and seeps located in or adjacent to streambanks or in-channel areas. These inputs of cold water are important in maintaining stream temperatures and instream flows for bull trout in Rock Creek, especially base flows during seasonal low flow periods such as late summer, early fall. The Service is concerned that changes to the down gradient groundwater system for Rock Creek may occur by the mine's dewatering and drainage operations. Mitigation has been proposed to minimize these effects (i.e., 1,000 foot buffer zones around Cliff Lake and Moran Basin); however, it is unknown how effective the mitigation will be with regard to groundwater drainage stress. Incidental take of bull trout is not anticipated at this time; however, due to the uncertainty of the mitigation effectiveness, it is reasonable to assert that over the long-term, new information from monitoring water quality may reveal an increase in the risk of incidental take to bull trout due to changes in stream temperature and instream flows that result from influence of the mine's activities on the groundwater system that sustains Rock Creek. Therefore, intensive long-term monitoring of stream temperatures and seasonal instream flows is essential in order to detect mining induced changes in the groundwater system that may elevate the risk of incidental take to Rock Creek bull trout. If monitoring results during project implementation indicate incidental take is anticipated, this would constititute new information of anticipated effects and reinitiation of consultation would be required.

R. Mark Wilson

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Montana Ecological Services Field Office

10-11-06

Date

REFERENCES

Adams, S.B., and T.C. Bjornn. 1997. Bull trout distributions related to temperature regimes in four central Idaho streams. Pages 371-380 *in* W.C. Mackay, M.K. Brewin, and M. Monita, editors. Friends of the bull trout conference proceedings. Bull Trout Task Force (Alberta), c/o Trout Unlimited Canada, Calgary.

Allan, J.H. 1980. Life history notes on the Dolly Varden char (*Salvelinus malma*) in the Upper Clearwater River, Alberta. Manuscript Report. Energy and Natural Resources, Fish and Wildlife Division, Red Deer, Alberta.

Avista Corporation. 2003. The Clark Fork project FERC project no.2058. 2002 annual report implementation of PM&E measures. February 2003 Draft. Spokane, Washington.

Baxter, C.V., C.A. Frissell, and F.R. Hauer. 1999. Geomorphology, logging roads, and the distribution of bull trout spawning in a forested river basin: implications for management and conservation. Transactions of the American Fisheries Society 128:854-867.

Baxter, C.V., and F.R. Hauer. 2000. Geomorphology, hyporheic exchange, and selection of spawning habitat by bull trout (*Salvelinus confluentus*). Canadian Journal of Fisheries and Aquatic Sciences 57:1470-1481.

Belt, G.H., J. O'Laughlin, and T. Merrill. 1992. Design of forest riparian buffer strips for the protection of water quality: analysis of scientific literature. Idaho Forest, Wildlife and Range Policy Analysis Group report No. 8. University of Idaho, Moscow.

Bjornn, T.C., and D.W. Reiser. 1991. Habitat requirements of salmonids in streams. Pages 83-138 *in* W.R. Meehan, editor, American Fisheries Society Special Publication 19.

Bjornn, T.C., and others. 1977. Transport of granitic sediment in streams and its effects on insects and fish. University of Idaho; Forest, Wildlife, and Range Experiment Stn., Bull. 17, Moscow.

Bjornn, T.C., and others. 1974. Sediment in streams and its effects on aquatic life. University of Idaho, Water Resources Research Institute; Technical Completion Rpt., Project B-025-IDA, Moscow.

Bjornn, T.C., and J. Mallet. 1964. Movements of planted and wild trout in an Idaho river system. Transactions of the American Fisheries Society 93:70-76.

Boag, T.D., and P.J. Hvenegaard. 1997. Spawning movements and habitat selection of bull trout in a small Alberta foothills stream. Pages 317-323 *in* W.C. Mackay, M.K. Brewin, and M. Monita, editors. Friends of the bull trout conference proceedings. Bull Trout Task Force (Alberta), c/o Trout Unlimited Canada, Calgary.

Bond, C.E. 1992. Notes on the nomenclature and distribution of the bull trout and the effects of human activity on the species. Pages 1-4 *in* Howell, P.J. and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis.

Bonneau, J.L., and D.L. Scarnecchia. 1996. Distribution of juvenile bull trout in a thermal gradient of a plunge pool in Granite Creek, Idaho. Transactions of the American Fisheries Society 125:628-630.

Buckman, R.C., W.E. Hosford, and P.A. Dupee. 1992. Malheur River bull trout investigations. Pages 45-57 *in* P.J. Howell and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis.

Cavender, T.M. 1978. Taxonomy and distribution of the bull trout, *Salvelinus confluentus* (Suckley), from the American northwest. California Fish and Game 64:139-174.

Chamberlain, T.W., R.D. Harr, and F.H. Everest. 1991. Timber harvesting, silviculture, and watershed processes. American Fisheries Society Special Publication 19:181-205.

