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Northern Region, Forest Service; Bureau of Land Management, Missoula Field Office

April 15, 2015

Joe Ashor, Field Manager
Bureau of Land Management, Missoula Field Office
3255 Fort Missoula Road
Missoula, Montana 59804

Scott Spaulding, Regional Fish Program Leader
Northern Region Forest Service
Federal Building, 200 East Broadway P.O. Box 7669
Missoula, Montana 59807

Dear Mr. Ashor and Mr. Spaulding:

This document transmits the U.S. Fish and Wildlife Service’s biological opinion (enclosed) based on review of the biological assessment on Road Related Activities that May Affect Bull Trout and Bull Trout Critical Habitat in Western Montana proposed by the U.S. Forest Service, Northern Region, and Bureau of Land Management, Missoula Field Office, in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.).

This consultation addresses road-related maintenance activities on lands located in western Montana that are managed by the Kootenai, Flathead, Lolo, Bitterroot, Helena, and Beaverhead-Deerlodge National Forests (Forest) and Bureau of Land Management (BLM), Missoula Field Office. The action area includes portions of the Flathead, Clark Fork, and Kootenai River systems and associated bull trout core areas and critical habitat units.

The purpose of this biological opinion is to facilitate road maintenance activities in an effort to provide safe transportation of forest users and in some cases reduce road-related sediment inputs, improve fish passage, and reduce the risks of road and road stream crossing failure. This document does not address potential effects to bull trout from the existence of the road network on Forest and BLM lands which should be addressed during the travel management planning process.
A complete project file for this consultation is located in the Montana Ecological Services Field Office in Helena, Montana. We appreciate your efforts to ensure the conservation of threatened and endangered species as part of our joint responsibilities under the Endangered Species Act, as amended. If you have questions or comments related to this correspondence, please contact me or Dan Brewer of my staff at 406-329-3951.

Sincerely,

Jodi L. Bush
Field Supervisor

Enclosures: Biological Opinion on the Road Related Activities that May Affect Bull Trout and Bull Trout Critical Habitat in Western Montana.

Copies To: MT Dept. Fish, Wildlife, and Parks, Helena, MT (Attn: Jeff Hagener)
File: 7759 Biological Opinions - 2015
Endangered Species Act - Section 7 Consultation

Biological Opinion
on the
Effects to Bull Trout and Bull Trout Critical Habitat
From the Implementation of
Proposed Actions Associated with
Road-related Activities that May Affect Bull Trout and Bull Trout Critical Habitat in
Western Montana

As Proposed by the
U.S. Forest Service, Northern Region (Bitterroot, Lolo, Flathead, Kootenai, Beaverhead
Deerlodge, and Helena National Forests), and the U.S. Bureau of Land Management, Missoula
Field Office

Completed by
U.S. Fish and Wildlife Service
Montana Ecological Services Office

April 15, 2015
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Table 8. Total miles of stream with lethal or sublethal effects by habitat type (Spawning and Rearing (SR) or Foraging, Migrating, and Overwintering (FMO)), levels of disturbance (low, medium, or high), and C-Rank (Potential Risk, Low Risk, At Risk, High Risk).

Table 9. Authorized annual amounts of anticipated incidental take based on the miles of stream with anticipated adverse effects by habitat type in occupied bull trout streams for each core area.
Introduction and Consultation History

This document represents the U.S. Fish and Wildlife Service’s (Service) biological opinion (BO) based on our review of the Biological Assessment (BA; U.S. Forest Service 2014) for Road-related Activities that May Affect Bull Trout and Bull Trout Critical Habitat in Western Montana, proposed by the U.S. Forest Service, Northern Region (Forest) and the Missoula Field Office, Bureau of Land Management (BLM). This BO addresses project related effects to the threatened bull trout (*Salvelinus confluentus*) and bull trout critical habitat in accordance with the Endangered Species Act (Act) of 1973 as amended (16 U.S.C. 1531 et seq.).

Section 7(b)(3)(A) of Act requires that the Secretary of Interior issue biological opinions on federal agency actions that may affect listed species or critical habitat. Biological opinions determine if the action proposed by the action agency is likely to jeopardize the continued existence of listed species or destroy or adversely modify critical habitat. Section 7(b)(3)(A) of the Act also requires the Secretary to suggest reasonable and prudent alternatives to any action that is found likely to jeopardize the continued existence of listed species or result in an adverse modification of critical habitat, if any has been designated.

The Service received a BA from the Forest on May 13, 2014. On September 12, 2014, the Service requested a 60 day extension to allow agencies to refine project design criteria and review the draft biological opinion. Additional information concerning the scope of activities was received on October 27, 2014. On December 15, 2014 the Service received a final BA.

This programmatic-level consultation only addresses routine road-related maintenance activities (see Table 1 below and Appendix A) on federal lands located west of the Continental Divide in Montana that are managed by the Kootenai, Flathead, Lolo, Bitterroot, Helena, and Beaverhead-Deerlodge National Forests and BLM. The action area includes portions of the Flathead, Clark Fork, and Kootenai river systems and associated bull trout core areas and critical habitat units. This document does not address potential effects to bull trout from the existence of the road networks on federal public lands or travel management. The purpose of this BO is to facilitate the program of routine road-related maintenance activities (see Table 1 below) in an effort to provide safe transportation and in some cases reduce road-related sediment inputs, improve fish passage, and reduce the risks of road and road stream crossing failure.

This BO addresses only the impacts to the federally listed bull trout and bull trout critical habitat within the action area and does not address the overall environmental acceptability of the proposed action.

I. Description of Proposed Action

The action area for this BO includes Forest and BLM administered lands in western Montana within the following core areas and critical habitat subunits: Upper Clark Fork River, Rock Creek, Blackfoot River, Clearwater River and Lakes, Middle Clark Fork River, West Fork Bitterroot River, Bitterroot River, Lower Clark Fork River, Hungry Horse, Holland Lake, Frozen Lake, Lindbergh Lake, Swan Lake, Flathead Lake, Doctor Lake, Big Salmon, Kootenai Lake and River, Bull Lake, and Lake Koocanusa. Road-related maintenance activities would occur on parts of the existing road network in the Bitterroot, Lolo, Kootenai, Flathead, Helena and
Beaverhead-Deerlodge National Forests, and BLM lands in western Montana.

The BA includes a description of the process (see Introduction section below) that the Forest and BLM must follow to meet the intent of the BA (U.S. Forest Service 2014 p. 3). These procedures provide a method for identifying road-related activities that fit within the analysis framework described in the proposed action section of the BA. The following description of the proposed action and procedures were taken from the BA (U.S. Forest Service 2014).

Introduction

The Forest and BLM have determined that all proposed activities conducted under the BA will comply with the Record of Decision and Standards and Guidelines of the administrative units’ respective large-scale planning processes, including BLM Resource Management Plans and National Forest Land and Resource Management Plans as amended by the Inland Native Fish Strategy (INFISH) (U.S. Forest Service 1995, 1998, 2008).

According to the Forest and BLM in order for road-related activities to meet the intent of BA, the following must be accomplished:

- Prior to implementing road-related activities, road maintenance personnel and a fisheries biologist will review each project. Together, they will ensure the project fits within the scope of the BA and BO;

- Before submitting projects as likely to adversely affect bull trout or bull trout critical habitat, every reasonable effort will be made to reduce the impacts through project modification so that effects are not likely to adversely affect bull trout and bull trout critical habitat; and

- All adverse activities submitted under the Forests and BLMs BA must incorporate design criteria that are selected from Appendix A and minimize effects to bull trout.

The analysis in the BA does not address potential effects to bull trout from the existence of the road network on federal public lands. Existing roads are considered a primary source of sediment related impacts to bull trout in developed watersheds (U.S. Forest Service 1998, p. 38), and the degraded baseline conditions caused by roads and sediment were part of the rationale for listing bull trout as threatened.

The analysis in the BA does not cover road activities that are conceived as part of a larger integrated landscape project. Consultation for these landscape-scale project activities needs to be covered in a comprehensive and stand-alone project consultation. Similarly, this road-based programmatic, assessment, and consultation is not intended to cover unpredictable disturbance activities such as fire and landslides that create effects to and may require road treatments outside of the scope of activities envisioned herein. These types of unpredictable road-based activities are to be addressed with the Service via the emergency consultation process.

The Forest and BLM evaluated the potential effects of road-related activities, including road surface maintenance, decommissioning, and stream crossing replacement and removal on bull
trout streams and bull trout critical habitat within the Columbia River Distinct Population Segment. The road-related activity types described in (Table 1 below) are necessary to help ensure a transportation system that is safe for public use, limit the risk of damage to facilities, and reduce the risk of damage to watersheds. The activities described in the BA can occur on a routine basis, starting at the date of this final BO in 2015 and continue for five years (through 2020). The process and proposed action described in the BA provides BLM and the Forest with a consistent methodology to design, implement, monitor, and document road-related maintenance and associated aquatic restoration activities.

**Description of the Road Related Activities and Design Criteria**

The proposed action includes 12 road-related activities and design criteria measures described in Appendix A. Road-related activities have been grouped into three Types (I, II, and III) based on similarity of effects (Table 1). Road-related activities are measured as either an individual site (i.e. bridge, culvert, and ford) or as a linear feature (i.e. miles of surface and ditch maintenance).

Table 1. Road-related activities grouped by their potential to affect bull trout and their critical habitat. A more detailed description of activity types is located in Appendix A. S= site activity and L= linear activity (adapted from U.S. Forest Service 2014).

<table>
<thead>
<tr>
<th>Activities that when implemented with required design criteria would have no effect, or insignificant or</th>
<th>Activities that when implemented with required design criteria may have short-term effects, on bull trout or bull</th>
<th>Activities that when implemented with required design criteria may have short-term effects, and will have</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I</td>
<td>Type II</td>
<td>Type III</td>
</tr>
<tr>
<td>Road surface drainage and cross-drain installation and maintenance (S)</td>
<td>Surface and ditch maintenance (L)</td>
<td>Culvert replacement- upgrade (S)</td>
</tr>
<tr>
<td>Snow removal (L)</td>
<td>Surface restoration and reconditioning and paving (L)</td>
<td>Road decommissioning (L)</td>
</tr>
<tr>
<td>Brushing (L)</td>
<td>Fill and cut-slope maintenance (L)</td>
<td>Road storage or closure (L)</td>
</tr>
<tr>
<td>Planting vegetation (L)</td>
<td>Road reconstruction (L)</td>
<td>Bridge, culvert, and ford maintenance (S)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Channel maintenance near roads (L)</td>
</tr>
</tbody>
</table>

The road-related maintenance actions listed above in Table 1 are not anticipated to result in an increase of road width. Increasing the width of travel ways within riparian management areas (i.e. Riparian Habitat Conservation Areas (RHCAs)) to accommodate increased traffic volume, larger vehicles, or other social issues is a concern. None of the road-related maintenance activities would result in an overall increase in road width and only projects that maintain current traffic volumes or use will qualify under the proposed action. However, some road-related maintenance activities that deviate slightly in project size and type from the proposed action may result in increased traffic volumes or use. These projects may be considered, but would require
further evaluation and approval by the Service through a Variance. The Forest and BLM will be required to provide a written or email request for a Variance as described below for these types of actions. Building new roads, including system roads or temporary roads, were not analyzed in the BA because new road construction is not part of the proposed action and therefore not addressed in this BO.

The Forest and BLM have developed specific procedures to identify discrete road maintenance activities that may be covered under the proposed action as well as design criteria to provide context for the road-related activities to minimize adverse effects to bull trout and designated critical habitat (see Appendix B).

**Allowable Activities and Limits under the Proposed Action**

Appendix A describes the road-related activities that are part of the proposed action. Appendix F lists the amount of road-related activities anticipated annually within each core area and Forest and BLM management unit. These estimates were generated by Forest and BLM biologist(s), engineering staff, and staff officers in some cases. The Forest and BLM have determined that activities described under Type I, II and III may result in either a No Effect (NE), May Affect Not Likely to Adversely Affect (NLAA) or May Affect Likely to Adversely Affect (LAA) determination, based on review of five factors: 1) location of activity and proximity to waterways; 2) duration of activity; 3) magnitude of activity; 4) timing of activity; and 5) mechanism of the activity’s effect (see Appendix H). Generally, Type II and III road activities that occur within 100 feet of an occupied bull trout stream were identified as LAA actions and totaled as either a linear feature (miles) or a site. Road-related activities measured as a linear feature include: snow removal, brushing, surface and ditch maintenance, surface restoration and reconditioning and paving, road reconstruction, channel maintenance near roads, road decommissioning, road storage, or closure. Road-related action measured as sites include: road surface drainage and cross-drain installation and maintenance, planting vegetation, fill and cut-slope maintenance, bridge, culvert, and ford maintenance, and culvert replacement-upgrade.

Generally, when Type I, II, and III activities occur greater than 100 feet away from the stream, the action is generally considered NLAA or NE. However, based on review of the five factors (listed above), Type II and III actions that occur greater than 100 feet from the stream can, in some situations, result in adverse effects that would therefore count towards the allowable amount of LAA activity miles and sites (see Appendix F). Similarly, Type I activities may under rare circumstances could result in adverse effects and therefore count toward the allowable amounts of LAA activity miles and sites (see Appendix F). If there are re-occurring situations where Type I activities reach a LAA determination than a separate stand-alone consultation maybe required. In addition to the limits on the amounts of road-related activities that may occur within each core area (see Appendix F), if a season’s likely to adversely affect maintenance activities in a given core area are unexpectedly concentrated within a local population or “other important population”, then the action agency will contact the Service to discuss whether additional or separate consultation is required. A guideline for an unusual concentration of activities is when projected adverse effects in a local population constitute five percent or more of that local population’s perennial stream network. Local population or other important population is generally comprised of one or more 6th filed Hydrological Unit Codes (HUCs) (see map in Appendix I). The five percent threshold was developed by members of the western
Montana Forest Service Fisheries Level One Team (including the U.S. Fish and Wildlife Service and BLM) during field reviews (Upper Rock Creek, Beaverhead-Deerlodge National Forest, Sept 19 – 20, 2012; Skalkaho drainage, Bitterroot National Forest, June 24, 2013) and subsequent discussions (included in BA references and Appendix H references). During these discussions the biologist shared their interpretations of the literature and after the field review literature was shared to support the discussion (included in BA references and Appendix H references). 

This process resulted in the derivation and support for limiting activities to a 5 percent threshold. The 5 percent (or more threshold) of “likely to adversely affect” activities in any given local population or other important population is not anticipated to be approached with any regularity. To determine if this threshold is being exceeded, the miles and sites for LAA activities are multiplied by the appropriate effects coefficient (see Table 5 in U.S. Forest Service 2014) to determine the total miles of stream with adverse effects. The LAA stream miles are then divided by the total miles of perennial stream that supports a local population (Appendix J) to determine the percent of stream impacted within that local population or other important population. The percent of stream impacted annually within local populations or other important populations will be monitored and reported annually.

Design Criteria

Standard mitigation will include reasonable implementation of all design criteria in Appendices A and D. The Forest or BLM personnel may require design criteria in addition to those listed in Appendix D (list of design criteria). Site specific conditions dictate if additional design criteria are required and the actions will be agreed upon by the biologists and road managers prior to completing the maintenance activity.

According to the Forest and BLM the following **design criteria measures 1 through 5 will be implemented on all road-related maintenance actions to meet the intent of the proposed action.**

1. A fisheries biologist will approve mitigation measures prior to project implementation and ensure they are in compliance with this programmatic.
2. A project that may affect the natural or existing shape of any stream or its banks or tributaries requires a 124 permit. All “special conditions” in the permit will be followed.
3. All State Best Management Practices (BMPs) and agency manual direction applicable to proposed road-related activities will be followed.
4. Any long-term need for road improvements will be documented in the management unit’s Annual Report of Road-related Activities (Appendix B) and referred to in future planning and maintenance prioritization efforts.
5. Options that would reduce or eliminate re-occurring activities or chronic sediment delivery will be documented in Appendix B (Annual Report of Road-related Activities). These options should be listed regardless of whether they are considered to be immediately feasible.
As noted in the specific guidelines, Montana State BMPs are to be applied for the type of action being taken. For example, if a road is being bladed, the BMPs associated with blading will also be applied. This does not imply that the entire segment of road, where actions are undertaken, must meet all BMPs. In the blading example, there may be undersized culverts or fish barriers in that segment of road. When actions are taken to replace these structures the applicable Montana BMPs would apply. While it is encouraged that roads be upgraded to meet all BMP standards, the only requirements for the purposes of this consultation is to apply those BMPs that are pertinent to the maintenance action undertaken at that time. Road systems that are not meeting INFISH standards or retarding the attainment of RMOs should be addressed during the travel management process.

**Variance Requests**

Variance from the project size and types described in the BA and in Appendix A (description of road-related actions) will likely be necessary because of the wide range of activities that could occur within the proposed action and the natural variability within western Montana. However, the use of variances should be relatively rare because the majority of activities will fall within the scope of the proposed action described in the BA.

The Service will consider granting variances when there is a clear conservation benefit or there are no additional adverse effects beyond that considered in this BO. Variance requests can be submitted to the Service via email correspondence. Variance requests will be completed in coordination with the land management unit biologist and will address all relevant questions in Appendix C (request for variance). If the Service does not approve a request for a variance, the project sponsor may initiate individual Section 7 consultation with the Service on the identified action.

In addition, if during completion of a project, the project sponsor becomes aware of new information or unforeseen circumstances such that the project cannot be completed according to the scope of effects or terms and conditions of the BO, the sponsor will require that the project stop operations, except for efforts to avoid or minimize resource damage, pending completion of individual consultation on the project.

**Reporting Requirements**

The land management units will use Appendix B (Annual Report of Road-related Activities) to summarize their previous year’s program of work and document the effects of those activities. Each land management unit will submit its Appendix B report for the prior year’s activities to the Service by January 30th of each year.

Level 1 fisheries biologists and their engineering staff will to continue to meet as needed to review and discuss the upcoming year’s activities. The biologist will confirm that the proposed activities:

- Include only those activities that are described in Appendix A;
- Are within the amounts provided in Appendix F; and
- Are within the amounts apportioned in the Incidental Take Statement for this BO.
Monitoring

Annually, the Level 1 team will discuss the road-related actions, design criteria, and the processes that could be improved to benefit bull trout and their habitat. The team will schedule one or more field reviews for the upcoming field season. The site will rotate among administrative units and be based on the location of the most pressing issues. The last field review occurred on the Beaverhead-Deerlodge National Forest in 2013. Forms such as the State’s BMP Audit may be used to focus the team review (http://www.dnrc.mt.gov/forestry/Assistance/Practices/Documents/2008AUDITREPORT.pdf).

III. Analytical Framework for the Jeopardy and Adverse Modification Analysis

Jeopardy Determination: In accordance with policy and regulation, the jeopardy analysis in this BO relies on four components: (1) the Status of the Species, which evaluates the bull trout’s range-wide condition, the factors responsible for that condition, and its survival and recovery needs; (2) the Environmental Baseline, which evaluates the condition of the bull trout in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the bull trout; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed federal action and the effects of any interrelated or interdependent activities on the bull trout; and (4) Cumulative Effects, which evaluates the effects of future, non-federal activities in the action area on the bull trout.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed federal action in the context of the bull trout’s current status, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the bull trout in the wild.

Interim Recovery Units (IRU) was defined in the final listing rule for the bull trout for use in completing jeopardy analyses. Pursuant to Service policy, when an action impairs or precludes the capacity of an IRU from providing both the survival and recovery function assigned to it, that action may represent jeopardy to the species. When using this type of analysis, the BO describes how the action affects not only the capability of the IRU, but the relationship of the recovery unit to both the survival and recovery of the listed species as a whole.

The jeopardy analysis for the bull trout in this BO uses the above approach and considers the relationship of the action area and core area (discussed below under the Status of the Species section) to the IRU and the relationship of the IRU to both the survival and recovery of the bull trout as a whole as the context for evaluating the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Within the context of the jeopardy analytical framework (Table 2), 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 2002 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
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 a level that would appreciably reduce survival and recovery of the species at a lower scale, such as the local or the core population scales, by deduction the proposed action would not jeopardize bull trout at the higher scale of the coterminous United States (i.e. range-wide). Therefore, the determination would result in a no-jeopardy finding. However, should a proposed action produce adverse effects that appreciably reduce survival and recovery of the species at a lower scale of analysis, then further analysis is warranted at the next higher scale. Generally, if a proposed federal 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 because of the relationship of each core area population to the survival and recovery of the species has a whole (70 CFR §402.02).

Survival is defined as for determination of jeopardy/adverse modification; the species’ persistence as listed or as a recovery unit, beyond the conditions leading to its endangerment, with sufficient resilience to allow for the potential recovery from endangerment. This condition is characterized by a species with a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, which exists in an environment providing all requirements for completion of the species’ entire life cycle, including reproduction, sustenance, and shelter (U.S. Fish and Wildlife Service 1998 p. 18). Recovery is defined as improvement in the status of listed species to the point at which listing is no longer appropriate under the criteria set out in section 4(a)(1) of the Act. [50 CFR §402.02].

For the purposes of bull trout recovery, emphasis is placed on the adult (migratory) life history forms at the core area scale. Benefits of migratory bull trout include greater fecundity resulting in increased reproductive potential, and dispersing the population across space and time so that spawning streams may be recolonized should local populations suffer a catastrophic loss (Rieman and McIntyre 1993, MBTSG 1998). In the absence of the migratory bull trout life form, isolated populations cannot be replenished when disturbance makes local habitats temporarily unsuitable, the range of the species is diminished, and the potential for enhanced reproductive capabilities are lost (Rieman and McIntyre 1993).

Adverse Modification Determination: This BO 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 ESA to complete the following analysis with respect to critical habitat.

The adverse modification analysis in this BO relies on four components: (1) the Status of Critical Habitat, which evaluates the range-wide condition of designated critical habitat for the bull trout in terms of primary constituent elements (PCEs); the factors responsible for that condition and the intended recovery function of the critical habitat overall; (2) the Environmental Baseline, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the recovery role of the critical habitat in the action area; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed federal action and the effects of any interrelated or interdependent activities on the PCEs and how that
will influence the recovery role of affected critical habitat units or subunits; and (4) *Cumulative Effects*, which evaluates the effects of future, non-federal activities in the action area on the PCEs and how that will influence the recovery role of affected critical habitat units.

For purposes of the adverse modification determination, the effects of the proposed federal action on bull trout critical habitat are evaluated in the context of the range-wide condition of the critical habitat, taking into account any cumulative effects, to determine if the critical habitat range-wide would remain functional (or would retain the current ability for the PCEs to be functionally established in areas of currently unsuitable but capable habitat) to serve its intended recovery role for the bull trout.

The analysis in this BO places an emphasis on using the intended range-wide recovery function of bull trout critical habitat, especially in terms of maintaining and/or restoring viable core areas, and the role of the action area relative to that intended function as the context for evaluating the significance of the effects of the proposed federal action, taken together with cumulative effects, for purposes of making the adverse modification determination.

The scales of analysis are described below in Table 2. The scales of analysis for jeopardy from smallest to largest are as follows: local population, core area, management unit, and IRU for the purposes of consultation and recovery. The core area scale is an appropriate unit of analysis by which threats to bull trout and recovery should be measured (FR 70, No 185). Similarly the geographical scales for critical habitat from smallest to largest are as follows: stream segment or water body, critical habitat subunit (CHSU), critical habitat unit (CHU) and the range of bull trout. Generally in the Clark Fork Management Unit (MU) and Kootenai MU, bull trout core areas are similar in geographical scale to the bull trout critical habitat subunit (CHSU).

The proposed action will affect portions of the core areas and associated subunits described in Table 2. For the purposes of this BO, all designated critical habitat supports and is occupied by a local population. For analysis purposes, the relationship of the local population within the action area to the larger population scales is illustrated in Tables 2 below.

Table 2. Hierarchy of units of analysis for bull trout jeopardy and adverse modifications analysis for this biological opinion.

<table>
<thead>
<tr>
<th>Coterminous United States</th>
<th>(5 Interim Recovery Unit/DPS and 32 Critical Habitat Units)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interim Recovery Unit-DPS / Critical Habitat Units</strong></td>
<td>Columbia River / 28 Critical Habitat Units</td>
</tr>
<tr>
<td><strong>Management Units/Critical Habitat Units</strong></td>
<td>Clark Fork Management Unit / Clark Fork River Basin</td>
</tr>
<tr>
<td></td>
<td>Kootenai Management Unit / Kootenai River Basin</td>
</tr>
<tr>
<td><strong>Core Areas and Critical Habitat Subunits</strong></td>
<td>Within that action area the geographical boundary of Core Areas is equal to the geographical boundary of Critical Habitat Subunits</td>
</tr>
<tr>
<td>Clark Fork Management Unit</td>
<td>Kootenai Management Unit</td>
</tr>
<tr>
<td><strong>Core Area and Subunits</strong></td>
<td>Kootenai Lake and River, Bull Lake, and Lake</td>
</tr>
<tr>
<td>Upper Clark Fork River, Rock Creek</td>
<td></td>
</tr>
</tbody>
</table>
Blackfoot River, Clearwater River and Lakes River, Middle Clark Fork River, West Fork Bitterroot River, Blackfoot River, Lower Clark Fork River (includes Lake Pend Oreille) River, Frozen Lake, Hungry Horse, Holland Lake, Swan Lake, Flathead Lake and Koocanusa

In the Clark Fork MU, a distinction has been made between two types of core areas (primary and secondary) based on the size, connectedness, and complexity of the associated watershed, and the degree of natural population isolation. The following have been designated as primary core areas under recovered conditions in the Clark Fork MU: the Upper Clark Fork River, Middle Clark River, Rock Creek, Blackfoot River, Bitterroot River, Lower Clark Fork River /Lake Pend Oreille, Priest Lakes and Priest River, Flathead Lake, Swan Lake, and Hungry Horse Reservoir, secondary core areas include, Holland Lake, Lindbergh Lake, Upper Kintla Lake, Kintla Lake, Doctor Lake, Big Salmon Lake and Frozen Lake (U.S. Fish and Wildlife Service 2002b, pp. 131-132). Similar to the Clark Fork Management Unit the two primary core areas in the Kootenai MU include Lake Koocanusa and the Kootenai/Kootenay Lake complex downstream of Libby Dam (U.S. Fish and Wildlife Service 2002d). The two secondary core areas include Bull Lake and Sophie core areas. The loss of a primary core area would represent a significant gap in the range of the species within this MU.

The Service determined that each of the 32 individual CHUs and 99 CHSUs are essential for the conservation of the species (U.S. Fish and Wildlife Service 2009a, p. 9). The Clark Fork River Basin CHU 31 is essential for maintaining bull trout distribution within the unique geographic region of the draft Columbia Headwaters Recovery Unit (see page 63927 of FR 75, No. 200) in large part because it represents the evolutionary heart of the migratory adfluvial bull trout life history form (U.S. Fish and Wildlife Service 2009a, p. 32). The Kootenai River Basin CHU is essential for maintaining bull trout distribution within this unique geographic region of the Columbia Headwaters RU. This CHU is a uniquely configured transboundary watershed, flowing in a horseshoe pattern that both originates (eastern or upstream arm) and ends (at Kootenay Lake) in British Columbia. This CHU is essential to bull trout recovery because it contains the strongest adfluvial core area population across the range of the species (10,000+ adults in Lake Koocanusa) and also supports the single largest spawning run of adult bull trout (3,000–5,000 adults annually) in the Wigwam River, British Columbia (U.S. Fish and Wildlife Service 2009a, p. 31).

IV. Status of the Species and Critical Habitat

A. Status of the Species

A.1 Listing Status

The coterminous United States population of the bull trout was listed as threatened on November 1, 1999 (64 FR 58910). The threatened bull trout occurs in the Klamath River Basin of south-central Oregon, the Jarbidge River in Nevada, north to various coastal rivers of Washington to

The bull trout was initially listed as three Distinct Population Segments (DPSs) (63 FR 31647, 64 FR 17110). The preamble to the final listing rule for the United States coterminous population of the bull trout discusses the consolidation of these DPSs, plus two other population segments, into one listed taxon and the application of the jeopardy standard under section 7 of the Act relative to this species (64 FR 58930):

“Although this rule consolidates the five bull trout DPSs into one listed taxon, based on conformance with the DPS policy for purposes of consultation under section 7 of the Act, we intend to retain recognition of each DPS in light of available scientific information relating to their uniqueness and significance. Under this approach, these DPSs will be treated as IRUs with respect to application of the jeopardy standard until an approved recovery plan is developed. Formal establishment of bull trout recovery units will occur during the recovery planning process.”

Consideration of the above recovery units for purposes of the jeopardy analysis is done within the context of making the jeopardy determination at the scale of the entire listed species in accordance with Service policy (Fish and Wildlife Service 2006, pp. 1-2).

Though wide ranging in parts of Oregon, Washington, Idaho, and Montana, bull trout in the interior Columbia River basin presently occur in only about 45 percent of the historical range (Quigley and Arbelbide 1997, p. 1177; Rieman et al. 1997, p. 1119). Declining trends due to the combined effects of habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, angler harvest and poaching, entrainment into diversion channels and dams, and introduced non-native species (e.g., brook trout, Salvelinus fontinalis) have resulted in declines in range-wide bull trout distribution and abundance (Bond 1992, p. 4; Schill 1992, p. 40; Thomas 1992, pp. 9-12; Ziller 1992, p. 28; Rieman and McIntyre 1993, pp. 1-18; Newton and Pribyl 1994, pp. 2, 4, 8-9; Idaho Department of Fish and Game in litt. 1995, pp. 1-3). Several local extirpations have been reported, beginning in the 1950s (Rode 1990, p. 1; Ratliff and Howell 1992, pp. 12-14; Donald and Alger 1993, p. 245; Goetz 1994, p. 1; Newton and Pribyl 1994, p. 2; Berg and Priest 1995, pp. 1-45; Light et al. 1996, pp. 20-38; Buchanan and Gregory 1997, p. 120).

Land and water management activities such as dams and other diversion structures, forest management practices, livestock grazing, agriculture, road construction and maintenance, mining, and urban and rural development continue to degrade bull trout habitat and depress bull trout populations (U.S. Fish and Wildlife Service 2002a, p. 13).

A.2 Species Description

Bull trout (Salvelinus confluentus), member of the family Salmonidae, are char native to the Pacific Northwest and western Canada. The bull trout and the closely related Dolly Varden
*(Salvelinus malma)* were not officially recognized as separate species until 1980 (Robins et al. 1980, p. 19). Bull trout historically occurred in major river drainages in the Pacific Northwest from the southern limits in the McCloud River in northern California (now extirpated), Klamath River basin of south central Oregon, and the Jarbidge River in Nevada to the headwaters of the Yukon River in the Northwest Territories, Canada (Cavender 1978, p. 165-169; Bond 1992, p. 2-3). To the west, the bull trout’s current range includes Puget Sound, coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992, p. 2-3). East of the Continental Divide bull trout are found in the headwaters of the Saskatchewan River in Alberta and the MacKenzie River system in Alberta and British Columbia (Cavender 1978, p. 165-169; Brewin and Brewin 1997, pp. 209-216). Bull trout are widespread throughout the Columbia River basin, including its headwaters in Montana and Canada.

### A.3 Life History

Bull trout exhibit resident and migratory life history strategies throughout much of the current range (Rieman and McIntyre 1993, p. 2). Resident bull trout complete their entire life cycle in the streams where they spawn and rear. Migratory bull trout spawn and rear in streams for one to four years before migrating to either a lake (adfluvial), river (fluvial), or, in certain coastal areas, to saltwater (anadromous) where they reach maturity (Fraley and Shepard 1989, p. 1; Goetz 1989, pp. 15-16). Resident and migratory forms often occur together and it is suspected that individual bull trout may give rise to offspring exhibiting both resident and migratory behavior (Rieman and McIntyre 1993, p. 2).

Bull trout have more specific habitat requirements than other salmonids (Rieman and McIntyre 1993, p. 4). Watson and Hillman (1997, p. 248) concluded that watersheds must have specific physical characteristics to provide habitat requirements for bull trout to successfully spawn and rear. It was also concluded that these characteristics are not necessarily ubiquitous throughout these watersheds resulting in patchy distributions even in pristine habitats.

Bull trout are found primarily in colder streams, although individual fish are migratory in larger, warmer river systems throughout the range (Fraley and Shepard 1989, pp. 135-137; Rieman and McIntyre 1993, p. 2 and 1995, p. 288; Buchanan and Gregory 1997, pp. 121-122; Rieman et al. 1997, p. 1114). Water temperature above 15°C (59°F) is believed to limit bull trout distribution, which may partially explain the patchy distribution within a watershed (Fraley and Shepard 1989, p. 133; Rieman and McIntyre 1995, pp. 255-296). Spawning areas are often associated with cold water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992, p. 6; Rieman and McIntyre 1993, p. 7; Rieman et al. 1997, p. 1117). Goetz (1989, pp. 22, 24) suggested optimum water temperatures for rearing of less than 10°C (50°F) and optimum water temperatures for egg incubation of 2 to 4°C (35 to 39°F).

All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Goetz 1989, pp. 22-25; Pratt 1992, p. 6; Thomas 1992, pp. 4-5; Rich 1996, pp. 35-38; Sexauer and James 1997, pp. 367-369; Watson and Hillman 1997, pp. 247-249). Jakober (1995, p. 42) observed bull trout overwintering in deep beaver ponds or pools containing large woody debris in the Lolo River drainage, Montana, and suggested that suitable winter habitat may be more restrictive than summer habitat. Bull trout prefer relatively stable channel and water flow conditions (Rieman and McIntyre 1993, p. 6).
Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997, pp. 368-369).

The size and age of bull trout at maturity depend upon life history strategy. Growth of resident fish is generally slower than migratory fish; resident fish tend to be smaller at maturity and less fecund (Goetz 1989, p. 15). Bull trout normally reach sexual maturity in 4 to 7 years and live as long as 12 years. Bull trout are iteroparous (they spawn more than once in a lifetime), and both repeat- and alternate-year spawning has been reported, although repeat-spawning frequency and post-spawning mortality are not well documented (Leathe and Graham 1982, p. 95; Fraley and Shepard 1989, p. 135; Pratt 1992, p. 8; Rieman and McIntyre 1996, p. 133).

Bull trout typically spawn from August to November during periods of decreasing water temperatures. Migratory bull trout frequently begin spawning migrations as early as April, and have been known to move upstream as far as 250 kilometers (km) (155 miles (mi)) to spawning grounds (Fraley and Shepard 1989, p. 135). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992, p. 1) and, after hatching, juveniles remain in the substrate. Time from egg deposition to emergence may exceed 200 days. Fry normally emerge from early April through May depending upon water temperatures and increasing stream flows (Pratt 1992, p. 1).

The iteroparous reproductive system of bull trout has important repercussions for the management of this species. Bull trout require two-way passage up and downstream, not only for repeat spawning, but also for foraging. Most fish ladders, however, were designed specifically for anadromous semelparous (fishes that spawn once and then die, and therefore require only one-way passage upstream) salmonids. Therefore, even dams or other barriers with fish passage facilities may be a factor in isolating bull trout populations if they do not provide a downstream passage route.

Bull trout are opportunistic feeders with food habits primarily a function of size and life history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macro zooplankton, and small fish (Boag 1987, p. 58; Goetz 1989, pp. 33-34; Donald and Alger 1993, pp. 239-243). Adult migratory bull trout are primarily piscivores, known to feed on various fish species (Fraley and Shepard 1989, p. 135; Donald and Alger 1993, p. 242).

A.4 Population Dynamics

The draft bull trout Recovery Plan (U.S. Fish and Wildlife Service 2002a, pp. 47-48) defined core areas as groups of partially isolated local populations of bull trout with some degree of gene flow occurring between them. Based on this definition, core areas can be considered metapopulations. A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meefe and Carroll 1994, p. 188). In theory, bull trout metapopulations (core areas) can be composed of two or more local populations, but Rieman and Allendorf (2001, p. 763) suggest that for a bull trout metapopulation to function effectively, a minimum 10 local populations are required. Bull trout core areas with fewer than five local populations are at increased risk of local extirpation, core areas with between five and 10 local populations are at intermediate risk, and core areas with
more than 10 interconnected local populations are at diminished risk (U.S. Fish and Wildlife Service 2002a, pp. 50-51).

The presence of a sufficient number of adult spawners is necessary to ensure persistence of bull trout populations. In order to avoid inbreeding depression, it is estimated that a minimum of 100 spawners are required. Inbreeding can result in increased homozygosity of deleterious recessive alleles which can in turn reduce individual fitness and population viability (Whitesel et al. 2004, p. 36). For persistence in the longer term, adult spawning fish are required in sufficient numbers to reduce the deleterious effects of genetic drift and maintain genetic variation. For bull trout, Rieman and Allendorf (2001, p. 762) estimate that approximately 1,000 spawning adults within any bull trout population are necessary for maintaining genetic variation indefinitely. Many local bull trout populations individually do not support 1,000 spawners, but this threshold may be met by the presence of smaller interconnected local populations within a core area.