Chandler, J.A., M.A. Fedora, and T.R. Walters. 2001. Pre- and post-spawn movements and spawning observations of resident bull trout in the Pine Creek watershed, eastern Oregon. Pages 167-172 *in* M.K. Brewin, A.J. Paul, and M. Monita, editors. Bull trout II conference proceedings. Trout Unlimited Canada, Calgary, Alberta.

Chapman, D.W. 1988. Critical review of variables used to define effects of fines in redds of large salmonids. Transactions of the American Fisheries Society 117:1-21.

Costello, A.B., T.E. Down, S.M. Pollard, C.J. Pacas, and E.B. Taylor. 2003. The influence of history and contemporary stream hydrology on the evolution of genetic diversity within species: an examination of microsatellite DNA variation in bull trout, *Salvelinus confluentus* (Pisces: Salmonidae). Evolution. 57(2): 328-344.

Craig, S.D. 2001. Bull trout, baseflows and water temperatures: quantifying minimum surface water discharges in small groundwater influenced catchments. Pages 129-135 *in* M.K. Brewin, A.J. Paul, and M. Monita, editors. Bull trout II conference proceedings. Trout Unlimited Canada, Calgary, Alberta.

Cummins, K.W., and G.H. Lauff. 1969. The influence of substrate particle size on the microdistribution of stream benthos. Hydrobiologia 34:145-181.

Dambacher, J.M., and K.K. Jones. 1997. Stream habitat of juvenile bull trout populations in Oregon and benchmarks for habitat quality. Pages 353-360 *in* W.C. Mackay, M.K. Brewin, and M. Monita, editors. Friends of the bull trout conference proceedings. Bull Trout Task Force (Alberta), c/o Trout Unlimited Canada, Calgary.

Donald, D.B., and D.J. Alger. 1993. Geographic distribution, species displacement, and niche overlap for lake trout and bull trout in mountain lakes. Canadian Journal of Zoology 71:238-247.

Downs, C.C. and R. Jakubowski. 2004. Lake Pend Oreille/Clark Fork River fishery research and monitoring. Avista Corporation; IDFG -05-51. 155 pp.

Dunham, J.B., and G.L. Chandler. 2001. Models to predict suitable habitat for juvenile bull trout in Washington State. Final report to U.S. Fish and Wildlife Service, Lacey, Washington.

Earle, J.E., and J.S. McKenzie. 2001. Microhabitat use by juvenile bull trout in mountain streams in the Copton Creek system, Alberta and its relation to mining activity. Pages 121-128 *in* M.K. Brewin, A.J. Paul, and M. Monita, editors. Bull trout II conference proceedings. Trout Unlimited Canada, Calgary, Alberta.

Everest, F.H., R.L. Beschta, J.C. Scrivener, K.V. Koski, J.R. Sedell and C.J. Cederholm. 1987. Fine sediment and salmonid production: a paradox. Pages 98-142 *in* E. Salo and T. Cundy, editors. Streamside management: forestry and fishery interaction. University of Washington, College of Forest Resources, Contribution 57, Seattle.

Federal Energy Regulatory Commission. 1999. Biological assessment on the effects of Cabinet Gorge, Noxon and Thompson Falls Dams. On File at U.S. Fish and Wildlife Service, Helena, Montana.

Fraley, J.J., and B.B. Shepard. 1989. Life history, ecology and population status of migratory bull trout (*Salvelinus confluentus*) in the Flathead Lake and River system, Montana. Northwest Science 63(4):133-143.

Fredenberg, W. 2002a. Further evidence that lake trout displace bull trout in mountain lakes. Intermountain Journal of Sciences 8(3): 143-152.

Fredenberg, W. 2002b. Personal communication. Fishery biologist. U.S. Fish and Wildlife Service, Creston Fish and Wildlife Center. Kalispell, Montana.

Frissell, C.A. 1993. A new strategy for watershed restoration and recovery of Pacific salmon in the Pacific Northwest. The Pacific Rivers Council, Eugene, Oregon.

Furniss, M.J., T.D. Roelofs, and C.S. Yee. 1991. Road construction and maintenance. Pages 297-323 *in* W.R. Meehan, editor. American Fisheries Society Special Publication 19.

Goetz, F.A. 1989. Biology of the bull trout Salvelinus confluentus a literature review. Willamette National Forest, Eugene, Oregon.

Goetz, F.A. 1991. Bull trout life history and habitat study. Final report prepared for Deshutes National Forest. Oregon State University, Corvallis.

Goetz, F.A. 1994. Distribution and juvenile ecology of bull trout (*Salvelinus confluentus*) in the Cascade Mountains. M.S. thesis. Oregon State University, Corvallis.