For bull trout populations to remain viable (and recover), natural productivity should be sufficient for the populations to replace themselves from generation to generation. A population that consistently fails to replace itself is at an increased risk of extinction. Since estimates of population size are rarely available, the productivity or population growth rate is usually estimated from temporal trends in indices of abundance at a particular life stage. For example, redd counts are often used as an indicator of a spawning adult population. The direction and magnitude of a trend in an index can be used as a surrogate for growth rate.

Survival of bull trout populations is also dependent upon connectivity among local populations. Although bull trout are widely distributed over a large geographic area, they exhibit a patchy distribution even in pristine habitats (Rieman and McIntyre 1993, p. 7). Increased habitat fragmentation reduces the amount of available habitat and increases isolation from other populations of the same species (Saunders et al. 1991, p. 22). Burkey (1989, p. 76) concluded that when species are isolated by fragmented habitats, low rates of population growth are typical in local populations and their probability of extinction is directly related to the degree of isolation and fragmentation. Without sufficient immigration, growth of local populations may be low and probability of extinction high. Migrations also facilitate gene flow among local populations because individuals from different local populations interbreed when some stray and return to non natal streams. Local populations that are extirpated by catastrophic events may also become reestablished in this manner.

In summary, based on the works of Rieman and McIntyre (1993, pp. 9-15) and Rieman and Allendorf (2001, pp 756-763), the draft bull trout Recovery Plan identified four elements to consider when assessing long-term viability (extinction risk) of bull trout populations: (1) number of local populations, (2) adult abundance (defined as the number of spawning fish present in a core area in a given year), (3) productivity, or the reproductive rate of the population, and (4) connectivity (as represented by the migratory life history form).

A.5 Status and Distribution

As noted above, in recognition of available scientific information relating to their uniqueness and significance, five population segments of the coterminous United States population of the bull trout are referred to as IRUs and considered essential to the survival and recovery of this species.
and are identified as: (1) Jarbidge River, (2) Klamath River, (3) Coastal-Puget Sound, (4) St. Mary-Belly River, and (5) Columbia River. Each of these IRUs is necessary to maintain the bull trout’s distribution, as well as its genetic and phenotypic diversity, all of which are important to ensure the species’ resilience to changing environmental conditions.

A summary of the current status and conservation needs of the bull trout within these IRUs is provided below. A comprehensive discussion of these topics is found in the draft bull trout Recovery Plan (U.S. Fish and Wildlife Service 2002a).

Central to the survival and recovery of the bull trout is the maintenance of viable core areas (U.S. Fish and Wildlife Service 2002a, p. 54). A core area is defined as a geographic area occupied by one or more local bull trout populations that overlap in their use of rearing, foraging, migratory, and overwintering (FMO) habitat, and in some cases their use of spawning habitat. Each of the population segments listed below consists of one or more core areas. One hundred and twenty one core areas are recognized across the United States range of the bull trout (U.S. Fish and Wildlife Service 2008, p. 21).

A core area assessment conducted by the Service for the five year bull trout status review determined that of the 121 core areas comprising the coterminous listing, 43 are at high risk of extirpation, 44 are at risk, 28 are at potential risk, 4 are at low risk and 2 are of unknown status (U.S. Fish and Wildlife Service 2008, p. 29).

**Jarbidge River IRU:** This IRU currently contains a single core area with six local populations. Less than 500 resident and migratory adult bull trout, representing about 50 to 125 spawners, are estimated to occur within the core area. The current condition of the bull trout in this segment is attributed to the effects of livestock grazing, roads, angler harvest, timber harvest, and the introduction of non-native fishes (U.S. Fish and Wildlife Service 2004b, p. iii). The draft bull trout Recovery Plan identifies the following conservation needs for this segment: (1) maintain the current distribution of the bull trout within the core area, (2) maintain stable or increasing trends in abundance of both resident and migratory bull trout in the core area, (3) restore and maintain suitable habitat conditions for all life history stages and forms, and (4) conserve genetic diversity and increase natural opportunities for genetic exchange between resident and migratory forms of the bull trout. An estimated 270 to 1,000 spawning fish per year are needed to provide for the persistence and viability of the core area and to support both resident and migratory adult bull trout (U.S. Fish and Wildlife Service 2004b, p. 62-63). Currently this core area is at high risk of extirpation (U.S. Fish and Wildlife Service 2005b, p. 9).

**Klamath River IRU:** This IRU currently contains three core areas and 12 local populations. The current abundance, distribution, and range of the bull trout in the Klamath River Basin are greatly reduced from historical levels due to habitat loss and degradation caused by reduced water quality, timber harvest, livestock grazing, water diversions, roads, and the introduction of non-native fishes. Bull trout populations in this unit face a high risk of extirpation (U.S. Fish and Wildlife Service 2002c, p. iv). The draft bull trout Recovery Plan (U.S. Fish and Wildlife Service 2002b, p. v) identifies the following conservation needs for this unit: (1) maintain the current distribution of the bull trout and restore distribution in previously occupied areas, (2) maintain stable or increasing trends in bull trout abundance, (3) restore and maintain suitable habitat conditions for all life history stages and strategies, and (4) conserve genetic diversity and
provide the opportunity for genetic exchange among appropriate core area populations. Eight to 15 new local populations and an increase in population size from about 3,250 adults currently to 8,250 adults are needed to provide for the persistence and viability of the three core areas (U.S. Fish and Wildlife Service 2002c, p. vi).

Coastal-Puget Sound IRU: Bull trout in the Coastal-Puget Sound IRU exhibit anadromous, adfluvial, fluvial, and resident life history patterns. The anadromous life history form is unique to this unit. This population segment currently contains 14 core areas and 67 local populations (U.S. Fish and Wildlife Service 2004a, p. iv; 2004a, pp. iii-iv). Bull trout are distributed throughout most of the large rivers and associated tributary systems within this unit. With limited exceptions, bull trout continue to be present in nearly all major watersheds where they likely occurred historically within this unit. Generally, bull trout distribution has contracted and abundance has declined, especially in the southeastern part of the unit. The current condition of the bull trout in this population segment is attributed to the adverse effects of dams, forest management practices (e.g., timber harvest and associated road building activities), agricultural practices (e.g., diking, water control structures, draining of wetlands, channelization, and the removal of riparian vegetation), livestock grazing, roads, mining, urbanization, angler harvest, and the introduction of non-native species. The draft bull trout Recovery Plan (U.S. Fish and Wildlife Service 2004a, pp. ix-x) identifies the following conservation needs for this unit: (1) maintain or expand the current distribution of bull trout within existing core areas, (2) increase bull trout abundance to about 16,500 adults across all core areas, and (3) maintain or increase connectivity between local populations within each core area.

St. Mary-Belly River IRU: This IRU currently contains six core areas and nine local populations (U.S. Fish and Wildlife Service 2002e, p. v). Currently, bull trout are widely distributed in the St. Mary River drainage and occur in nearly all of the waters that were inhabited historically. Bull trout are found only in a 1.2-mile reach of the North Fork Belly River within the United States. Redd count surveys of the North Fork Belly River documented an increase from 27 redds in 1995 to 119 redds in 1999. This increase was attributed primarily to protection from angler harvest (U.S. Fish and Wildlife Service 2002e, p. 37). The current condition of the bull trout in this population segment is primarily attributed to the effects of dams, water diversions, roads, mining, and the introduction of non-native fishes (U.S. Fish and Wildlife Service 2002e, p. vi). The draft bull trout Recovery Plan (U.S. Fish and Wildlife Service 2002e, pp. v-ix) identifies the following conservation needs for this unit: (1) maintain the current distribution of the bull trout and restore distribution in previously occupied areas, (2) maintain stable or increasing trends in bull trout abundance, (3) maintain and restore suitable habitat conditions for all life history stages and forms, (4) conserve genetic diversity and provide the opportunity for genetic exchange, and (5) establish good working relations with Canadian interests because local bull trout populations in this unit are comprised mostly of migratory fish whose habitat is mainly in Canada.

Columbia River IRU: The Columbia River IRU includes bull trout residing in portions of Oregon, Washington, Idaho, and Montana. Currently, following consolidation of some core areas, this IRU contains 90 of the 118 core areas across the range of bull trout. In the early 1950s, bull trout populations within this IRU were at best stable and more often declining (Thomas 1992; Schill 1992; Pratt and Huston 1993). Bull trout were estimated to have
historically occupied about 60 percent of the Columbia River Basin, and in 1997, bull trout occurred in 45 percent of the estimated historical range (Quigley and Arbelbide 1997, p. 1177).

The condition of the bull trout populations within these core areas varies from poor to good, but generally all have been subject to the combined effects of habitat degradation, fragmentation, and alterations associated with one or more of the following activities: dewatering, road construction and maintenance, mining and grazing, blockage of migratory corridors by dams or other diversion structures, poor water quality, incidental angler harvest, entrainment into diversion channels, and introduced non-native species.

In 2008 as part the 5-year status review of bull trout and prior to consolidation, the Service determined that of the total 95 core areas in the Columbia River IRU population segment, 38 are at high risk of extirpation, 35 are at risk, 20 are at potential risk, two are at low risk, and two are at unknown risk (U.S. Fish and Wildlife Service 2005b, pp. 1-94).

The draft bull trout Recovery Plan (U.S. Fish and Wildlife Service 2002a, p. v) identified the following conservation needs for the Columbia River IRU: (1) maintain or expand the current distribution of the bull trout within core areas; (2) maintain stable or increasing trends in bull trout abundance; (3) maintain and restore suitable habitat conditions for all bull trout life history stages; and (4) conserve genetic diversity and provide opportunities for genetic exchange.

The draft bull trout Recovery Plan (U.S. Fish and Wildlife Service 2002a, p. 2) identified 22 recovery units within the Columbia River IRU. These units are now referred to as Management Units (MUs). MUs include groupings of bull trout with historical or current gene flow within them and were designated to place the scope of bull trout recovery on smaller spatial scales than the larger population segments.

Individual MUs are important to bull trout recovery by providing for the distribution of bull trout across their native range and maintaining adaptive ability to ensure long-term persistence. Similarly, individual core areas are the foundation of MUs, and maintenance of these areas is critical to recovery (U.S. Fish and Wildlife Service 2002a). Genetic diversity enhances long-term survival of a species by increasing the likelihood that the species is able to survive changing environmental conditions. For instance, a local population of bull trout may contain individuals with genes that enhance their ability to survive in the prevailing local environmental conditions. Individuals with a different genetic complement may persist in the local population in much lower abundance than those with locally adapted genes.

Each MU is important; and recovery units are an appropriate scale at which to gauge progress toward recovery for individual distinct population segments and the species within the coterminous United States. Recovering bull trout in each MU will maintain the overall distribution of bull trout in their native range. Conserving core areas and their habitats within recovery units should preserve genotypic and phenotypic diversity and allow bull trout access to diverse habitats. The continued survival and recovery of individual core areas is critical to the persistence of MUs and their role in the recovery of a distinct population segment (U.S. Fish and Wildlife Service 2002a, p. 54). The proposed action is located within the Clark Fork and Kootenai MUs which is detailed below:
Clark Fork River MU: In the Clark Fork River MU, 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 35 core areas for bull trout. In 2002, the Service identified 152 local populations of bull trout within these core areas (U.S. Fish and Wildlife Service 2002b, p. 131). The Clark Fork River MU is among the largest and most diverse across the range of the species and contains the highest number of core areas of any MU, due in large part to the preponderance of isolated headwater lakes in the system (U.S. Fish and Wildlife Service 2002b, p. ix).

The 2008 status review applied a risk assessment model to each core area within the MU. The model used to rank the relative risk to bull trout was based on the Natural Heritage Program’s 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 (referred to as a C-Rank in the model).

Results of the status review (U.S. Fish and Wildlife Service 2005b) indicated that of its 35 core areas, the Clark Fork River MU has 18 core areas rated at high risk, 5 rated as at risk and 7 at potential risk. A core area rated at high risk was functioning at “at risk” because of very limited and/or declining numbers, range, and/or habitat, making the bull trout in this core area vulnerable to extirpation (U.S. Fish and Wildlife Service 2005b).

The Service considers many of the core areas in the Clark Fork River MU to be at risk of extirpation due in part to natural isolation, single life-history form, and low abundance. Expansion of non-native species is the single largest human-caused threat in most of the core areas. Dams and degraded habitat have also contributed to bull trout declines across this MU.

Kootenai River MU: The Kootenai River MU forms part of the range of the Columbia River population segment. The Kootenai River MU is unique in its international configuration, and recovery will require strong international cooperative efforts. Within the Kootenai River MU, the historic distribution of bull trout is relatively intact. Abundance of bull trout in portions of the watershed has been reduced, and remaining populations are fragmented. Results of the status review (U.S. Fish and Wildlife Service 2005b) indicated that of its 4 core areas (Lake Koocanusa, Kootenai River, Sophie Lake, Bull Lake) and 10 local populations, the Kootenai MU has 1 core areas rated at high risk, 2 rated as at risk and 1 at low risk.

The greatest threats to bull trout in this MU, in order of magnitude, are introduced species, forestry, water withdrawals, angling and poaching, migration barriers, residential development, and mining (Fredenberg 2008). Distribution of bull trout has changed little since listing as bull trout continue to be present in nearly all major watersheds where they likely occurred historically.

B. Critical Habitat

B.1 Legal Status of Designated Critical Habitat
Litigation resulted in the U.S. District Court for the District of Oregon granting the Service a voluntary remand of the 2005 critical habitat designation. Subsequently the Service published a proposed critical habitat rule on January 14, 2010 (75 FR 2260) and a final rule on October 18,
2010 (75 FR 63898). The rule became effective on November 17, 2010. A justification document was also developed to support the rule and is available on our website (http://www.fws.gov/pacific/bulltrout). The scope of the designation involved the species’ coterminous range, which includes the Jarbidge River, Klamath River, Coastal-Puget Sound, St. Mary-Belly River, and Columbia River population segments (also considered as IRUs). The Service’s 5 year review (Fish and Wildlife Service 2008, pg. 9) identifies six draft recovery units. Until the bull trout draft recovery plan is finalized, the current five interim recovery units are in affect for purposes of section 7 jeopardy analyses and recovery. The adverse modification analysis does not rely on recovery units.

Range-wide, the Service designated reservoirs/lakes and stream/shoreline miles in 32 critical habitat units (CHU) as bull trout critical habitat (Table 3). Designated bull trout critical habitat is of two primary use types: (1) SR; and (2) FMO.

Table 3. Stream/shoreline distance and reservoir/lake area designated as bull trout critical habitat by state.

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<th>State</th>
<th>Stream/ Shoreline Miles</th>
<th>Stream/ Shoreline Kilometers</th>
<th>Reservoir/ Lake Acres</th>
<th>Reservoir/Lake Hectares</th>
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<td>14,116.5</td>
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<td>Washington (marine)</td>
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</tbody>
</table>

The rule identifies and designates as critical habitat approximately 1,323.7 km (822.5 miles) of streams/shorelines and 6,758.8 hectares (ha) (16,701.3 acres (ac)) of lakes/reservoirs of unoccupied habitat to address bull trout conservation needs in specific geographic areas in several areas not occupied at the time of listing. These unoccupied areas were determined by the Service to be essential for restoring functioning migratory bull trout populations based on currently available scientific information. These unoccupied areas often include lower mainstem river environments that can provide seasonally important migration habitat for bull trout. This type of habitat is essential in areas where bull trout habitat and population loss over time necessitates reestablishing bull trout in currently unoccupied habitat areas to achieve recovery.

The final rule continues to exclude some critical habitat segments based on a careful balancing of the benefits of inclusion versus the benefits of exclusion. Critical habitat does not include: (1) waters adjacent to non-federal lands covered by legally operative incidental take permits for habitat conservation plans (HCPs) issued under section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended (Act), in which bull trout is a covered species on or before the publication of this final rule; (2) waters within or adjacent to Tribal lands subject to certain
commitments to conserve bull trout or a conservation program that provides aquatic resource protection and restoration through collaborative efforts, and where the Tribes indicated that inclusion would impair their relationship with the Service; or (3) waters where impacts to national security have been identified (75 FR 63898). Excluded areas are approximately 10 percent of the stream/shoreline miles and 4 percent of the lakes and reservoir acreage of designated critical habitat. Each excluded area is identified in the relevant CHU text, as identified in paragraphs (e)(8) through (e)(41) of the final rule. It is important to note that the exclusion of water bodies from designated critical habitat does not negate or diminish their importance for bull trout conservation. Because exclusions reflect the often complex pattern of land ownership, designated critical habitat is often fragmented and interspersed with excluded stream segments.

Conservation Role and Description of Critical Habitat: The conservation role of bull trout critical habitat is to support viable core area populations (75 FR 63943). The core areas reflect the metapopulation structure of bull trout and are the closest approximation of a biologically functioning unit for the purposes of recovery planning and risk analyses. CHUs generally encompass one or more core areas and may include FMO areas, outside of core areas, that are important to the survival and recovery of bull trout.

As previously noted, 32 CHUs within the geographical area occupied by the species at the time of listing are designated under the final rule. Twenty-nine of the CHUs contain all of the physical or biological features identified in this final rule and support multiple life-history requirements. Three of the mainstem river units in the Columbia and Snake River basins contain most of the physical or biological features necessary to support the bull trout’s particular use of that habitat, other than those physical and biological features associated with Primary Constituent Elements (PCEs) 5 and 6, which relate to breeding habitat (see list below).

The primary function of individual CHUs is to maintain and support core areas, which (1) contain bull trout populations with the demographic characteristics needed to ensure their persistence and contain the habitat needed to sustain those characteristics (Rieman and McIntyre 1993, p. 19); (2) provide for persistence of strong local populations, in part, by providing habitat conditions that encourage movement of migratory fish (MBTSG 1998, pp. 48-49; Rieman and McIntyre 1993, pp. 22-23); (3) are large enough to incorporate genetic and phenotypic diversity, but small enough to ensure connectivity between populations (MBTSG 1998, pp. 48-49; Rieman and McIntyre 1993, pp. 22-23); and (4) are distributed throughout the historic range of the species to preserve both genetic and phenotypic adaptations (MBTSG 1998, pp. 13-16; Rieman and Allendorf 2001, p. 763; Rieman and McIntyre 1993, p. 23).

In determining which areas to designate as critical habitat, the Service considered the physical and biological features that are essential to the conservation of bull trout and that may require special management considerations or protection. These features are the PCEs laid out in the appropriate quantity and spatial arrangement for conservation of the species. The PCEs for bull trout are those habitats components that are essential for the primary biological needs of foraging, reproducing, rearing of young, dispersal, genetic exchange, or sheltering (75 FR 63898, p. 2306). The PCEs of designated critical habitat are:
1. Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia.

2. Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including, but not limited to, permanent, partial, intermittent, or seasonal barriers.

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

4. Complex river, stream, lake, reservoir, and marine shoreline aquatic environments and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.

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

6. In spawning and rearing (SR) areas, substrate of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine sediment, generally ranging in size from silt to coarse sand, embedded in larger substrates, is characteristic of these conditions. The size and amounts of fine sediment suitable to bull trout will likely vary from system to system.

7. A natural hydrograph, including peak, high, low, and base flows within historic and seasonal ranges or, if flows are controlled, minimal flow departures from a natural hydrograph.

8. Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.

9. Sufficiently low levels of occurrence of non-native predatory (e.g., lake trout, walleye, northern pike, smallmouth bass); interbreeding (e.g., brook trout); or competing (e.g., brown trout) species that, if present, are adequately temporally and spatially isolated from bull trout.

B.2 Current Range-wide Condition of Bull Trout Critical Habitat

The condition of designated bull trout critical habitat varies across its range from poor to good. Although still relatively widely distributed across its historic range, the bull trout occurs in low numbers in many areas, and populations are considered depressed or declining across much of its range (67 FR 71240). This condition reflects the condition of bull trout habitat. The primary land and water management activities impacting the physical and biological features essential to the conservation of bull trout include timber harvest and road building, agriculture and agricultural diversions, livestock grazing, dams, mining, urbanization and residential development, and non-native species presence or introduction (75 FR 2282).
There is widespread agreement in the scientific literature that many factors related to human activities have impacted bull trout and their habitat, and continue to do so. Among the many factors that contribute to degraded PCEs, those which appear to be particularly significant and have resulted in a legacy of degraded habitat conditions are as follows:

1. Fragmentation and isolation of local populations due to the proliferation of dams and water diversions that have eliminated habitat, altered water flow and temperature regimes, and impeded migratory movements (Dunham and Rieman 1999, p. 652; Rieman and McIntyre 1993, p. 7).

2. Degradation of spawning and rearing habitat and upper watershed areas, particularly alterations in sedimentation rates and water temperature, resulting from forest and rangeland practices and intensive development of roads (Fraley and Shepard 1989, p. 141; MBTSG 1998, pp. ii - v, 20-45).

3. The introduction and spread of non-native fish species, particularly brook trout and lake trout, as a result of fish stocking and degraded habitat conditions, which compete with bull trout for limited resources and, in the case of brook trout, hybridize with bull trout (Leary et al. 1993, p. 857; Rieman et al. 2006, pp. 73-76).

4. In the Coastal-Puget Sound region where amphidromous bull trout occur, degradation of mainstem river FMO habitat, and the degradation and loss of marine near shore foraging and migration habitat due to urban and residential development.

5. Degradation of FMO habitat resulting from reduced prey base, roads, agriculture, development, and dams.

One objective of the final rule was to identify and protect those habitats that provide resiliency for bull trout use in the face of climate change. Over a period of decades, climate change may directly threaten the integrity of the essential physical or biological features described in PCEs 1, 2, 3, 5, 7, 8, and 9. Protecting bull trout strongholds and cold water refugia from disturbance and ensuring connectivity among populations were important considerations in addressing this potential impact. Additionally, climate change may exacerbate habitat degradation impacts both physically (e.g., decreased base flows, increased water temperatures) and biologically (e.g., increased competition with non-native fishes).

Clark Fork River Critical Habitat Unit 31: The Clark Fork River Basin CHU includes 5,356.0 km (3,328.1 mi) of streams and 119,620.1 ha (295,586.6 ac) of lakes and reservoirs designated as critical habitat. The subunits within this unit provide spawning, rearing, foraging, migratory, connecting, and overwintering habitat. For a detailed description of this unit and subunits, for justification of why this CHU, included CHSUs, or in some cases individual water bodies are designated as critical habitat, and for documentation of occupancy by bull trout, see Service (2010), or http://www.fws.gov/pacific/bulltrout. The Clark Fork River Basin CHU is essential to maintaining bull trout distribution within this unique geographic region of the Columbia Headwaters Recovery Unit in large part because it represents the evolutionary heart of the migratory adfluvial bull trout life history form (U.S. Fish
and Wildlife Service 2009a, p. 32). Flathead Lake and Lake Pend Oreille are the two largest lakes in the range of the species, and bull trout from those core areas historically grew to be large and migrated upstream up to 322 km (200 mi) to spawning and rearing habitats. These habitats were partially fragmented by hydroelectric dams and other manmade barriers but are increasingly being reconnected with dam removal (Milltown Dam) and improved fish passage (Cabinet Gorge, Noxon Rapids, Thompson Falls). The resident life history form of bull trout is minimally present in this CHU and fluvial bull trout play a reduced role relative to adfluvials. The two major lakes (Flathead and Pend Oreille), as well as over 20 additional core areas established in smaller headwater lakes that are isolated from Flathead and Pend Oreille to varying degrees, are the primary refugia for the naturally occurring adfluvial form of bull trout across their range.

Kootenai River Critical Habitat Unit 30: This unit consists of 522.5 km (324.7 mi) of streams and 12,089.2 ha (29,873.0 ac) of lakes and reservoirs. The Kootenai River Basin CHU is essential for maintaining bull trout distribution within this unique geographic region of the Columbia Headwaters RU. This CHU is a uniquely configured trans boundary watershed, flowing in a horseshoe pattern that both originates (eastern or upstream arm) and ends (at Kootenay Lake) in British Columbia. This CHU is essential to bull trout recovery because it contains the strongest adfluvial core area population across the range of the species (10,000+ adults in Lake Koocanusa) and also supports the single largest spawning run of adult bull trout (3,000–5,000 adults annually) in the Wigwam River, British Columbia. These high population levels produce a harvestable surplus, allowing closely regulated angler utilization in Lake Koocanusa and provide numerous opportunities for research and evaluation of a high-density (i.e., recovered) bull trout population. The core area populations (Lake Koocanusa, Kootenai River, Bull Lake) represent working models for creating and sustaining bull trout recovery opportunities in other heavily managed watersheds (U.S. Fish and Wildlife Service 2009a, p. 31).

C. Analysis of Species/Critical Habitat Likely to be Affected

Bull trout are listed as threatened and critical habitat has been designated under the Act. The action area for this BO includes Forest and BLM administered lands in western Montana within the following core areas and critical habitat subunits: Upper Clark Fork River, Rock Creek, Blackfoot River, Clearwater River and Lakes, Middle Clark Fork River, West Fork Bitterroot River, Bitterroot River, Lower Clark Fork River, Hungry Horse, Holland Lake, Frozen Lake, Lindbergh Lake, Swan Lake, Flathead Lake, Doctor Lake, Big Salmon, Kootenai Lake and River, Bull Lake, and Lake Koocanusa. Road-related maintenance activities would occur on parts of the existing road network in the Bitterroot, Lolo, Kootenai, Flathead, Helena and Beaverhead-Deerlodge National Forests, and BLM lands in western Montana. Road maintenance activities would occur in 16 core areas (see Appendix F) within the Clark Fork River and Kootenai River CHU. The Forest and BLM have determined that activities described under Activity Types II and III may result in a NE, NLAA, or LAA determination. Generally, Type II and III road activities that occur within 100 feet of an occupied bull trout stream were identified as LAA actions and totaled as either miles of stream or number of sites (see Appendix F). Appendix F describes the extent of annual work proposed for NLAA and LAA activities within a core area. Generally Type I action when implemented with required design criteria will result in a NE or a NLAA determination. The amount of activity proposed for each core area is primarily based on estimated levels that have occurred over the past five years. Based on site
specific review, Type I, II, and III actions may result in adverse effects and would therefore count towards the allowable amount of LAA stream miles and sites identified in Appendix F.

The Service has reviewed the Type I activities (road surface drainage, snow removal, brushing, and vegetation planting) and the associated design criteria and concurs with the determination that the proposed activities are NLAA bull trout and bull trout critical habitat. The Service bases its concurrence on strict adherence to the design criteria for each road activity, including design criteria 1 through 5 (see Appendix A).

C.1 Previous Consultations

Consulted-on effects are those effects that have been analyzed through section 7 consultation as reported in a BO. These effects are an important component of objectively characterizing the current condition of the species. To assess consulted-on effects to bull trout, we analyzed all of the BOs, 137 in total, received by the Regional offices of Region 1 and 5, from the time of listing until August 2003 (U.S. Fish and Wildlife Service 2003). Of these, 124 BOs (91 percent) applied to activities affecting bull trout in the Columbia Basin population segment, 12 BOs (9 percent) applied to activities affecting bull trout in the Coastal-Puget Sound population segment, 7 BOs (5 percent) applied to activities affecting bull trout in the Klamath Basin population segment, and one BO (< 1 percent) applied to activities affecting the Jarbidge and St. Mary-Belly population segments (Note: these percentages do not add to 100, because several BOs applied to more than one population segment). 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.

A total of 120 BOs or Section 10 permits issued take for the Clark Fork River MU since listing to February 6, 2014 (39 from listing to August 2003 and 72 from August 2003 to now). All of the BOs have included mandatory terms and conditions and reporting requirements, which are binding on the action agency, in order to reduce the potential impacts of anticipated incidental take to bull trout. Several projects within this core area overlap and/or run concurrently. Many of these projects have resulted in short-term adverse effects followed by anticipated long-term benefits. In the Kootenai River MU a total of 19 BO have been issued (4 from listing to August 2003 and 15 from August until now). Similar to the Clark Fork River MU many of these projects have resulted in short-term adverse effects followed by anticipated long-term benefits.

C.2 Conservation Needs

The goal of the draft bull trout Recovery Plan is to describe the actions needed to achieve recovery; that is to ensure the long-term persistence of self-sustaining, complex interacting groups (or multiple local populations that may have overlapping spawning and rearing areas) of bull trout distributed across the species' native range. Recovery of bull trout will require reducing threats to the long-term persistence of populations, maintaining multiple interconnected populations of bull trout across the diverse habitats of their native range, and preserving the diversity of bull trout life-history strategies (e.g., resident or migratory forms, emigration age, spawning frequency, local habitat adaptations) (U.S. Fish and Wildlife Service 2002, p. v.).
The draft bull trout Recovery Plan (Fish and Wildlife Service 2002a, p. vii) identifies the following tasks needed for achieving recovery: (1) protect, restore, and maintain suitable habitat conditions for bull trout, (2) prevent and reduce negative effects of non-native fishes, such as brook trout, and other non-native taxa on bull trout, (3) establish fisheries management goals and objectives compatible with bull trout recovery, (4) characterize, conserve, and monitor genetic diversity and gene flow among local populations of bull trout, (5) conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site-specific recovery tasks, (6) use all available conservation programs and regulations to protect and conserve bull trout and bull trout habitats, (7) assess the implementation of bull trout recovery by MUs, and (8) revise MU plans based on evaluations.

Central to the survival and recovery of the bull trout is the maintenance of viable core areas (U.S. Fish and Wildlife Service 2002a and 2004d). A core area is defined as a geographic area occupied by one or more local bull trout populations that overlap in their use of rearing, foraging, migratory, and overwintering habitat, and in some cases in their use of spawning habitat. Some of the actions needed in the Clark Fork MU and Kootenai River MU include reducing general sediment sources, upgrading problem roads, and improving instream flows (U.S. Fish and Wildlife Service 2002b, pp. 141-162).

Temperature regimes associated with global climate change also threaten bull trout persistence. Because air temperature affects water temperature, species at the southern margin of their range that are associated with cold water patches, such as bull trout, may become restricted to smaller, more disjunct patches or become extirpated as the climate warms (Rieman et al. 2007, p. 1560). Rieman et al. (2007, pp. 1558, 1562) concluded that climate is a primary determining factor in bull trout distribution. Some populations already at high risk, such as the Jarbidge, may require “aggressive measures in habitat conservation or restoration” to persist (Rieman et al. 2007, p. 1560). Conservation and restoration measures that would benefit bull trout include protecting high quality habitat, reconnecting watersheds, restoring flood plains, and increasing site-specific habitat features important for bull trout, such as deep pools or large woody debris (Kinsella 2005).

V. Environmental Baseline

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

The action area is defined as all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area for this BO includes Forest and BLM administered lands in western Montana within the following core areas: Upper Clark Fork River, Rock Creek, Blackfoot River, Clearwater River and Lakes, Middle Clark Fork River, West Fork Bitterroot River, Bitterroot River, Lower Clark Fork River.
(includes Lake Pend Oreille), Hungry Horse, Holland Lake, Frozen Lake, Lindbergh Lake, Swan Lake, Flathead Lake, Kootenai Lake and River, Bull Lake, and Lake Koocanusa. Specifically, road maintenance activities will occur on portions of road on the Bitterroot, Kootenai, Lolo, Flathead, Helena, and Beaverhead-Deerlodge National Forests and BLMin western Montana.

A. Status of the Species and Critical Habitat in the Action Area

The status of bull trout populations within affected core areas was assessed using information from the 2008 status assessment (U.S. Fish and Wildlife Service 2008), Bull Trout Conservation Strategy on USFS Lands in Western Montana (BTCS) (U.S. Forest Service 2013a), draft Bull Trout Recovery Plan (U.S. Fish and Wildlife Service 2002a,b,d), Final Rule for Bull Trout Critical Habitat, and other sources of information.

Local populations within the action area consist of resident, adfluvial, and fluvial migratory populations and range in size from a few individuals to hundreds of adult bull trout. Information on the size and trend of these populations ranges greatly. Many of the local populations within the action area do not have reliable abundance data, but we can characterize them in a qualitative way based on number of local populations and some incomplete abundance information. For the purposes of this document, strong populations are those that are well distributed and relatively abundant within the capability of the watersheds in which they exist. Basins known to have the strongest populations of bull trout include Lake Koocanusa, Hungry Horse Reservoir, and Swan Lake. Moderate populations, relative to core area size and habitat potential are present in Blackfoot River, Clearwater River and Lakes, and Flathead Lake. Other core areas hold weak populations, for a variety of reasons. Some are core areas isolated with artificial barriers (e.g., Clark Fork River core areas); some have naturally limiting habitat, while others have habitat degraded by factors such as predation or competition from introduced species or water diversions (e.g., Rock Creek and Bitterroot River). Population estimates for many core areas are not well known (U.S. Fish and Wildlife Service 2005a,b, 2008). For detailed descriptions of the status of each core area and their local populations see U.S. Fish and Wildlife Service 2005a, U.S. Fish and Wildlife Service 2008, and U.S. Forest Service 2013a.

Bull trout habitat in the Upper Clark Fork River, Middle Clark Fork River, and Lower Clark Fork core areas, the Clearwater River and Lakes core area, and the Kootenai River and Lake Koocanusa core areas is generally poor; habitat in the Blackfoot, Bitterroot, Flathead Lake, and Rock Creek Core Areas is fair; and habitat in the West Fork Bitterroot and Hungry Horse Reservoir Core Areas is generally fair to good. Habitat in the Swan Lake Core Area rated poor in the baseline assessment, but local biologists believe that this does not accurately represent on the ground conditions in some cases. Similar variability exists within each of the core areas, and this is analyzed and described in detail by individual 6th level HUC in the BTCS. Patches of functioning habitat help many of the local bull trout populations persist. However, the current amount of functioning habitat and fragmented nature of functioning habitat available to this wide-ranging species appears to be insufficient to sustain robust populations (U.S. Forest Service 2013a).

On federal (Forest Service and BLM) lands in the action area, access for fish to aquatic habitats in all core areas, with the exception of the Middle Clark Fork River, is generally good. There are important bull trout habitats blocked by dams, diversions, and culverts, but several local
populations have more access now than in the recent past because of restoration activities. Additional improvement in the remediation of physical barriers in the future is likely because impairments are readily observable, technologically feasible, and public sentiment is generally supportive of fish passage projects (U.S. Forest Service 2014).

To summarize, the status of bull trout populations and its critical habitat varies and is often associated with the degree of human use and development. Areas with high levels of urbanization, residential development, extensive irrigated agriculture, and watersheds with high road densities have generally poorer quality habitat than those areas that are relatively undeveloped. Where urban, residential, and agricultural development are lacking, road networks associated with forest management constitute the primary impact to critical habitat.

B. Factors Affecting the Species Environment (Habitat) Within the Action Area

The primary factor affecting bull trout habitat conditions on federal lands in the action area includes road management (U.S. Forest Service 1998 and 2013a). Roads contribute to a degraded baseline condition, part of the rationale for listing bull trout as threatened. In order to address the legacy effects of the existing road system the Land and Resource Management Plan (LRMP) biological opinion requires that the Forest Service and BLM minimize and reduce effects of roads (see U.S. Fish and Wildlife Service 1998d, RF-1 through RF-5). The LRMP biological opinion only addresses the impacts of roads in general and does not address any site specific road impacts. The LRMP biological opinion requires that impacts of the existing road network be addressed during site specific project development. The information generated through the watershed analysis and project level analysis should be available for future road management actions/projects. Travel planning is a key component for addressing the ongoing impacts of the road system (U.S. Forest Service 1998). Since 2007, the Helena and Bitterroot National Forests have completed travel planning efforts. The following paragraphs provide a general discussion on some of the impacts of road systems on bull trout habitat.

Road densities have been shown to be an effective proxy for departure of aquatic environments from historical conditions, the state of current condition, and ostensibly past management (Rieman et al. 2000). The correlation of higher road densities with fewer bull trout is repeated throughout the Columbia River Basin, including the action area, where native fisheries and land management issues overlap (Ripley et al. 2005, Quigley and Arbelbide 1997, Riggers et al. 1997).

Roads directly affect natural sediment and hydrologic regimes by altering stream flow, sediment loading, sediment transport and deposition, channel morphology, channel stability, substrate composition, stream temperatures, water quality, riparian conditions within a watershed. For example, interruption of hill-slope drainage patterns alters the timing and magnitude of peak flows and changes base stream discharge (Furniss et al. 1991) and sub-surface flows (Furniss et al. 1991; Megahan 1974). Road-related mass soil movements can continue for decades after the roads have been constructed (Furniss et al. 1991). Activities that promote excessive substrate movement reduce bull trout production by increasing egg and juvenile mortality, and reducing or eliminating habitat (e.g., pools filled with substrate) important to later life-history stages (Fraley and Shepard 1989; Brown 1992).
Road/stream crossings can also be a major source of sediment to streams resulting from channel fill around culverts and subsequent road crossing failures (Furniss et al. 1991). Plugged culverts and fill slope failures are frequent and often lead to catastrophic increases in stream channel sediment, especially on old abandoned or unmaintained roads (Weaver et al. 1987). Unnatural channel widths, slope, and streambed form occur upstream and downstream of stream crossings (Heede 1986), and these alterations in channel morphology may persist for long periods of time. Channelized stream sections resulting from riprapping of roads adjacent to stream channels are directly affected by sediment from side casting, snow removal, and road grading; such activities can trigger fill slope erosion and failures.