Graham, P.J., B.B. Shepard, and J.J. Fraley. 1981. Use of stream habitat classifications to identify bull trout spawning areas in streams. Pages 186-190 *in* Acquisition and utilization of habitat inventory information: proceedings of the symposium. American Fisheries Society, Western Division, Portland, Oregon.

Gurrieri, J. 2001. Hydrology and Chemistry of Wilderness Lakes and Evaluation of Impacts from Proposed Underground Mining, Cabinet Mountains Wilderness, Montana. In Proceedings of Mine Design, Operations & Closure Conference, Whitefish, Montana.

Haas, G.R., and J.D. McPhail. 1991. Systematics and distributions of Dolly Varden *(Salvelinus malma*) and bull trout (*Salvelinus confluentus*) in North America. Canadian Journal of Fisheries and Aquatic Sciences 48:2191-2211.

Haas, G.R. and J.D. McPhail. 2001. The post-Wisconsin glacial biogeography of bull trout (*Salvelinus confluentus*): a multivariate morphometric approach for conservation biology and management. Canadian Journal of Fisheries and Aquatic Sciences 58:2189-2203

Hansen, B. 2001. Threats to the persistence of a small disjunct bull trout population on the Flathead Indian Reservation, western Montana, USA. Pages 233-236 *in* M.K. Brewin, A.J. Paul, and M. Monita, editors. Bull trout II conference proceedings. Trout Unlimited Canada, Calgary, Alberta.

Harvey B.C., and T.E Lisle. 1998. Effects of suction dredging on streams; a review and an evaluation strategy. Fisheries 23(8):8-17.

Hauer, R.F., G.C. Poole, J.T. Gangemi, and C.V. Baxter. 1999. Large woody debris in bull trout (*Salvelinus confluentus*) spawning streams of logged and wilderness watersheds in northwest Montana. Canadian Journal of Fisheries and Aquatic Sciences 56:915-924.

Henry, M.G., and G.J. Atchison. 1991. Metal effects on fish behavior-advances in determining the ecological significance of responses. Pages 131-143 *in* M.C. Newman, and A.W. McIntosh, editors. Metal Ecotoxicology: Concepts and Applications. Lewis Publishers, Chelsea, Michigan.

Idaho Fish and Game. 1995. Assessment and conservation strategy for bull trout. Idaho Department of Fish and Game, Boise.

Jakober, M.J. 1998. Role of stream ice on fall and winter movements and habitat use by bull trout and cutthroat trout in Montana headwater streams. Transactions of the American Fisheries Society 127:223-235.

Kanda, N. and F.W. Allendorf. 2001. Genetic population structure of bull trout from the Flathead River basin as shown by microsatellites and mitochondrial DNA markers. Transactions of the American Fisheries Society 130:92-106.

Ketcheson, G.L. and W.F. Megahan. 1996. Sediment production and downslope sediment transport from forest roads in granitic watersheds. Research Paper INT-RP-486. USFS Intermoountian Research Station. Ogden, Utah. 12pp.

Kleinschmidt Associates. 1996. Fish entrainment mortality study, Black River, FERC No. 2569 (Herrings). Report prepared for Niagara Mohawk Power Corp., Syracuse, NY.

Lake Pend Oreille Bull Trout Watershed Assessment Group. 1999. On file at U.S. Fish and Wildlife Service, Helena, Montana.

Leary, R.F.; F.W. Allendorf, and S.H. Forbes. 1993. Conservation genetics of bull trout in the Columbia and Klamath River watersheds. Conservation Biology 7:856-865.

Lee, D.C., J.R. Sedell, B.E. Rieman, R.F. Thurow, and J.E. Williams. 1997. Chapter 4: Broadscale assessment of aquatic species and habitats. Pages 1057-1496 *in* T.M. Quigley, and S.J. Arbelbide, editors. An Assessment of Ecosystem Components in the Interior Columbia Basin and Portions of the Klamath and Great Basins: Volume III. PNW-GTR-405. USDA Forest Service, Portland, Oregon.

Liermann, B.W. and T.D. Tholl. 2005. Native Salmonid Abundance Monitoring. Montana Tributary Habitat Acquisition and Recreational Fishery Enhancement Program, Appendix B. Progress Report – 2003.

Liermann, B.W. 2004. Native Salmonid Abundance Monitoring. Avista Corporation, Spokane, Washington.

Liermann, B.W., Katzman, L.M., and T.D. Tholl. 2003. Habitat Restoration Monitoring. Montana Tributary Habitat Acquisition and Recreational Fishery Enhancement Program, Appendix B. Comprehensive Report – 2001-2002.

Light, J.T., L.G. Herger, and M. Robinson. 1996. Upper Klamath Basin bull trout conservation strategy, a conceptual framework for recovery. Part One. The Klamath Basin Bull Trout Working Group. (As referenced in USDI 1998c).