In forested, western Montana watersheds, the secondary road network is a major contributor of sediment to perennial streams (MBTSG 1998). Montana Bull Trout Restoration Team (2000) ranked forest practices (including road construction and use of secondary forest roads) as the greatest risk to restoration of bull trout in Montana. An assessment of fish populations in the Interior Columbia River Basin found that bull trout are less likely to use streams for spawning and rearing in highly road systems (Quigley et al. 1997). As linear compacted features, roads in forested watersheds can substantially alter hill slope hydrology, causing surface flow in areas far from established stream channels (Luce 1997). Roads and drainage ditches are essentially ephemeral stream channels (Leopold and Miller 1956) and greatly expand the natural watershed drainage network (Montgomery 1994). Watersheds with high road densities commonly produce elevated sediment levels and experience increased peak flows (Meehan 1991; Luce 1997). Luce and Black (1999) observed that most segments of road within forested watersheds produced little sediment, but a few segments produced large amounts. Thus, it is possible to substantially reduce road erosion by targeting those few sections that exhibit the greatest sediment production (Luce and Black 1999). Factors that influence the delivery of sediment to streams from forest roads include the proximity of the road to the stream, gradient, and section length of the road, degree of road use, road condition (maintenance), number of stream crossings and soil type. The amount of fine sediment that reaches streams can be reduced by increasing the distance between the road segments and the streams (Elliot, et al. draft 2000, Abdullah 2008, Figure 1 in U.S. Forest Service 2014). The location of forest roads in relation to the stream channel and the density of stream crossings within a watershed is a key factor for estimating the amount of sediment delivered to the stream from the road surface and associated features (Baxter et al. 1999, McCaffery et al. 2007). Much of the existing road network was established decades ago and contains numerous stream crossing structures (i.e., culverts). Although proper design and location of these structures can minimize the risk of structural failure, any crossing structure is almost certain to fail if it is not maintained or removed when a road is abandoned (USDA et al. 1993; Murphy 1995). When a culvert is plugged by debris or is overtopped by high flows, streams associated with these structures can be diverted, can contribute to road failure, and can cause sedimentation (Murphy 1995).

In addition to sedimentation, culverts can fragment habitat by creating a barrier to fish movement. According to a study by the U.S. Forest Service, a large percentage of the culverts on Forest Service lands are either a total or partial barrier for juvenile salmonids (U.S. Forest Service 2006). Many of the culverts surveyed had high constriction ratios, limiting the ability of the culverts to pass 100-year flow events, thus increasing the potential for culvert failure over time (U.S. Forest Service 2006). Recent information concerning climate change indicates that these non-climate stressors (fish passage barriers and undersized culverts) can exacerbate climate change.
impacts (Rieman et al. 2010, p.21). For example, as stream temperatures increase access to first and second order streams (higher elevation and cooler) becomes more important. In addition, as rain on snow events become more frequent or intense the likelihood of road crossing failures increases. Stream crossing failures can result in large pulses of sediment delivery to streams. As a result management efforts to reduce non-climate stresses (fish passage barriers and sediment delivery from road failures) that may influence survival, growth, and habitat capacities; conserve and expand habitats; reconnect streams; and conserve genetic and phenotypic diversity, should be emphasized (Rieman et. al 2010, p.21). Since the 2000 fires, the elimination of fish passage barriers at culverts has been a focus of the Forest’s Fisheries and Engineering programs.

Rocks in close proximity to streams can also affect allochthonous input and habitat complexity. Meredith et al (2014) identified the existence of roads near stream roads (< 30 meters or 98 feet) as a primary factor resulting in reduced habitat conditions for bull trout. This study indicated that stream reaches near roads have a reduced frequency of large woody debris and that roads near streams can have the same effect on a stream reach as large changes in climate, geomorphology, and management. “It can take up to 100 years for instream wood to recover from past riparian logging (Murphy and Koski 1989; Beechie et al. 2000), and roads may further reduce the ability of riparian areas to recover from disturbance“ (Meredith et al. 2014).

Since 2008 the Forest has made a focused effort to minimize the impacts from the existing road system. Table 3 in U.S. Forest Service 2014, displays activities completed on Forest Service lands in western Montana between 2008 and 2013. Many of these improvements may benefit bull trout; however, these improvements compared with the baseline conditions have not been analyzed. The significance of these beneficial projects to bull trout is difficult to determine when compared with the overall impacts of the road system. For example, there are approximately 20,030 miles of road, and only 3,727 are maintained annually. The miles of road maintained within bull trout watersheds or the amount of road maintenance needed has not been identified. It is important to note that the Forests in western Montana support 81 percent (or 1,462 miles) of the designated spawning and rearing habitat for bull trout. Given this high percentage, and the potential negative effects of roads on streams, the management of the road system is a principal concern for bull trout.

In an effort to better understand and focus management actions the Forest developed the BTCS (U.S. Forest Service 2013a). This strategy has been completed and can be used to guide conservation activities for bull trout on western Montana’s Forest Service lands (U.S. Forest Service 2013b). The BTCS provides: a standardized process for updating bull trout habitat and population baselines; provides a structured assessment of fish populations and habitat conditions, stressors, and needs; and identifies opportunities that will further guide the location, type, and extent of projects on Forest lands intended to conserve, restore, and ultimately contribute to bull trout recovery.

Threats to bull trout habitat differ by core area. Table 4 shows the relative threats that exist for each of the core areas in the action area, as ranked in order of importance (1 through 5) by interagency teams of scientists (Fredenberg 2008). For example introduced species was ranked as the primary threat followed by forest management than angling and poaching. Doctor Lake was determined to have no existing threats. The most significant threat among all core areas in the action area is introduced species, followed by dewatering, angling and poaching, forest
management, migration barriers and transportation networks are the next most prevalent threats.

Table 4. Relative factors ranked in order of importance (1 through 5) affecting the species by core area for 16 core areas in the action area (Fredenberg 2008).

<table>
<thead>
<tr>
<th>Core Areas</th>
<th>Ag. Practices</th>
<th>Angling &amp; Poaching</th>
<th>Dewatering</th>
<th>Entrainment</th>
<th>Migration Barriers</th>
<th>Forest Management</th>
<th>Introduced Species</th>
<th>Livestock Grazing</th>
<th>Mining</th>
<th>Residential Development</th>
<th>Transport Networks</th>
<th>Water Quality</th>
<th>Other</th>
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<tbody>
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<td></td>
<td></td>
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<td>2</td>
<td>1</td>
<td></td>
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<td>Upper Clark Fork River</td>
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<td>Lower Clark Fork River (includes Lake Pend Oreille)</td>
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<td>Rock Creek</td>
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<td>Bitterroot River</td>
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<td>Blackfoot River</td>
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<td>Clearwater River and Lakes</td>
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The decline in bull trout result from the combined effects of habitat degradation and fragmentation, the blockage of migratory corridors; poor water quality, angler harvest and poaching, entrainment (process by which aquatic organisms are pulled through a diversion or other device) into diversion channels and dams, and introduced nonnative species. Specific land and water management activities that depress bull trout populations and degrade habitat include the effects of dams and other diversion structures, forest management practices, livestock grazing, agriculture, agricultural diversions, road construction and maintenance, mining, and urban and rural development (Beschta et al. 1987; Chamberlain et al. 1991; Meehan 1991; McIntosh et al. 1994; MBTSG 1995a-e, 1996a-f; Light et al. 1996; U.S. Forest Service and U.S. Fish and Wildlife Service 1995). For a more detailed discussion of the factors affecting the species and habitat in the action area, see the BTCS.

VI. Effects of the Action

A. Analyses for Effects of the Action

"Effects of the action" refers to the direct and indirect effects of an action on the species or critical habitat, which, when combined with the effects of other activities that are interrelated or interdependent with that action, will be added to the environmental baseline. Direct effects are considered immediate effects of the project on the species or its habitat. Indirect effects are those caused by the proposed action and are later in time, but are still reasonably certain to occur. Interrelated actions are 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.

This effects analysis focuses on the 12 road-related activities as described in the proposed action section of this BO. Road activities described in the project description section are necessary to provide safe transportation, and in some cases, will reduce the adverse effects of the road network. Meehan et al. (1991) points out that proper and timely road maintenance can help limit sediment delivery from existing roads to streams. Generally, impacts to bull trout and bull trout critical habitat stem from road maintenance activities that generate, transport, and deliver sediment to flowing streams and alter or remove streamside vegetation. As a result, a reduction in stream shading or allochthonous inputs occurs, thus altering stream morphology and function.
Bull trout are most sensitive to changes in habitat that occur in headwater areas encompassing important spawning and rearing habitats for fluvial and adfluvial stocks as well as remnant resident populations (Quigley et al. 1997). Many Forest Service and BLM roads occur in headwater areas where there is high potential for bull trout to be influenced by actions associated with road maintenance. Road maintenance activities near small perennial and intermittent, non-fish bearing streams are especially important as they can account for more than half the total drainage network and route sediment to downstream fish bearing streams (Quigley et al. 1997).

The Forest and BLM manage a large percentage of the most sensitive habitats (i.e. SR) for bull trout. Approximately 63 percent of the 3,223 miles of designated critical habitat is located on federal lands within the action area. In addition, 40 percent of the 1,422 miles of FMO habitat and 81 percent of the 1,801 miles of SR habitat is located on federal lands. Although much of the existing road system results in ongoing impacts (i.e. legacy effects) to aquatic habitats, determining the overall effects of the existing road system are not part of this analysis. A general description of the overall effects of roads on bull trout habitat is provided in section V.b., Factors Effecting the Species, above. During the forestwide travel planning process, the Bitterroot and Helena National Forests completed assessments of the overall effects of the existing road systems (U.S. Fish and Wildlife Service 2012: U.S. Fish and Wildlife Service 2009b).

Road-related maintenance activities on Forest Service and BLM lands in western Montana involves many actions and projects during the course of the year. According to the 2007 BA for road maintenance actions (U.S. Forest Service 2007), individual Forest, and BLM Districts have maintained an average of 16 percent of the secondary road system, or 4,741 miles each year (U.S. Forest Service 2007). Between 2008 and 2012, the Forest and BLM estimated that approximately 3,727 miles of the 20,030 total miles of road were maintained. Over this same time period, 138 miles of road within 100 feet of a stream were maintained annually.

This proposed action includes an average of 110 miles of road-related activities occurring within 100 feet of the stream, annually over a period of five years. Appendix F describes the extent of work proposed in FMO and SR habitats within each management unit and core area. Likewise, the analysis below shows effects of the proposed action to the species within FMO and SR habitats. SR habitat supports life stages (egg fry and juveniles) that are much more sensitive to sediment related effects than FMO habitat, which generally supports subadult and adult bull trout. SR habitat supports multiple year classes of juveniles of resident or migratory fish and may also support subadult and adults from local populations of resident bull trout. The preferred spawning habitat of bull trout consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989, p. 133). Bull trout typically spawn in a narrow time window of a couple weeks during periods of decreasing water temperatures, but spawning ranges from August to November depending on local conditions (Swanberg 1997, p. 735). Generally FMO habitat includes lower elevation main stem rivers and lakes. FMO habitats are important for seasonal connectivity among existing upstream populations which includes more than just habitat for migration at limited times of year. These areas are important to subadult and adult migratory bull trout to forage, migrate, mature, or overwinter.

To analyze the effects from the proposed action, the following discussion is divided into three sections. The first section (Effects by activity type) describes the general effects of each of the 12 road-related activities, grouped by activity Type I, II, or III (described below). This section
identifies the potential impacts to important habitat elements (e.g. sediment, temperature, fish passage etc.) for each of the activity types. The second section (Effects to critical habitat PCEs) describes effects to critical habitat PCEs. This section provides a detailed assessment of the impacts associated with the potential changes to habitat elements important to bull trout (e.g. sediment, temperature, fish passage etc.). The last section (Effects of the proposed activities levels) describes the effects of the amount or level of activity that is anticipated for each core area.

Effects by activity type: Road-related activities are grouped into three Types (I, II, and III) based on similarity of effects. As shown in Table 5, effects of Type I activities, when implemented with required design criteria, would be discountable, insignificant, or beneficial to bull trout and bull trout critical habitat. Type II activities, when implemented with required design criteria, may have short-term effects, with little or no beneficial effects on bull trout or their habitat. Type III activities, when implemented with the required design criteria, may have short-term effects, and will have beneficial mid- or long-term effects on bull trout or their habitat. Generally, Type II and III activities that occur within the stream or near the stream (less than 100 feet) are likely to result in unavoidable, short-term adverse effects. Type II and III activities generally result in disturbance to the stream channel or sediment related impacts and are anticipated to result in short-term lethal and sublethal effects to the species and its habitat. However, based on review of the five factors (see Effects of the proposed activities levels section below), Type I, II and III actions can result in a NE up to an LAA determination. Activities determined to result in a NLAA or LAA would count towards the anticipated annual amounts of road-related maintenance activities as described in Appendix F.

Table 5. Activities grouped by their potential to affect bull trout and their critical habitat. S= site activity and L= linear activity (adapted from U.S. Forest Service 2014).

<table>
<thead>
<tr>
<th>Type I</th>
<th>Type II</th>
<th>Type II</th>
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<tbody>
<tr>
<td>Activities that when implemented with required design criteria would have no effects, insignificant or discountable effects bull trout or bull trout critical habitat.</td>
<td>Activities that when implemented with required design criteria may have short-term effects bull trout or bull trout critical habitat.</td>
<td>Activities that when implemented with required design criteria may have short-term effects, and will have beneficial mid- or long-term effects on bull trout or bull trout critical habitat.</td>
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<tr>
<td>Road surface drainage and cross-drain installation and maintenance (S)</td>
<td>Surface and ditch maintenance (L)</td>
<td>Culvert replacement- upgrade (S)</td>
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<tr>
<td>Snow removal (L)</td>
<td>Surface restoration and reconditioning, and paving (L)</td>
<td>Road decommissioning (L)</td>
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<tr>
<td>Brushing (L)</td>
<td>Fill and cut-slope maintenance</td>
<td>Road storage or closure (L)</td>
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<td>Planting vegetation (L)</td>
<td>Road reconstruction (L)</td>
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</tr>
<tr>
<td>Bridge, culvert, and ford maintenance (S)</td>
<td>Channel maintenance near roads (L)</td>
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</table>
**Effects of Type I activities:** Type I activities include road drainage and cross-drain installation and maintenance, snow removal, brushing, and planting vegetation. When the activities occur with the prescribed design criteria (selected for the site specific conditions and detailed in Appendix A), these activities are expected to have discountable, insignificant, or beneficial effects to the species and its habitat.

**Road drainage and cross-drain installation and maintenance:** Surface cross drains consist of surface shaping and devices designed to capture water that collects on and drains down the road and to release it in a manner that minimizes effects to adjacent areas and the watershed. Surface shaping includes broad-based (drivable) dips, waterbars, and rolls in road’s profile. Devices include open-top or slotted culverts, metal waterbars, and rubber water diverters.

The purpose of drainage structures and cross drains is to remove flowing and standing water from the road surface in a hydraulically efficient manner, thus reducing the erosion of the road surface or associated feature. Maintenance of drainage structures and cross drains maintains the functionality of these structures by reducing surface roughness of the feature or eliminating flow obstructions in or to the drainage structure.

To avoid effects to bull trout and their habitat, sediment-laden water from the road surface will be routed so that it would not directly enter the stream, an area that is indirectly routed to fish-bearing waters, or routed onto an erodible surface that delivers sediment to the stream.

Material from within the cross drain or drainage structure would be removed and placed in a stable location, and not wasted into the stream channel or into areas where it can be routed back into the active channel.

Seven project specific design criteria apply to this activity type as described in Appendix A of this BO. These specific mitigation measures are designed and expected to eliminate measurable quantities of sediment runoff water. Runoff will be filtered through roadside vegetation or trap sediment before it enters the stream. No measurable quantities of sediment are anticipated to be delivered to the stream.

**Snow removal:** Removal of snow from the entire road width and turnouts may include removal of snow slides, minor earth slides, fallen timber, and boulders. The most substantial impact to bull trout from snow removal stems from the routine deposition of sand and inorganic debris from the snow covered road surface into the stream. This typically occurs where roads immediately parallel streams and little option exists for alternative snow removal options.

Snow plowing can result in increased erosion of the road surface and fill slope. As plowed roads begin to thaw in spring, water can flow down vehicle ruts in the ice covered road surface for long distances, eventually cutting off the road onto fill slopes at sites not necessarily designed to handle flows, and increasing sediment delivery to streams. For example, open top cross-drains generally do not function under winter conditions because they become frozen over. Under this activity, snow removal will only occur on roadways with appropriate winter BMPs and or roads with drive through dips. Additionally, poor implementation of design criteria or extreme winter conditions can result in side-casted snow partially blocking culverts or adding to culvert icing problems and thereby increasing risk of culvert/road washout during thawing or rain-on-snow
conditions when runoff increases rapidly.

The chronic deposition of traction sand, de-icing chemicals and inorganic material from the snow and ice covered road into the stream is not an activity covered in this programmatic.

The Forest and BLM District adopted five design criteria for snow removal to reduce the potential for sediment production from ice rutting plugging culverts (see Appendix A). Measurable amounts of sediment delivery are not anticipated as a result of this activity.

**Brushing:** Removing brush from the roadside is intended to increase sight distance for vehicular traffic on corners and narrow sections of the road and to reduce encroachment of trees and shrubs into the road prism. Brushing typically involves a combination of machine and handwork, and typically involves short sections of road.

Potential impacts of brushing on bull trout and bull trout habitat are reduced stream shading, increased stream temperature, reduced local allochthonous inputs and increased sediment influx. The removal of streamside vegetation can result in direct solar radiation to stream water, resulting in elevated stream temperatures at and downstream from the point of brush removal. Brush removal may also reduce overall surface roughness along the stream bank or on the floodplain, resulting in a reduced ability to filter sediment originating upslope from the stream channel.

To reduce the potential impacts of brush removal along roads near streams, brushing is limited to situations where public safety is an overriding concern, emphasizing site specific rather than broad scale action. Brush removal will retain a shrub height that will allow for long-term survival of native shrubs.

The Forest and BLM District adopted three specific design criteria to reduce the potential impacts of brush removal along roads near streams (see Appendix A). These criteria focus on restricting streamside brushing to those areas and situations where public safety is an overriding concern, and emphasizing site-specific rather than broad, scale action. Brush removal will retain a minimal woody “stubble height” of no less than the height needed to maintain the sediment filtering capacity of the shrub base, and long-term viability of bank-supporting shrubs. Measurable changes to stream temperature or amounts of sediment delivery are not anticipated as a result of this activity.

**Planting vegetation:** Plantings are regularly planned with large ground disturbing activities. However, there are times when planting within or near road prisms are required to establish or fortify past projects or migrating channels. Vegetation inhibits soil erosion by providing obstructions to flow, reducing velocity and the capability of run off to transport sediment, and by binding soil particles with subsurface vegetative growth.

Plantings are done by hand or heavy equipment. The adverse effects of plantings, when coordinated with a native vegetation specialist, are generally imperceptible beyond the scale of the immediate site. There can be very minor and short-term introductions of fine sediment during planting. The use of fertilizers is minimal. There are no design criteria to minimize effects of this activity. Measurable changes of sediment delivery are not anticipated as a result
of this activity.

**Effects of Type II activities:** Type II activities include surface and ditch maintenance, surface restoration, reconditioning, and paving, fill and cut-slope maintenance, road reconstruction, bridge, culvert, and ford maintenance, and channel maintenance near roads. Typically type II actions occur on only a small portion or segment of the total length of the road that have the potential to deliver sediment. When implemented with required design criteria, including State of Montana requirements, Type II activities are expected to have effects that range from no effect to measureable effects (i.e. LAA) on bull trout or their habitat. When these activities occur in close proximity to a stream and are of sufficient magnitude these activities have the potential to result in adverse effects to the species and its habitats as a result of increased sediment delivery (see Appendix F. Miles/Sites with potential measurable impact to perennial and intermittent streams). Treatment of roads, ditches, and their associated cut and fill slopes are the predominant road-related activities that have the potential to result in adverse effects to bull trout and their habitat. Sugden and Woods (2007) examined sediment production from native surface roads in the Belt Supergroup and glacial till parent materials of western Montana. The factors most responsible for explaining road erosion include activities under Type II actions (grading, roadbed gravel content, etc.). A regression model that contained these variables explained 68 percent of the variability in sediment erosion from roads in the study sites (U.S. Forest Service 2014). Generally, when these activities occur within 100 feet a stream, they have a high potential to result in adverse effects to the species and its habitat.

**Surface and ditch maintenance:** Surface and ditch maintenance removes ruts created by wheeled vehicles or flowing water to reduce the potential for water to become channelized flow. A rutted travel way can produce as much as twice the volume of fine sediment as a smooth surfaced travel way that is regularly maintained by blading (Burroughs and King 1989). Regular surface blading also can reduce fill slope erosion. Surface blading may be repeated during the year. Dust abatement is also part of surface maintenance, but does not include use of petroleum-based compounds. Vegetative material or rocks that have fallen into the roadway or shoulders almost always need to be moved. Placement of this material in the stream channel may result in adverse effects to bull trout habitat. However, it is noteworthy that these boulders and wood may benefit habitat attributes and should be considered for placement into the floodplain and channel as long as fine sediments are a minor component of the debris.

Ditch maintenance includes ditch "pulling" and ditch "heeling.” Ditch pulling involves the use of a bladed machine, such as a road grader, that cleans the ditch by running the blade along the bottom and sides of the ditch, thereby pulling material onto the road surface. Ditch heeling uses machinery to push material away from the road and onto the back-slope. Both techniques may be employed in the same road section to reshape the ditch and restore proper water drainage.

Ditch maintenance can generate large amounts of fine sediment within and adjacent to the ditch and along the road surface. In some cases, fine sediment pulled from the ditch is bladed across the entire road surface and onto the fill slope. Luce and Black (1999) demonstrated a seven-fold increase in sediment production when vegetation was cleaned from the ditch and base of the cutslope in fine-grained soils, and found that erosion from cleaned ditches exceeded erosion from road surfaces. Burroughs and King (1989) suggest that unprotected ditches may be greater sources of sediment that an unimproved road surface on roads with a low travel volume.
Sediment production in ditches can be reduced by retaining surface roughness within the ditch, thereby slowing the flow of ditch water and reducing the sediment transport capacity. The most common method of artificially increasing surface roughness is by lining ditches with rock (Anderson et al. 1970). Highway Research Board report 108 developed a successful d50 size relationship for roadside ditch armoring with rock that has been demonstrated to reduce sediment generation and long-term maintenance costs (Anderson et al. 1970).

The Forest and BLM adopted nine design criteria (see Appendix A) to reduce sediment production from road surface and road ditch maintenance activities. The majority of these measures focus on reducing road surface erosion from disturbed sites or by managing soil material generated by maintenance actions.

**Surface restoration and reconditioning, and paving:** Surface restoration typically involves adding aggregate to the road surface and subsurface, applying chloride compounds or other binding agents, and the roto-milling process. Activities such as chip sealing and asphalt pavement are also included in this subcategory.

Addition of aggregate to an unimproved road surface can reduce sediment production. Anderson et al. (2012) demonstrated that placing a six-inch lift of 1.5-inch minus crushed rock on an unimproved road surface reduced sediment production by 70 percent over a five-month period. Burroughs and others (1985 in Burroughs and King 1989) measured a reduction in sediment production of 79 percent with the placement of a four-inch lift of 1.5-inch minus crushed rock in a simulated rainfall exercise.

The depth and quality of the aggregate applied to an unimproved road surface determine the effectiveness of the aggregate in reducing sediment production. Anderson et al. (2012) found that a two inch lift of 1.5-inch minus crushed rock on a sandy loam road surface was not effective in reducing sediment, whereas a six-inch lift of the same material and on the same surface reduced sediment production by an estimated 92 percent. Aggregate quality is determined by composition and parent material (Foltz, 1996). Cederholm et al. (1980) found that paved roads had sediment discharge rates similar to lightly used and non-used native surface roads, and much less than unpaved roads with heavy or moderate use.

Contaminants found in runoff originate from vehicular sources rather than pavement materials. In grey literature it has been reported that bull trout can be negatively affected by increased chemical pollutants from leaching asphalt and increased vehicle traffic when roads are paved (Donahue, no date in U.S. Forest Service 2014). Reclaimed asphalt pavement (RAP) is often used on Forest Service roads. It can be directly recycled into new asphalt. Recycling is not always immediately possible, and the RAP may have to be stockpiled and can be exposed to rainwater that could leach chemicals to the environment. Brantley and Townsend (1999) found that few if any priority pollutant chemicals leached from the RAP samples they collected. None of the trace organic chemicals or heavy metals investigated was detected, indicating that RAP would pose minimal risk from a leaching standpoint.

Of note, paving road and improving large sections of road has the potential to increase recreational use. Cumulative impacts to aquatic resources from increased use are not assessed in this analysis or covered by this BO.
Road surface restoration and reconditioning through the application of aggregate is the primary means to reduce sediment delivery from road surfaces. The Forest and BLM developed six design criteria (see Appendix A) to reduce sediment production and minimize the potential for chemical contamination.

**Fill and cut-slope maintenance:** Fill slopes are typically exposed surfaces created to form the road prism during the initial construction phase. Fill slopes adjacent to streams or floodplains are chronic sources of sediment (Burroughs and King 1989, Meehan et al. 1991). Sediment is generated through gravitational movement of soil from over-steepened surfaces and through sheet, rill and gully erosion. The majority of larger gullies that form in fill slopes originate from road surface drainage (Burroughs and King 1989), indicating that management of fill slope erosion is best accomplished by management of road surface drainage. Burroughs and King (1989) suggested that fill slope erosion could be minimized by directing flow away from the fill slope surface, and sloping the road surface inward to the uphill side of the road. In-road sloping concentrates surface runoff as ditch flow, which can result in the potential for elevated sediment production at or downhill from the collection area (Anderson et al. 2012).

Fill slopes often exceed the existing preconstruction hill slope gradient; failure of fill slopes is common in steep terrain, especially on secondary roads (Meehan et al., 1991). Maintenance of the fill slope is intended to reduce soil loss on the downhill side of the road and to replace soil lost from erosion. Inorganic material from the road surface or uphill ditch is routed onto the fill slope during surface blading to replace soil lost through erosion.

Maintenance may be required to address chronic erosion of the fill slope or damage resulting from a natural or man caused event. Damage may range from partial erosion of the road fill to entire washouts of the road prism. Some fill slopes may be stabilized with structures such as ballast rock, gabions or other forms of retaining walls. In these cases, initial stabilization actions are likely to reduce maintenance requirements in the long-term. The treatments identified in the biological assessment to address fill slope maintenance needs to include constructing more frequent water handling devices, ditch relief culverts, and leadoff ditches in the road surface. Increasing the frequency of structures reduces the volume of water leaving the road surface at any individual drainage structure, and thus reduces the potential for soil erosion at that point. Additional maintenance treatments include armoring scoured areas below culverts, and covering erosion-prone surfaces with erosion control mat and vegetation. In general, maintenance treatments that reduce the soil loss from fill slopes tend to reduce the influx of sediment from fill slopes into stream channels.

Adverse impacts to bull trout and bull trout habitat stemming from fill slope maintenance can result from a number of different factors. Placement of new inorganic material at the top of the fill slope from road surface maintenance can result in a direct influx of sediment entering a stream through the gravitational movement of deposited material. Cutting the top of a fill slope during surface maintenance or fill slope maintenance can remove established vegetation and expose erodible soil. Sediment entering the stream from these actions has the potential to impact bull trout habitat immediately downstream from the point of delivery. As fill slopes are typically linear features, the amount of sediment potentially entering the stream as a result of maintenance of these features is a factor of segment length and degree of disturbance.
Cut slope maintenance is designed to reduce or alleviate the loss of soil from the cut slope. Cut slope failures (slumps, slides) may require extensive work to correct the immediate and underlying problem. When a cut slope failure has occurred resulting in excess material in the ditch or roadway, a temporary ditch may be constructed around the slide to channel surface runoff around the blockage. Generally, excess material is removed and the original ditch function is restored. Removal of excess material ( undercutting) from the toe of a cut slope carries a risk of slope destabilization.

The cut slope contributes loose material to the ditch or road surface through a variety of processes, including soil creep, sheet wash ( sheet flow) rilling, raveling and slumping. In general, higher cut slopes produce more material that lower cut slopes. Exposing soil at the base of the cut slope during ditch or cut slope maintenance can exacerbate erosion within the ditch.

Roads which parallel streams often have segments that are susceptible to damage from high water events. Often, near-stream roads have one shoulder that leads directly to the stream channel. Following high water events, maintenance in the form of buttressing and the addition of rock is required to retain the road prism in place.

Riprap (graded stone or crashed rock) is the most common material used, and often over-used, in the stabilization of streambanks. Riprap prevents channel migration and thus reduces bank erosion. However, it impairs ecological processes, disrupts surface and subsurface flow exchange, and inhibits development of streamside vegetation (Fischenich 2003). It is important to understand stream processes to insure that the selected stabilization measures will work in harmony with the existing and future river conditions. Alternatives that incorporate bioengineering features will be considered. Every effort will be made to use bioengineering principles and practices for stabilizing streambanks. Bioengineering is defined as the integration of living woody and herbaceous materials along with organic and inorganic materials to increase the strength and structure of soil. Streambank soil bioengineering is defined as the use of living and nonliving plant materials in combination with natural and synthetic support materials for slope stabilization, erosion reduction, and vegetative establishment.

The Forest and BLM District identified ten design criteria (see Appendix A) to reduce sediment production and delivery from fill slope, cut slope, and ditch maintenance. The majority of these measures focus on reducing surface erosion from disturbed sites or by managing soil material generated by maintenance actions.

**Road reconstruction:** Reconstruction activity effects are similar to, but can be more intense than those discussed for the effects of surface and ditch maintenance and surface restoration and reconditioning, and paving. The reason for greater potential for intensive or extensive adverse effects is that the potential size of the project increases the duration of activity and exposure to adverse environmental factors (i.e. weather and recovery of vegetation). These projects have the potential to last longer and create a larger disturbed area.

Chronic sources of sediment arise from the recurring need for road-related activities along roads, and this is especially egregious if roads are in poor locations or poorly constructed. Therefore,
rather than chronic maintenance, it can be environmentally beneficial to initiate more comprehensive road reconstruction.

This activity subcategory includes relatively small areas, such as approaches to bridges that may or may not provide benefit to aquatic resources. It may also include substantial road reconstruction projects that must result in a documented improvement to the aquatic resource and be approved by a fisheries biologist. If there are imperceptible benefits or controversy regarding the benefits of the proposed road reconstruction, the project requires a supplemental site specific biological assessment with project details to be submitted to the Service for review. To clarify, for coverage under this Programmatic BO, the projects that include significant new near-stream disturbance, such as road relocations or adding additional road width over extended lengths need to be beneficial or include separate supplemental analysis.

The Service will review the supplemental biological assessment to determine if the scope of the reconstruction activities could be included in this BO and provide feedback whether they require additional project information and effects analysis. To the extent possible, these analyses should tier to this biological assessment. Road reconstruction projects should have a clear benefit to bull trout and meet the intent of the BTCS and INFISH.

The Forest and BLM District developed 12 design criteria (see Appendix A) to minimize the potential sediment delivery from simple and more complex road reconstruction activities.

**Bridge, culvert, and ford maintenance:** Bridge maintenance includes the removal of material from the bridge deck, running plank replacement, spot painting (including sanding, wire brushing, sand blasting, and priming) and clearing abutments and piers of accumulated floating debris. The Forest and BLM recognize that these activities may be conducted with a degree of urgency at times, should the loss of the structure be imminent. As such, the Forest and BLM propose that cleaning of the bridge “… may occur anytime, when delaying maintenance will result in significant impacts to bull trout habitat.” In consideration of the potential for urgent action, sediment producing actions upstream of spawning areas will be avoided during the spawning/rearing period of September 1 through May 15.

Bridge and culvert maintenance also includes rip-rapping of piers and abutments to reinforce or repair the structural integrity of these features. These activities also may be conducted with a degree of urgency when loss or damage to the structure may be imminent. Rip-rapping of piers and abutments directly impacts stream channels in the immediate vicinity of existing structures, and likely results in inorganic material entering the channel.

Eight design criteria (see Appendix A) were developed for the above activities to discourage the use of riprap and encourage use of techniques (e.g. bioengineered bank stabilization) to allow for growth of stream side vegetation and maintain stream morphology and function.

**Channel maintenance near roads:** Effects of channel maintenance actions include short-term increases in sediment and pulses of turbidity to the stream channel. Those effects may have short-term impact to bull trout habitat. The design criteria (Appendix A) for this activity type aim to reduce or eliminate the need for repeated actions.
When beaver dams are built adjacent to culverts, they may cause the culverts to plug and overflow on the existing road surface. Removal of those dams can release large amounts of sediment and cause short-term pulses of sediment and turbidity to the stream.

Bank protection conducted on sections of road prism that encroach into the channel migration zone is discussed in the fill slope maintenance section above. Bank protection beyond the fill slope is addressed here.

The most common type of bank protection is rip rap. Design criteria were developed to minimize the use of rip rap and incorporate techniques that include the use of rootwads and cross-veins. Bank protection typically involves in-stream work that can cause short-term sediment pulses and is often accomplished with mechanized equipment.

Bed-load removal is required in areas where crossing structures are located in a natural deposition area or by an undersized stream crossing that do not pass bed-load or debris efficiently. Removal of the bed-load is usually accomplished by using a backhoe or other mechanized equipment.

Culvert cleaning includes mechanical removal of any material that is obstructing the flow of water through the culvert. The activity typically involves in-stream work that can cause short-term sediment pulses. This activity can reduce the risk of culvert failure providing some benefit to the fisheries resource. However, culverts that require repeated bedload removal and cleaning are likely undersized and misaligned with the stream channel. These structures would be prioritized on the land management unit for alteration, removal, or replacement.

This activity type includes five design criteria (see Appendix A) to minimize the negative effects from increased turbidity, reduced floodplain function, and habitat complexity.

**Effects of Type III activities:** Type III activities include culvert replacement or upgrading culverts with culvert or bridges that provide aquatic organism passage (AOP). Fords will be used when the Forest and BLM biologists conclude that the use of that type of crossing is the most beneficial to aquatic resources. Culverts in non-fish-bearing channels may also be upgraded. The impact of road-stream crossings, on both perennial and intermittent streams, is an important factor when considering the impact of road networks to fish habitat.

Type III activities also include road decommissioning and road storage or closure. When implemented with required design criteria, these activities are expected to have a beneficial effect on bull trout or their habitat. However, there will be times when these projects have adverse short-term effects on bull trout or their habitat.

**Culvert replacement or upgrade:** During these activities, standard design features reduce sediment input during the replacement or removal process; however, it is impossible to stop all sediment input from being transported to or suspended in water. Monitoring by the Flathead (U.S. Forest Service 1999a) and Lolo National Forest (U.S. Forest Service 1999b) indicates that culvert removal can produce up to 1 to 2 tons of sediment at each crossing, with most of that material deposited within the first 150 feet downstream of the culvert. Turbidity monitoring on the Bitterroot National Forest (U.S. Forest Service 2014) indicated that water clarity is
substantially affected for one to several hours. It also indicated that in some situations
dewatering and re-watering channels may cause more turbidity and disturbance than efficiently
working with the stream left in its channel.

All new or replacements for stream crossings will provide aquatic passage and follow Forest
Service Region One passage construction guidelines unless biological rationale dictates that the
barrier remains or be reconstructed (i.e., non-native invasion). The Forest and BLM will work
with local Montana, Fish, Wildlife and Parks and Service biologists to identify those needs at the
population scale.

Culvert removal or replacement to facilitate fish passage is generally considered a beneficial
effect to bull trout populations because it reduces the risk of population decline from isolation.
Culvert replacement removes physical barriers that fragment the stream system and isolate
groups of fish from one another. Reconnection enables refounding of suitable habitat following
a local extirpation. Connected stream systems allow bull trout to recover from disturbance
events at a more rapid rate than those fragmented by physical barriers (Rieman et al. 1997;
Gresswell 1999). The importance of providing access to suitable headwater habitats is likely to
become increasingly important as climate change progresses. This information suggests that
greater emphasis should be placed on monitoring and replacing undersized culverts. There also
needs to be consideration for the trade-offs that may occur if non-natives would
disproportionately benefit from the project.