Lockard, L. and Hintz, D. 2005. Upstream Fish Passage Studies. Fish Passage/Native Salmonid Restoration Program, Appendix C. Annual Progress Report – 2004. Avista Corp. Spokane, Washington.

Lockard, L., M. Carlson, and L. Hintz. 2004. Fisheries investigations and monitoring. Annual progress report - 2003. Fish Passage / Native Salmonid Restoration Program. Avista Corp., Spokane, Washington.

Lockard, L., R. Weltz, and E. Stender-Wormwood. 2005. Tributary Trapping and Downstream Juvenile Bull Trout Transport Program. Fish Passage Native Salmonid Program, Appendix C. Annual Progress Report – 2004. Avista Corp. Spokane, Washington.

Lockard, L., R. Weltz, and E. Stender. 2004. Tributary Trapping and Downstream Juvenile Bull Trout Transport Program. Fish Passage Native Salmonid Program, Appendix C. Annual Progress Report – 2003. Avista Corp. Spokane, Washington.

Lockard, L., R. Weltz, E. Stender, J. Storaasli, and J. Stover. 2003. Tributary Trapping and Downstream Juvenile Bull Trout Transport Program. Fish Passage Native Salmonid Program, Appendix C. Annual Progress Report – 2002. Avista Corp. Spokane, Washington.

Lockard, L., S. Wilkinson, and S. Skaggs. 2002a. Experimental adult fish passage studies annual progress report–2001 fish passage/native salmonid program, Appendix C. Prepared for Avista Corporation, Noxon, Montana.

Lockard, L., R. Weltz, J. Stover, and R. Lockard. 2002b. Tributary Trapping and Downstream Juvenile Bull Trout Transport Program. Fish Passage Native Salmonid Program, Appendix C. Annual Progress Report – 2001. Avista Corp. Spokane, Washington.

Long, M.H. 1997. Sociological implications of bull trout management in northwest Montana: illegal harvest and game warden efforts to deter. *In*: W.C. Mackay, M.K. Brewin, and M. Monita, editors. Friends of the bull trout conference proceedings, Bull Trout Task Force (Alberta), c/o Trout Unlimited Canada, Calgary pp. 71-74.

Martin, S. 1992. Southeast Washington species interaction study: Bull trout (*Salvelinus confluentus*), Steelhead trout (*Onchorhynchus mykiss*), and spring chinook salmon (*Onchorhynchus tshawytscha*). Information report no. 92-1, BPA, WDW, and Eastern Washington University.

Martin S.B., and W.S. Platts. 1981. Effects of mining. GTR-PNW-119, USDA Forest Service, Pacific Northwest Forest and Range Experiment Station.

McLeay D.J., I.K. Birtwell, G.F. Hartman, and G.L. Ennis. 1987. Response of Arctic grayling to acute and prolonged exposure to Yukon placer mining sediment. Canadian Journal of Fisheries and Aquatic Sciences 44:658-673.

McPhail, J.D. and C. Murray. 1979. The early life history and ecology of Dolly Varden (*Salvelinus malma*) in the upper Arrow Lakes. Rpt to the BC Columbia Hydro and Power Authority and Kootenay Dept of Fish and Wildlife.

Meehan, W.R. 1991. Introduction and overview. Pages 1-15 *in* W.R. Meehan, editor. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society Special Publication 19.

Montana Bull Trout Restoration Team. 2000. Restoration Plan For Bull Trout In The Clark Fork River Basin And Kootenai River Basin Montana. Prepared for Governor Marc Racicot. Helena, Montana.

Montana Bull Trout Scientific Group. 1995a. Bitterroot River drainage bull trout status report. Prepared for The Montana Bull Trout Restoration Team, Montana Fish, Wildlife, and Parks, Helena.

Montana Bull Trout Scientific Group. 1996a. Swan River drainage bull trout status report (including Swan Lake). Prepared for The Montana Bull Trout Restoration Team, Montana Fish, Wildlife, and Parks, Helena.

Montana Bull Trout Scientific Group. 1996b. Lower Clark Fork River drainage bull trout status report (Cabinet Gorge Dam to Thompson Falls). Prepared for The Montana Bull Trout Restoration Team, Montana Fish, Wildlife, and Parks, Helena.

Montana Bull Trout Scientific Group. 1996c. Middle Clark Fork River drainage bull trout status report (from Thompson Falls to Milltown, including the lower Flathead River to Kerr Dam). Prepared for The Montana Bull Trout Restoration Team, Montana Fish, Wildlife, and Parks, Helena.

Montana Bull Trout Scientific Group. 1998. The relationship between land management activities and habitat requirements of bull trout prepared for The Montana Bull Trout Restoration Team, Montana Fish, Wildlife and Parks, Helena.

Montana Department of Environmental Quality and USDA Forest Service. 2001. Final Environmental Impact Statement Rock Creek Project, Volume 1 and Volume 11 (Appendices). Helena, Montana.