The Forest and BLM District have developed 12 design criteria (see Appendix A) to address the
potential short-term sediment delivery from this activity type. Although these mitigation
measures would reduce sediment input during the replacement or removal process, it is
impossible to stop all sediment input from occurring. The sediment produced by the culvert
replacements is likely to cause some scattered, temporary (several weeks to months) reductions
in bull trout spawning and rearing habitat near the culverts. These habitat reductions would
displace some juvenile bull trout in habitats near the culverts for sever
al weeks to months

Road decommissioning, closure, and storage: Impacts stemming from road closure and
obliteration may include increased sediment production at the points of soil disturbance, such as
berm construction sites and along the road prisms where recontouring takes place. When the
road surface becomes vegetated, the potential for sediment delivery is reduced.

Road closure is often accomplished by blocking access to the road or road segment with a gate or
earth berm. Appendix E addresses how roads placed in a closed or stored status or
decommissioned are to be treated. Historically, it was common practice for the road prism to be
retained and culverts, cross drain structures, and other water handling devices were left in place.
Occasionally, the hardened soil on the road surface was scarified and then seeded.

Culverts that remain in the road behind gates and berms that are not properly sized, positioned,
and inspected will be considered for removal. These have an increased risk for failure by
reducing awareness of potential maintenance needs. The accumulation of debris has the
potential to obstruct culverts and other road drainage structures. Without maintenance and
periodic cleaning, these structures can fail, resulting in sediment production from the road
surface, ditch, and fill slopes. The design criteria to address drainage structures left behind gates
and berms require annual monitoring of these structures.

Though hydrologic function of the hillslope is not restored when roads are closed or stored, a reduction or elimination of road use can result in a reduction in sediment generation and delivery, even if the road prism remains (Reid and Dunne 1984). Reduced road use by wheeled vehicles fosters vegetation of the road surface, ameliorating rainfall impacts and reducing erosion (Burroughs and King, 1989).

Road closure Levels III and IV include surface and crossing treatments in roads with the intention of eliminating vehicle use for an extended period of time (9 years), and roads that are intended to be removed from the transportation system (Appendix E). Road closures III and IV involve ripping the road surface (or de-compaction with a backhoe type of equipment depending on the situation), typically to a depth of 1-12 inches. This practice decreases soil bulk density and improves the infiltration capacity of the former road surface, restoring some level of hydrologic function (Moll 1996). Ripping the road surface can be an effective step in watershed restoration, although ripping does not provide complete hydrologic recovery in many soil types (Luce 1997). The risk of water concentration, channelized flow, and sediment production and delivery is not entirely eliminated.

Recontouring and obliterating (Level IV and V) roads involves excavating the road fill and placing it in the road cut, and blending the fill with the cut slope to re-establish the preconstruction or similar hillslope. All culverts and most other water handling devices are removed from the road prism. This type of road closure offers the greatest long-term benefit by reducing sediment delivery, reducing the risk of culvert failure, and the need for maintenance.

One of the principal concerns associated with road closures III, IV, and V is the amount of exposed soil that is created as a result of road ripping, the removing of fill from culvert and bridge locations and the post obliteration slope. Roads that are oblitered that will likely adversely affect bull trout are typically those within close proximity to a stream channel. Exposed, unconsolidated soil near a stream channel has the potential to enter the stream through sheet, rill or localized channeled flow. Sediment delivery has the potential to affect bull trout habitat in several ways as described in the section below under Effects of accelerated fine sediment transport and delivery to waterways (PCE 3 and 6).

The Forest and BLM have developed design criteria 41 and 44 (see Appendix E) to address the potential short-term sediment delivery from erosion of exposed soil surfaces. During the process of road obliteration, culverts and bridges in the road prism will be removed. Following the removal of culverts and bridges, stream channels will be reconfigured to dimensions that approximate the preconstruction profile. Channel reconfiguration provides long-term benefits by restoring appropriate stream gradient, entrenchment ratios, and width to depth ratios. Channel reconfiguration will also attempt to reestablish stable side slopes that mimic terraces upstream and downstream of the site.

Problems associated with these features will be corrected within a reasonable period of time, considering potential impacts to bull trout. To the degree reasonable, the agency will divert water around project areas while excavation is occurring. Weed treatments are also a common practice during the soil disturbing activities. Weed treatments are not analyzed under this
programmatic consultation.

Effects to critical habitat PCEs

To analyze the proposed action the Forest and BLM applied the following impact analysis approach titled “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/matrix; U.S. Fish and Wildlife Service 1998a). The framework/matrix analysis incorporates 4 biological indicators and 19 physical habitat indicators. The majority of the matrix analysis consists of specific consideration of the 19 habitat indicators. Analysis of the framework/matrix habitat indicators provides a thorough analysis of the existing baseline condition and potential impacts to bull trout habitat. Therefore, when assessing potential effects to bull trout as a species, through use of the matrix, agency biologists concurrently provide an analysis of effects to the PCEs for bull trout critical habitat and related habitat indicators.

The effects of the road-related activities on pathways and indicators and associated PCEs are described below. The emphasis is based on the indicators and PCEs that the road-related activities are most likely to influence. Appendix G provides a detailed description of the relationships of each habitat indicator to PCEs.

Effects on habitat connectivity (PCE 2): Improving stream crossings results in improvements to the habitat indicator barriers and its associated PCE 2. These improvements can provide bull trout access to habitat that was previously inaccessible or only seasonally accessible and has the potential to improve a population’s size and resilience. New or replaced stream crossing structures will not impede fish movement as structures on potentially fish bearing streams are required to provide for fish passage unless designed specifically as a barrier to protect upstream populations from invasion by non-native fish species. In-stream work conducted during bull trout migration periods may result in temporary restrictions in movement. Temporary increases in sediment or turbidity may also impact bull trout (see discussion above). Design criteria listed for this activity would usually be effective in reducing sediment-related effects, but effects may linger for hours and can occur periodically for several months.

Effects of accelerated fine sediment transport and delivery to waterways (PCE 3 and 6): The proposed action results in impacts to the sediment indicator and associated PCE 3 and 6. As a result of Type II and III road-related activities, fish will be exposed to elevated turbidity and suspended sediment, and potentially higher levels of substrate embeddedness.

Factors that influence the delivery of sediment to streams from forest roads include the proximity of the road to the stream, gradient, and section length of the road, degree of road use, road condition (maintenance), number of stream crossings and soil type. The location of forest roads in relation to the stream channel and the density of stream crossings within a watershed is a key factor in the amount of sediment delivered to the stream from the road surface and associated features (Baxter et al. 1999, McCaffery et al. 2007).

Following the initial construction period, the road surface and shoulders become increasingly compacted, and thus, less vulnerable to erosion with vehicular traffic. Cut slopes, fill slopes, drainage ditches, and occasionally, the road surface become vegetated with time. Vegetation
inhibits soil erosion by providing obstructions to flow, reducing velocity, and the capability of runoff to transport sediment, and by binding soil particles with subsurface vegetative growth.

Some bull trout may decrease feeding, experience increased stress, or may be unable to use the affected area depending on the magnitude and duration of the increase in suspended sediments. Salmonids have evolved in systems that periodically experience short-term pulses (days to weeks) of high suspended sediment loads, often associated with flood events, and are presumably adapted to high pulse exposures (U.S. Forest Service 2014). When added to background levels, the proposed action would result in additional suspended sediment and associated energetic costs to bull trout.

Chronic moderate turbidity can harm new-emerged salmonid fry, juveniles, and even adults by causing physiological stress that reduces feeding and growth, and increases basal metabolic requirements (Lloyd 1987, Bjornn and Reiser 1991, Servizi and Martens 1991, Fairchild et al. 1987). Juveniles avoid chronically turbid streams, such as glacial streams or those disturbed by human activities, unless those streams must be traversed along a migration route (Lloyd et al. 1987). Older salmonids typically move laterally and downstream to avoid turbidity plumes (McLeay et al. 1987, Lloyd 1987, Servizi and Martens 1991).

Fish exposed to moderately high turbidity levels in natural settings are able to feed, although at a lower rate and with increased energy expenditure due to a more active foraging strategy. Over a period of several days or more, reduced feeding resulting from increased turbidity can translate into reduced growth rates. Turbidity also limits fish vision which can interfere with social behavior (Berg and Northcote 1985) and predator avoidance (Miner and Stein 1996, Gregory 1993).

Deposition of fine sediments reduces egg incubation success (Grieg et al. 2007), interferes with primary and secondary production (Fairchild et al. 1987), and degrades cover for juvenile salmonids (Bjornn and Reiser 1991). In forested western Montana watersheds, the secondary road network is a major contributor of sediment to perennial streams (MBTSG 1998). The Montana Restoration Plan for Bull Trout in the Clark Fork River Basin and Kootenai River Basin ranked forest practices (including construction and use of secondary forest roads) as the greatest risk to bull trout in Montana (MBTRT 2000).

Where buffer strips are retained between roads and stream channels, much of the sediment laden sheet flow (or unchannelized flow) from the road surface and cut and fill slopes can be intercepted before it enters the channel (Belt et al. 1992). The efficacy of the buffer strip is largely a function of the capacity of physical obstructions within the buffer to reduce flow velocity and allow deposition of sediment. Physical obstruction to flow is provided by vegetation, fallen logs, large rocks, logging slash, or any material that reduces the velocity of unchannelized sheet flow.

The proposed action has the potential to result in sediment delivery to action area streams. Culvert cleaning, replacement and removal, construction and upgrading of road drainage structures, and in some cases, road obliteration is likely to produce a pulse of sediment that will enter stream channels. Elevated sediment levels generated by the implementation of these and similar projects will gradually taper off as exposed soil at project locations becomes vegetated.
Effects to Habitat Complexity (PCE 4): The proposed action results in impacts to the large woody debris indicator and associated PCE 4. Cover, in the form of pools, and habitat complexity are very important components of bull trout habitat (Quigley and Arbelbide 1997). Large woody debris (LWD) is one of the primary means by which pools and undercut banks are formed in many stream channel types (Quigley and Arbelbide 1997), and is an important element for providing habitat complexity in aquatic ecosystems. Habitat complexity is important because bull trout have some of the most specialized requirements of any salmonid (U.S. Fish and Wildlife Service 2002). Pool frequency and habitat complexity are affected by the amount of instream large wood, the interaction between the channels and the floodplain, and connectivity of aquatic habitats. Pool frequency and quality is generally fair across the basin, with approximately half being rated fair (FAR), 30 percent have poor pool frequency/quality (FUR), and 20 percent have good (FA) pool frequency/quality. Good quality areas are generally in wilderness or other less developed watersheds (U.S. Forest Service 2013a).

Disturbance history and regimes affect the stability of stream channels and stream flows. These are important habitat characteristics for bull trout populations (Rieman and McIntyre 1993). The side channels, stream margins, and pools with suitable cover for bull trout are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel during winter through spring (Fraley and Shepard 1989, Pratt 1992, Pratt and Huston 1993). Streams with a natural hydrograph (those with normal discharge variations over time as a response to seasonal precipitation), permanent water, and an absence of nonnative species are representative of the highest quality ecological habitat of the species.

Road maintenance has the potential to affect pools by removal of LWD through the clearing of trees that have fallen across the road and into the stream and clearing material from within stream crossing structures (Furniss et al. 1991). LWD removal from streams upstream of bridges and culverts to reduce risk of bridge or culvert blockage during high water is another means by which pool habitat can be adversely affected. Design criteria that limit the removal and plan for the replacement of large wood (Appendix D. see design criteria 15 and 53) reduce the potential for road-related activities to affect bull trout. Stream crossings are also designed to accommodate the debris that streams carry during high-water events, which allows large wood to remain in the channel at more natural frequencies.

Effects on water temperature (PCE 5): The proposed action results in impacts to the temperature indicator and associated PCE 5. Water temperature is particularly important to bull trout. Bull trout have been repeatedly associated with the coldest water within river basins (Quigley and Arbelbide 1997). Road, bridge, and culvert maintenance can result in reduction or removal of streamside vegetation through brushing activities, possibly resulting in temperature increases. The risk of temperature increases is highest in very small streams and on roads adjacent to or crossing stream channels.

Generally, existing temperature refugia would be maintained. It is expected that activities implemented with the design criteria would not degrade the existing refugia, but activities may inhibit the natural recovery or expansion of refugia.
Following the design criteria for brushing at stream crossings and along streamside roads should reduce effects on temperature to a discountable level (U.S. Forest Service 2014). However, because of public safety concerns, the design criteria may not be implemented in all cases. It is recognized that there is a long-term impact of maintaining roads within the near-stream zones, which excludes the opportunity for re-establishing the cooling capacity of these sites.

**Effect to Flow and Hydrology (PCE 7):** The proposed action results in impacts to the peak and base flow indicator and associated PCE 7. Roads density and location can affect the natural hydrograph by intercepting and quickly routed precipitation to a stream which can increase peak flow. The proposed action will not result in an increase in the existing road network beyond the current baseline. Work performed under the programmatic, such as implementing design criteria 3, and installing the appropriate number of cross drains (design criteria 9), when implemented correctly would likely reduce road surface erosion and potential delivery of fine sediments to streams. The effectiveness of BMPs is variable and influenced by the amount of road use and weather conditions. In addition, road decommissioning would reduce the drainage area network and result in a more natural hydrograph resulting in a beneficial effect to this PCE.

**Effects on water chemistry (PCE 8):** The proposed action results in impacts to the chemical contamination indicator and associated PCE 8. The proposed action does not include the use of petroleum-based chemicals for dust control. The risks of adverse effects from chemical contamination related to road maintenance actions are mostly associated with the potential for hydraulic fluid and fuel spills from mechanical equipment. Written hazardous materials response plans are required for each Forest and BLM unit. These plans will at a minimum describe emergency communications, locations of clean-up equipment, and a description of the actions to take. The potential effect of asphalt used during paving is discussed above.

There have been reports of chloride-based dust abatement products harming riparian vegetation when applied on gravel roads in a forest setting (Hagle 2002). The effects relate to the product’s capacity to move easily with water through soils. Potential impacts include elevated chloride concentrations in streams downstream of application areas and shallow groundwater contamination (Heffner 1997). Currently, these effects have not been noted along the roads maintained by the Forest or BLM units within this assessment area. Concentrations of chloride in water were sampled once after a treatment on a streamside road on the Bitterroot Forest (U.S. Forest Service 2014a). Samples from treatment sites were not higher than the upstream control. Design criteria 42 (see Appendix E) would reduce the potential for chemical contamination by requiring a written hazardous materials response plans that includes an emergency communications, locations of clean-up equipment, and a description of the actions to take (U.S. Forest Service 2014).

**Effects to biological indicators (PCE 9):** The biological indicators in the framework/matrix (U.S. Fish and Wildlife Service 1998a) are subpopulation size, growth and survival, life history diversity and isolation, persistence and genetic integrity. These are all addressed above as a function of habitat characteristics such as promoting (or at least avoiding degradation of) migratory corridors where appropriate, and conserving or minimizing impacts to other habitat characteristics. See discussion under habitat connectivity. The proposed action is not anticipated to facilitate the distribution of non-native species.
Aggregate Effects by Core Area

To analyze the impact to the species the effects from the various activities must be aggregated across core areas (Table 6). Appendix F lists the extent of work proposed by activity type (I, II, and III) for each management unit and core area. The Forest and BLM have determined that activities described under Type I, II and III may result in either a NLAA or LAA determination, based on review of the following five factors: 1) location of activity and proximity to waterways; 2) duration of activity; 3) magnitude of activity; 4) timing of activity; and 5) effect pathway of activity. If the activities for an upcoming season (Appendix B) are concentrated or numerous, then the action agency as part of the proposed action will contact the Service to discuss whether additional or separate consultation is required. An unusual concentration of activities is defined as road work that results in adverse effects to 5 percent or more of the perennial stream within a local population watershed (usually one or more 6th field HUCs).

Generally, Type II and III road activities that occur within 100 feet of an occupied bull trout stream were identified as LAA actions and totaled as either miles number of sites (see Appendix F). These are the types of actions that have the greatest potential for aggregated effects. For the purposes of this analysis, an occupied bull trout stream is defined as any perennial stream within an occupied watershed. These areas include stream reaches that become dry during low water years (e.g. Rock Creek near Trout Creek Montana and lower portion of Cedar Creek). When Type I, II, and III activities occur greater than 100 feet away from the stream, the action is generally considered NLAA. However, based on review of the five factors (listed above), Type II and III actions that occur greater than 100 feet from the stream can, in some situations, result in adverse effects that would therefore count towards the allowable amount of LAA activity miles and sites (see Appendix F). Similarly, Type I activities may, under rare circumstances result in adverse effects and therefore count toward the allowable amounts of LAA activity miles and sites (see Appendix F). If there are re-occurring situations where Type I activities reach a LAA determination than a separate stand-alone consultation maybe required. Type I activities when implemented with required design criteria, regardless of proximity to a stream, would typically result in effects to the species or habitat that are discountable, insignificant, or beneficial.

The 100-foot distance was chosen as an index of effect and not a precise measurement of the quantity of fine sediment that is delivered to waterways, nor as a threshold between effect and no effect. Analyzing (and tracking) actions within 100 feet and greater than 100 feet of the stream, by activity Type I, II, or III provides a basis for identifying the level of activity (and effects) likely to occur within a core area annually. Table 6 defines the total estimated levels (miles and sites) of all activities by activity Type (I, II, and III) within each core area that may occur annually.
Table 6. Total annual amounts (miles and sites) of all Type I, II, and III activities, by habitat type (Spawning and Rearing (SR) or Foraging Migrating, and Overwintering (FMO)) within each bull trout core area (adapted from Appendix F, U.S. Forest Service 2014).

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<td>50</td>
<td>10</td>
</tr>
<tr>
<td>Bull Lake</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>10</td>
<td>1</td>
</tr>
</tbody>
</table>

It is important to note that it is common to find road segments that are much further than 100 feet of streams that produce fine sediments that eventually influence waterways. It is also common to find roads within 100 feet of streams that show no signs of delivering sediment to waterways (Elliot 2000). Results of past work (Figure 1 in U.S. Forest Service 2014) and recent Rocky Mountain Research Station road-sediment effects monitoring (from a western Montana landscape) also indicate that the majority of fine sediment delivered from road networks to stream channels did in fact originate within 100 feet of a channel (Tom Black, personal communication and project file data in U.S. Forest Service 2014). The design criteria are intended to reduce maintenance effects that are often fine-sediment related but also can be related to vegetation removal or channel disturbance (see Appendix A).