Moran, S. 2006. Lower Clark Fork River, Montana - Avista Project Area - 2005 Annual Bull and Brown Trout Redd Survey Report. Avista Corporation. Noxon, Montana.

Moran, S. 2005. Lower Clark Fork River, Montana - Avista Project Area - 2004 Annual Bull and Brown Trout Redd Survey Report. Avista Corporation. Noxon, Montana.

Moran, S. 2004. Lower Clark Fork River, Montana - Avista Project Area - 2003 Annual Bull and Brown Trout Redd Survey Report. Avista Corporation. Noxon, Montana.

Nelson R. L.M.L. McHenry, and W.S. Platts. 1991. Mining. Pages 425-457 *in* W.R. Meehan, editor. Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. American Fisheries Society Special Publication 19.

Nelson, M.L., T.E. McMahon, and R.F. Thurow. 2002. Decline of the migratory form in bull charr, *Salvelinus confluentus*, and implications for conservation. Environmental Biology of Fishes 64:321-332.

Neraas, L.P. and P. Spruell. 2001. Fragmentation of riverine systems: the genetic effects of dams on bull trout (Salvelinus confluentus) in the Clark Fork River system. Molecular Ecology (10):1153-1164.

Oligher, R.C. and I.J. Donaldsen. 1966. Fish passage through turbines. Tests at Big Cliff Hydroelectric Plant, Progress Report No.6. Report prepared for the Department of the Army, Corps of Engineers, Walla Walla District, WA.

Overton, C.K., M.A. Radko, and R.L. Nelson. 1993. Fish habitat conditions; using the northern/intermountain regions inventory procedures for detecting differences on two differently managed watersheds. GTR-INT-300, USDA Forest Service, Ogden, Utah.

Pratt, K.L. 1984. Habitat use and species interactions of juvenile cutthroat (*Salmo clarki lewisi*) and bull trout (*Salvelinus confluentus*) in the upper Flathead River basin. M.S. Thesis. University of Idaho, Moscow.

Pratt, K.L. 1985. Pend Oreille trout and char life history study. Idaho Department of Fish and Game, Boise.

Pratt, K.L. 1992. A review of bull trout life history. Pages 5-9 *in* P.J. Howell, and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis.

Pratt, K.L., and J.E. Huston. 1993. Status of bull trout (*Salvelinus confluentus*) in Lake Pend Oreille and the lower Clark Fork River: draft. The Washington Power Company, Spokane.

Quigley, T.M., and S.J. Arbelbide. 1997. An assessment of ecosystem components in the interior Columbia basin and portion of the Klamath and Great basins: Volume III. Pages 1,057-1,713 *in* T.M. Quigley, editor. The Interior Columbia Basin Ecosystem Management Project: Scientific Assessment. PNW-GTR-405.USDA Forest Service, Portland, Oregon.

Ralph, S.C., G.C. Poole, L.L. Conquest, and R.J. Naiman. 1994. Stream channel morphology and woody debris in logged and unlogged basins of western Washington. Canadian Journal of Fisheries and Aquatic Sciences 51:37-51.

Ratliff, D.E. 1992. Bull trout investigations in the Metolius River- Lake Billy Chinook system. Pages 37-44 *in* P.J. Howell and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis.

Ratliff, D.E., and P.J. Howell. 1992. The status of bull trout populations in Oregon. Pages 10-17 *in* P.J. Howell and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis.

Reiser, D.W., E. Conner, K. Binkley, K. Lynch, and D. Paige. 1997. Evaluation of spawning habitat used by bull trout in the Cedar River watershed, Washington. Pages 331-338 *in* W.C. Mackay, M.K. Brewin, and M. Monita, editors. Friends of the bull trout conference proceedings. Bull Trout Task Force (Alberta), c/o Trout Unlimited Canada, Calgary.

Rich, C.F. 1996. Influence of abiotic and biotic factors on occurrence of resident bull trout in fragmented habitats, western Montana. M.S. Thesis. Montana State University, Bozeman.

Riehle, M., W. Weber, A.M. Stuart, S.L. Thiesfeld, and D.E. Ratliff. 1997. Progress report of the multi-agency study of bull trout in the Metolius River system, Oregon. Pages 137-144 *in* W.C. Mackay, M.K. Brewin, and M. Monita, editors. Friends of the bull trout conference proceedings. Bull Trout Task Force (Alberta), c/o Trout Unlimited Canada, Calgary.

Rieman, B.E., and J.D. McIntyre. 1993. Demographic and habitat requirements for conservation of bull trout. GTR-INT-302. USDA Forest Service, Boise, Idaho.

Rieman, B.E., and J.D. McIntyre. 1995. Occurrence of bull trout in naturally fragmented habitat patches of varied size. Transactions of the American Fisheries Society 124:285-296.

Rieman, B.E., and J.D. McIntyre. 1996. Spatial and temporal variability in bull trout redd counts. North American Journal of Fisheries Management 16:132-141.

Rieman, B.E., and D.L. Myers. 1997. Use of redd counts to detect trends in bull trout (*Salvelinus confluentus*) populations. Conservation Biology 11:1015-1018.

Rieman, B.E., D.C. Lee, and R.F. Thurow. 1997. Distribution, status, and likely future trends of bull trout in the interior Columbia River basin and Klamath River basins. North American Journal of Fisheries Management 17:1111-1125.

RMC. 1994. Survival of fish in turbine passage through the Townsend Dam, Pennsylvania (FERC Project No. 3451). Report prepared for Beaver Falls Municipal Authority, Beaver Falls, PA.

Rode, M. 1990. Bull trout (*Salvelinus confluentus Suckley*) in the McCloud River: status and recovery recommendations. California Department of Fish and Game, Inland Fisheries Administrative Report No. 90-15, Sacramento.

Ross, M.R.. 1997. Fisheries Conservation and Management. Chapter 4: The Human Factor in Fisheries Conservation and Management. Prentice Hall, New Jersey. 374pp.

Saffel, P.D., and D.L. Scarnecchia. 1995. Habitat use by juvenile bull trout in belt-series geology watersheds of northern Idaho. Northwest Science 69:304-317.

Saunders, R.L., and J.B. Sprague. 1967. Effects of copper-zinc mining pollution on a spawning migration of Atlantic salmon. Water Research 1:419-432. (As referenced in Henry and Atchison 1991).

Schill, D.J. 1992. River and stream investigations. Idaho Department of Fish and Game, Boise.

Schmetterling, D.A. and D.H. McEvoy. 2000. Abundance and diversity of fishes migrating to a hydroelectric dam in Montana. North American Journal of Fisheries Management 20:711-719.

Sedell, J.R., P.A. Bisson, F.J. Swanson, and S.V. Gregory. 1988. What we know about large trees that fall into streams and rivers. Pages 47-81 *in* C. Maser, R.F. Tarrant, J.M. Trappe, and J.F. Franklin, editors. From the forest to the sea: a story of fallen trees. GTR-PWR 229. USDA Forest Service, Portland, Oregon.

Selong, J.H., T.E. McMahon, A.V. Zale, and F.T. Barrows. 2001. Effect of temperature on growth and survival of bull trout, with application of an improved method for determining thermal tolerance in fishes. Transactions of the American Fisheries Society 130:1026-1037

Shepard, B.B., J.J. Fraley, T.M. Weaver, and P. Graham. 1982. Flathead River fisheries study 1982. Montana Department of Fish, Wildlife and Parks, Helena.

Shepard, B.B., S.A. Leathe, T.M. Weaver, and M.D. Enk. 1984. Monitoring levels of fine sediment within tributaries to Flathead Lake, and impacts of fine sediment on bull trout recruitment. Pages 146-156 *in* Proceedings of the Wild Trout III Symposium, Yellowstone National Park, Wyoming.

Sheridan, D. 1977. Hard rock mining on the public land. Council of Environmental Quality. U.S. Government Printing Office, Washington, D.C. (As referenced in Nelson et al. 1991).

Sigler, J.W., T.C. Bjornn, and F.H. Everest. 1984. Effects of chronic turbidity on density and growth of steelhead and coho salmon. Transactions of the American Fisheries Society 113: 142-150.

Sprague, J.B., and W.J. Logan. 1979. Separate and joint toxicity to rainbow trout of substances used in drilling fluids for oil exploration. Environmental Pollution 19:269-281. (As referenced in Nelson et al. 1991).

Sprague, J.B., P.F. Elson, and R.L. Saunders. 1965. Sublethal copper-zinc pollution in a salmon river-a field and laboratory study. International Journal of Air and Water Pollution 9:531-543. (As referenced in Henry and Atchison 1991).

Spruell, P., B.E. Rieman, K.L. Knudsen, F.M. Utter, and F.W. Allendorf. 1999. Genetic population structure within streams: microsatellite analysis of bull trout populations. Ecology of Freshwater Fish (8):114-121.

Spruell, P., and 7 others. 2000. Genetic management plan for bull trout in the Lake Pend Oreille - Lower Clark Fork River system. Report to the Avista Aquatic Implementation Team by the bull trout Genetics Advisory Panel; November 15, 2000. UM Wild Trout and Salmon Genetics Lab, University of Montana, Missoula.

Spruell, P., A.R. Hemmingsen, P.J. Howell, N. Kanda, and F. Allendorf. 2003. Conservation genetics of bull trout: Geographic distribution of variation at microsatellite loci. Conservation Genetics 4: 17-29.

Tappel, P.D. and T.C. Bjornn. 1983. A new method of relating size of spawning gravel to salmonid embryo survival. North American Journal of Fisheries Management 3:123-135.

Taylor, E.B., S. Pollard, and D. Louie. 1999. Mitochondrial DNA variation in bull trout (*Salvelinus confluentus*) from northwestern North America: implications for zoogeography and conservation. Molecluar Ecology. 8:1155-1170.

Thomas, G. 1992. Status report: bull trout in Montana. Montana Department of Fish, Wildlife and Parks, Helena.

Thurow, R.F. 1987. Evaluation of the South Fork Salmon River steelhead trout fishery restoration program. Performed for USDI Fish and Wildlife Service.

USDA Forest Service. 1987. Kootenai National Forest Plan. Kootenai National Forest, Libby, Montana.

USDA Forest Service. 1999. Bull trout biological assessment for Rock Creek Mine. Kootenai National Forest, Libby, Montana.

USDA Forest Service. 2000. Watershed baseline information for Rock Creek watershed. Kootenai National Forest, Libby, Montana.

USDA Forest Service. 2006. Final geotechnical assessment report sinkhole development at the Troy Mine and implications for the proposed Rock Creek Mine, Lincoln and Sanders Counties, Montana. Prepared for Forest Supervisor, Kootenai National Forest; Prepared by Tetra Tech, Inc.(Helena, MT) and R Squared Incorporated (Denver, CO); 42 pages plus attachments.

USDA Forest Service, USDI Fish and Wildlife Service, and Bureau of Land Management. 1998a. Guidance to USDA Forest Service, USDI Fish and Wildlife Service, and Bureau of Land Management on section 7 consultation–conference for bull trout.

USDA Forest Service, USDI Fish and Wildlife Service, and Bureau of Land Management. 1998b. Guidance to USDA Forest Service, USDI Fish and Wildlife Service, and Bureau of Land Management on approach for completing Forest Service/BLM section 7 consultation on the effects of actions to bull trout.

USDI Fish and Wildlife Service. 1997. Administrative 12-month finding on the petition to have bull trout listed as an endangered species. Pages 99-114 *in* W.C. Mackay, M.K. Brewin, and M. Monita, editors. Friends of the bull trout conference proceedings. Bull Trout Task Force (Alberta), c/o Trout Unlimited Canada, Calgary.

USDI Fish and Wildlife Service. 1998a. A framework to assist in making endangered species act determinations of effect for individual or grouped action at the bull trout core area watershed scale. Region 1, USFWS.

USDI Fish and Wildlife Service. 1998b. Endangered and threatened wildlife and plants; determination of threatened status for the Klamath River and Columbia River distinct population segments of bull trout. Federal Register 63(111):31647-31674.

USDI Fish and Wildlife Service. 1998c. Klamath River and Columbia River bull trout population segments: status summary and supporting documents lists. Prepared by bull trout listing team, USFWS.

USDI Fish and Wildlife Service. 1998d. Biological opinion for the effects to bull trout from the continued implementation of land and resource management plans and resource management plans as amended by the interim strategies for managing fish producing watersheds in eastern Oregon and Washington, Idaho, western Montana and portions of Nevada (INFISH) and the interim strategy for managing anadromous fish-producing watersheds in eastern Oregon and Washington, Idaho and portions of California (PACFISH). Region 1, USFWS.

USDI Fish and Wildlife Service. 1998e. Bull trout interim conservation guidance. Prepared by the USFWS.

USDI Fish and Wildlife Service. 1999. Determination of threatened status for the bull trout in the coterminous United States; Final Rule. Federal Register 64(210):58909-58933.

USDI Fish and Wildlife Service. 2002a. Endangered and Threatened Wildlife and Plants; Proposed Designation of Critical Habitat for the Klamath River and Columbia River Distinct Population Segments of Bull Trout. Federal Register 67(230):71285-71334.

USDI Fish and Wildlife Service. 2002b. Chapter 1, Introduction. Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. Portland, Oregon.

USDI Fish and Wildlife Service. 2002c. Chapter 3, Clark Fork River Recovery Unit, Montana, Idaho, and Washington. Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. Portland, Oregon.

USDI Fish and Wildlife Service. 2002d. Chapter 4, Kootenai River Recovery Unit, Montana, Idaho, and Washington. Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan. Portland, Oregon.

USDI Fish and Wildlife Service. 2003. Effects of Actions that Have Undergone Section 7 Consultation for Bull Trout Under the Endangered Species Act. U.S. Fish and Wildlife Service, Portland, Oregon.

USDI Fish and Wildlife Service. 2004a. Draft Recovery Plan for the Coastal-Puget Sound Distinct Population Segment of Bull Trout (*Salvelinus confluentus*). U.S. Fish and Wildlife Service, Portland, Oregon.

USDI Fish and Wildlife Service. 2004b. Draft Recovery Plan for the Jarbidge Distinct Population Segment of Bull Trout (*Salvelinus confluentus*). U.S. Fish and Wildlife Service, Portland, Oregon.

USDI Fish and Wildlife Service. 2004c. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Klamath River and Columbia River Distinct Population Segments of Bull Trout; Final Rule. Federal Register 69(193):59996-60076.

USDI Fish and Wildlife Service. 2005a. Bull trout core area templates - complete core area by core area analysis. W. Fredenberg and J. Chan, *editors*. U. S. Fish and Wildlife Service. Portland, Oregon. 660 pages.

USDI Fish and Wildlife Service. 2005b. Bull trout core area conservation status assessment. W. Fredenberg, J. Chan, J. Young and G. Mayfield, *editors*. U. S. Fish and Wildlife Service. Portland, Oregon. 95 pages plus attachments.

USDI Fish and Wildlife Service. 2005c. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Bull Trout. Federal Register 70(185):56211-56311.

Washington Water Power. 1995a. 1994 Water quality and limnologic evaluations on the lower Clark Fork River. The Washington Water Power Company, Spokane.

Washington Water Power. 1995b. Fish community assessment on Cabinet Gorge and Noxon Rapids Reservoirs. The Washington Water Power Company, Spokane.

Washington Water Power. 1996. Lower Clark Fork River tributary survey. The Washington Water Power Company, Spokane.

Walters, T.F. 1995. Sediment in streams: sources, biological effects, and control. American Fisheries Society Monograph 7. 251pp.

Washington Water Power. 1998. Final report: historic and current resources for the Washington Water Power Cabinet Gorge and Noxon Rapids hydrologic projects. The Washington Water Power Company, Spokane.

Watershed Consulting. 1997. 1996 Field data summary report for Rock Creek near Noxon, Montana: final. Watershed Consulting, Polson, Montana.

Watson, G., and T.W. Hillman. 1997. Factors affecting the distribution and abundance of bull trout: an investigation at hierarchical scales. North American Journal of Fisheries Management 17:237-252.

Weaver T.M., and J.J. Fraley. 1993. A method to measure emergence success of westslope cutthroat trout fry from varying substrate compositions in a natural stream channel. North American Journal Fisheries Management 13:817-822.

Weaver, T.M. and R.G. White. 1985. Coal Creek Fisheries Monitoring Study No.III. Quarterly Progress Report. U.S. Forest Service, Montana State Cooperative Fisheries Research Unit, Bozeman. MT.

Webb, M., H. Ruber, and G. Leduc. 1976. The toxicity of various mining flotation reagents to rainbow trout (*Salmo gairdneri*). Water Research 10:303-306.

Weber, D.D., D.J. Maynard, W.D. Gronlund, and V. Konchin. 1981. Avoidance reactions of migrating adult salmon to petroleum hydrocarbons. Canadian Journal of Fisheries and Aquatic Sciences 38:779-781.

Wels, P., and J.S. Wels. 1991. The developmental toxicity of metals and metalloids in fish. Pages 145-169 *in* M.C. Newman and A.W. McIntosh, editors. Metal Ecotoxicology: Concepts and Applications. Lewis Publishers, Chelsea, Michigan.

Whitesel, T.A. and 7 coauthors. 2004. Bull trout recovery planning: A review of the science associated with population structure and size. Science Team Report #2004-01, U.S. Fish and Wildlife Service, Region 1, Portland, Oregon.

Williams, R.N., R.P. Evans, and D.K. Shiozawa. 1997. Mitochondrial DNA diversity patterns of bull trout in upper Columbia River basin. Pages 283-297 *in* W.C. Mackay, M.K. Brewin, and M. Monita, editors. Friends of the bull trout conference proceedings. Bull Trout Task Force (Alberta), c/o Trout Unlimited Canada, Calgary.

Williams, J.E., J.E. Johnson, D.A. Hendrickson, S. Contreras-Balderas, J.D. Williams, M. Navarro-Mendoza, D.E. McAlliser and J.D. Decon. 1989. Fishes of North America: endangered, threatened, or of special concern. Fisheries 14(6):2-20.

Woodward, D.F., J.N. Goldstein, and A.M. Farag. 1997. Cutthroat trout avoidance of metals and conditions characteristic of a mining waste site: Coeur d'Alene River, Idaho. Transactions of the American Fisheries Society 126:699-706.

Woodward, D.F., J.A. Hansen, H.L. Bergman, E.E. Little, and A.J. DeLonay. 1995. Brown trout avoidance of metals in water characteristic of the Clark Fork River, Montana. Canadian Journal of Fishery and Aquatic Sciences 52:2031-2037.

Ziller, J.S. 1992. Distribution and Relative Abundance of Bull Trout in the Sprague River Subbasin, Oregon. Pages 18-29 *in* P.J. Howell and D.V. Buchanan, editors. Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis.

APPENDICES