Table 7 defines the maximum number of miles and sites of road activities in each core area that have the potential to result in measurable impacts to perennial and intermittent streams and are anticipated to result in a LAA determination. Table 7, also includes the miles of stream adversely affected, the
total amount of occupied stream within each core area, and the percent of perennial stream miles affected within in each core area (assuming all LAA activities occur within a bull trout watersheds). The miles of stream with adverse effects was calculated by multiplying the miles of LAA Type II activities (i.e. actions within 100 feet of a perennial stream) by 1 and each LAA Type II site by 0.5 miles. In other words, every mile of Type II activity within 100 feet of a stream equates to 1 mile of stream affected, and for every Type II site, 0.5 miles of stream would be affected. Similarly, every mile of Type III activity within 100 feet of a stream equates to 0.1 miles of stream affected and for every Type III site, 0.25 miles of stream would be adversely affected (see Table 5 in U.S. Forest Service 2014). The total miles of occupied perennial stream within each core area includes all designated critical habitat and other areas important to bull trout populations (Appendix J).

Table 7. Total miles and number of sites of LAA Type II and III activities, miles of perennial stream adversely affected, total miles of occupied stream, and the percent of occupied stream adversely affected annually within each core area by habitat type (Spawning and Rearing (SR) or Foraging Migrating , and Overwintering (FMO)) based on the proposed action.

<table>
<thead>
<tr>
<th>Core Area</th>
<th>Total amount of LAA Type II and III, road-related actions</th>
<th>(a) Miles of stream with anticipated adverse effects by habitat type</th>
<th>(b) Total miles of occupied perennial stream within a core area, by habitat type (includes critical habitat)</th>
<th>Percent of occupied stream with adverse effects by habitat type within a core area. (a) ÷ (b)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Miles</td>
<td>Sites</td>
<td>Miles</td>
<td>Sites</td>
</tr>
<tr>
<td>Upper Clark Fork</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Rock Creek</td>
<td>9</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Blackfoot River</td>
<td>10</td>
<td>14</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Clearwater River and Lakes</td>
<td>4</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>West Fork Bitterroot</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Bitterroot River</td>
<td>9</td>
<td>9</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Middle Clark Fork</td>
<td>8</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Flathead Lake</td>
<td>5</td>
<td>2</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Frozen Lake</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Hungry Horse</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Swan Lake</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Holland Lake</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Lake Pend Oreille/Lower Clark Fork</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Lake Koocanusa</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Kootenai River</td>
<td>8</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>
It is important to note that the value in the last column of Table 7 provides a cautious estimate of the percent of habitat impacted. For example in the Bitterroot River core area there are over 2,000 miles of perennial stream, and only 723 miles are occupied by bull trout. In order for 2.7 (1.8 + 0.9) percent of bull trout streams within the core area to be impacted all of a year’s LAA road work would need to occur in or near an occupied bull trout stream. The proposed action is likely to result in adverse sediment related effects to only a small percentage of occupied streams within each core area, with the exception of Frozen Lake, Lake Koocanusa, and Bull Lake. For these core areas, as mentioned above, it is unlikely that all of the annual estimated work would occur in or near bull trout streams in these core areas. In addition, an unusual concentration of activity (5 percent or more) within these core areas would trigger further review. Furthermore, there is variability in the level of impacts among road activities. The variability of effects is based on many factors including roadbed gravel content, annual precipitation, time since last grading and road slope. The primary concern from the proposed action is the duration (e.g. number of events over time), intensity (e.g. percent of population affected), and severity (e.g. time it takes to recover from a disturbance) of increased sediment delivery to streams during and shortly after maintenance activities.

The Service anticipates that the duration of effects for any given local population in the action area will result in infrequent multiple pulses of sediment that last from less than a few hours to days and are unlikely to be repeated in the following year. Sediment delivered to the stream will likely impact SR habitats that support early life stages of bull trout until spring or fall or until high flows occur. Increased sediment from the proposed activities has the potential to impact several life stages of bull trout within the action area during and shortly after the activity type occurs. Increases in sedimentation can 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). Fine sediments may also reduce the availability of wintering habitat for adult and juvenile fish by increasing substrate embeddedness and by reducing the water volume of over-wintering pools. Increased sediment can also reduce juvenile rearing success and decrease aquatic insect production, thereby decreasing growth, by causing increased embeddedness of the substrate (Bjornn et al. 1977; Irving and Bjornn 1984; Weaver and Fraley 1991; Suttle et al. 2004). These sediment pulses will likely result in effects to habitat or individuals that may result in lethal and sub-lethal effects to individual bull trout.
The intensity of sediment impacts will likely only affect a small percentage of individuals within a core area and local population. Within a given core area, most of the road-related activities with adverse effects will occur in SR habitats. These areas are particularly sensitive to sediment related impacts. Based on field reviews (Upper Rock Creek, Beaverhead Deerlodge National Forest on Sept 19 – 20; Skalkaho Drainage, Bitterroot National Forest, June 24, 2013), the Montana Level I team identified a threshold for level (intensity) of activity. Once road work results in adverse effects to 5 percent or more of the perennial stream within a local population watershed, the potential for population level impacts becomes a concern. Alternately, treating near one percent along streams raises much less concern. Therefore, if more than 5 percent of the perennial stream within a local population watershed will be adversely affected per year, the Service will be notified to discuss whether additional or separate consultation is required. To determine if the threshold would be exceeded, the miles and sites for LAA activities are multiplied by the appropriate effects coefficient (see Table 5 in U.S. Forest Service 2014 and Table 7 above) by habitat type (SR or FMO) to determine the total miles of stream with adverse effects. The LAA stream miles are then divided by the total miles of perennial stream that supports a local population (Appendix J) to determine the percent of stream impacted.

The Service expects the severity of sediment related effects will not reduce the current rate of recovery because only a small portion of an individual local population and its habitat (less than 5 percent) will be adversely affected, and activities will not occur in consecutive years or over a continuous section of stream. The recovery rates of local populations will likely be maintained at its current level and in some areas slightly improved as a result of the long-term benefits of Type III (road crossing upgrades and road decommissioning) activities.

The proposed design criteria are part of the proposed action and are expected be effective in reducing sediment delivery during the most sensitive time periods important to bull trout (September 1 to May 15 in SR habitat). In addition, maintenance activities typically only occur on a small portion or segment of road near streams which also aids in minimizing the intensity of sediment impacts.

**Summary:** Adverse impacts to bull trout and bull trout critical habitat stem from road-related maintenance activities that generate, transport and deliver sediment to flowing streams and alter or reduces LWD recruitment that in turn reduces pool quality and frequency and alters stream morphology and function. One of the chronic sources of sediment arises from the recurring need for road-related activities on roads and road crossing structures that are in poor locations or of poor design. The location, design, and overall condition (maintenance) of the established roads and associated road features directly influences the degree road maintenance actions will impact bull trout and bull trout habitat. Road-related maintenance actions are unlikely to result in any long-term major improvements to the current habitat conditions (U.S. Forest Service 2014). The proposed action includes numerous design criteria to reduce the potential sediment effects (see Appendix A) and limit the scope of activity in a core area (Appendix F) and any given local population (5 percent threshold). The proposed action requires that each land management unit monitor projects to assure mitigation measures are implemented and findings will be documented. In addition, the Forest and BLM would maintain an internal dialog between engineering and fisheries staffs, and a reporting process is proposed that would ensure that expected effects and levels of activities are not exceeded (see Design Criteria 1 through 5).
In those core areas scheduled for activity Type III, minor benefits are likely to occur. The proposed action would result in long-term improvement from improved fish passage at road stream crossing structures. Culvert removal and replacements that meet INFISH standards will eliminate barriers that currently limit bull trout movement, thus improve population resiliency to disturbance by increasing the availability of additional spawning and rearing habitat. Road decommissioning will result in long-term minor benefits by reducing sediment sources, reducing the risk of culvert failure, and the need for maintenance. Road decommissioning in RHCAs would result in minor improvements to riparian conditions and subsequent minor restores to temperature and pool frequency and quality. In addition, graveling road surfaces would result in result in minor beneficial effect by reducing road surface sediment sources. These improvements would result in minor beneficial effects to habitat indicators sediment and pool frequency and quality.
B. Species' Response to the Proposed Action

A species' response to a proposed action relates to several factors. For example, the species response to disturbance will depend on the number of individuals or amount of habitat affected, although the age, sex, breeding status, and distribution of affected individuals, as well as the genetic variability within the remaining population(s), are equally important because they determine a population's ability to recover from the loss of individuals. The sensitivity to change, relates to the degree to which a population or species is prone to change when disturbed. Resilience is the factor that relates to the characteristics of populations, species, or critical habitat units allowing them to recover from different magnitudes of disturbance. For example, the greater the reproductive rate, the more resilient the species may be to population losses. Moreover, habitat specificity and other factors also contribute to a species' resiliency. Critical habitat also has resilience: grasslands, for example, can be more resilient to the adverse effects of fire than a forest. Recovery rate is the factor that relates to the time required for an individual, population, species, community, or ecosystem to return to equilibrium after exposure to a disturbance. A population, species, community, or ecosystem that has a fast recovery rate is called stable. It is often difficult to know the recovery rate or resilience of species such as bull trout.

The above species response factors are captured in the Service’s five year status review of the species, core area C-Rank (U.S. Fish and Wildlife Service 2008). For the purposes of this analysis the C-Rank is compared to levels of disturbance within in each core area. The C-Rank integrates four factors: population abundance, distribution, population trend, and threats. Core areas with an At Risk or High Risk C-Rank are likely to be prone to disturbance events, less resilient, and take longer for recovery rates to return to equilibrium. Table 8 below describes the total stream miles where lethal or sublethal effects are anticipated to occur, levels of disturbance from the proposed action and C-Rank. Disturbance levels are based on the miles of stream with adverse effects divide by the total miles of occupied bull trout streams in the core area (see Table 7 last column). Disturbance levels are divided into three categories based on the percent of stream affected. As mentioned above it is important to note that estimated disturbance levels will likely be lower than those analyzed in Table 8. Estimated disturbances levels were calculated under the assumption that all road-related maintenance actions in a given core area would occur in or near occupied bull trout streams. In addition, if the proposed annual road-related maintenance activities would affect more than 5 percent of the perennial streams that supports a local population, the Service will be notified to discuss whether additional or separate consultation is required.
Table 8. Total miles of stream with lethal or sublethal effects by habitat type (Spawning and Rearing (SR) or Foraging Migrating, and Overwintering (FMO)), levels of disturbance (low, medium, or high), and C-Rank (Potential Risk, Low Risk, At Risk, High Risk).

<table>
<thead>
<tr>
<th>Core Area</th>
<th>Total stream miles with anticipated lethal (L), and or sublethal (SL), effects by habitat type.</th>
<th>Levels of disturbance: Low 0-5 miles, Medium 5-10 miles, High &gt; 10 miles</th>
<th>Core Area C-Rank (U.S. Fish and Wildlife Service 2008)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SR Miles</td>
<td>Effects</td>
<td>FMO Miles</td>
</tr>
<tr>
<td>Upper Clark Fork River</td>
<td>3.9</td>
<td>L, SL</td>
<td>1.5</td>
</tr>
<tr>
<td>Rock Creek</td>
<td>9.9</td>
<td>L, SL</td>
<td>0.0</td>
</tr>
<tr>
<td>Blackfoot River</td>
<td>13.1</td>
<td>L, SL</td>
<td>2.0</td>
</tr>
<tr>
<td>Clearwater River and Lakes</td>
<td>5.9</td>
<td>L, SL</td>
<td>0.0</td>
</tr>
<tr>
<td>West Fork Bitterroot River</td>
<td>3.9</td>
<td>L, SL</td>
<td>1.5</td>
</tr>
<tr>
<td>Bitterroot River</td>
<td>9.8</td>
<td>L, SL</td>
<td>1.5</td>
</tr>
<tr>
<td>Middle Clark Fork River</td>
<td>10.0</td>
<td>L, SL</td>
<td>0.0</td>
</tr>
<tr>
<td>Flathead Lake</td>
<td>4.0</td>
<td>L, SL</td>
<td>3.7</td>
</tr>
<tr>
<td>Frozen Lake</td>
<td>1.4</td>
<td>L, SL</td>
<td>1.0</td>
</tr>
<tr>
<td>Hungry Horse</td>
<td>3.0</td>
<td>L, SL</td>
<td>2.7</td>
</tr>
<tr>
<td>Swan Lake</td>
<td>4.4</td>
<td>L, SL</td>
<td>2.9</td>
</tr>
<tr>
<td>Holland Lake</td>
<td>0.0</td>
<td>-</td>
<td>2.9</td>
</tr>
<tr>
<td>Lower Clark Fork River (Lake Pend Oreille)</td>
<td>5.0</td>
<td>L, SL</td>
<td>4.4</td>
</tr>
<tr>
<td>Lake Koocanusa</td>
<td>5.8</td>
<td>L, SL</td>
<td>3.5</td>
</tr>
<tr>
<td>Kootenai River</td>
<td>7.9</td>
<td>L, SL</td>
<td>2.9</td>
</tr>
<tr>
<td>Bull Lake</td>
<td>3.7</td>
<td>L, SL</td>
<td>0.0</td>
</tr>
</tbody>
</table>

The expected bull trout population response to the proposed road-related maintenance activities is associated with impacts to the aquatic habitat and the resulting impacts to individual bull trout that inhabit the action area. The proposed action includes thresholds that limit the amount of activity at both the local population level and core area scales. The species response to the proposed action is of greatest concern in those core areas scheduled for high levels of annual, road-related activities (high levels of disturbance) with a High Risk C-Rank (Table 8). The Bull Lake is the only core area with a High Risk C-Rank with correspondingly high levels of disturbance. This core area responds more sharply to disturbances and requires longer time frames to recover from disturbance. Therefore, the rate of recovery of this core area population will likely be reduced to a small degree by the proposed action, thus extending the recovery period. The remaining core areas in the action area were rated as At Risk, Low Risk, or Potential Risk and will receive a medium to low level of disturbance. The effects of the proposed action in these core areas are not anticipated to extend or reduce recovery rates as a result of the annual...
level of proposed road-related actions. The recovery rates of these core areas are likely to be maintained at current levels, and in some areas, slightly improved as a result of the long-term benefits of Type III activities (road crossing upgrades and road decommissioning). Culvert removals and replacements will eliminate barriers that currently limit bull trout movement, thus improve population resiliency to disturbance by increasing the availability of additional spawning and rearing habitat. Road decommissioning will result in long-term benefits by reducing sediment sources, the risk of culvert failure, and the need for maintenance. Road reconstruction activities that add aggregate to the road surface will reduce the amount of sediment reaching the stream.

C. Effects of the Action to Designated Critical Habitat

The specific effects of the proposed action on critical habitat are virtually the same as those described in the preceding section because the PCEs considered under critical habitat involve the same habitat parameters. Consequently, those discussions and analysis of effects apply here. The primary factor by which bull trout and bull trout critical habitat have the potential to be adversely affected by the proposed action is through changes to the sediment habitat indicators (PCE 6). In addition, activities associated with the proposed action could negatively impact PCE 3 (abundant food base), PCE 4 (complex habitats), with minor improvements to PCE 2 (migratory corridors) and PCE 7 (hydrograph). The Service anticipates 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. Increases in sedimentation could cause minor 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 reduce the functional suitability of any PCE or result in significant modification of critical habitat. Reducing large woody debris recruitment would result in degrades to PCE 3. Minor improvement to PCE function would occur to PCEs 2 and 9 as a result of improved habitat access from barrier removal. The function of PCE 7 would also improve as a result of reduced road densities and disconnection of the road system from the stream through the installation of road drainage features (i.e. BMPs).

VII. Cumulative Effects

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

Residential development is anticipated to increase throughout western Montana and can affect both the species and critical habitat. 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 decreases in woody debris contributions, increase sediment, and increase summer stream temperatures within the action area. However, a Habitat Conservation Plan (HCP) is being implemented by MDNRC,
and designed to protect native fish relative to forest management and associated actions, 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 (U.S. Fish and Wildlife Service 2002b). It is likely that recreational fishing in especially in known spawning streams in the fall will likely increase as the general residential population in western Montana increases. In addition, misidentification of bull trout has been a concern because of the similarity of appearance with brook trout. 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 populations in Montana. 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).

Cumulative effects of the core areas are reflected in bull trout population numbers and life history forms. All core areas are at risk of increased activities and concern for the viability and effects to bull trout populations well documented (U.S. Fish and Wildlife Service 2005a,b). It is anticipated that road-related activities similar to those described in this document may occur in the future on non-federal lands, and in conjunction with a multitude of other activities, could result in additive adverse effects. Clearly, activities occurring in stream channels on private lands at the same time the proposed federal activities are occurring on the same stream will result in additive adverse effects to bull trout, at least in the short-term. However, some non-federal activities will likely also be targeted for improving conditions for bull trout from existing levels over the long-term and will work in concert with federal actions toward recovery of bull trout in some instances. Sediment effects from high road densities and fish passage have been identified in the action area as having significant impacts to bull trout (U.S. Fish and Wildlife Service 2002). The proposed action would reduce sediment impacts from the forest roads, reduce the risk of culvert failure, and improve fish passage and habitat conditions. Overall the proposed action is expected to alleviate some cumulative impacts from past road-related activities.

VIII. Conclusion

A. Jeopardy Analysis

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 road-related maintenance actions, 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.”

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 (USDI 2006). 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 (see section III), the approach to the jeopardy analysis in relation to the proposed action follows a hierarchical relationship between units of analysis (i.e., geographical subdivisions) that characterize effects at the lowest unit or scale of analysis (the local population) toward the highest unit or scale of analysis (the Columbia River Interim Recovery Unit) of analysis. Table 2 shows the hierarchical relationship between units of analysis that was used to determine whether the proposed action, road maintenance activities, 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.

The proposed road-related activities are anticipated to adversely impact bull trout and bull trout habitat annually (see Appendix F) over a five year period in 13 core areas in the Clark Fork River and three core areas in the Kootenai River Management Units. Road maintenance activities would likely result in lethal and or sub-lethal effects when carried out in SR habitats and sub-lethal effects in FMO habitats from the degradation caused by sediment inputs to aquatic habitats and impact spawning habitat, rearing habitat, and food supply and the related risk to all bull trout life history stages. The sediment related effects will likely be short-term (hours to months) during or shortly after the activity. All 16 core areas are scheduled for activities that could result in take and are also anticipated to have actions that would benefit the species. Beneficial effects are likely to occur as a result of reduced road densities and improved fish passage.

The information and analysis presented in this BO indicates that if the proposed annual road-related maintenance activities would affect more than 5 percent of the perennial streams that supports a local population, the Service will be notified to discuss whether additional or separate consultation is required. This low disturbance level (i.e. percent of total perennial stream miles adversely affected) is unlikely to reduce the reproduction numbers or distribution of bull trout at the core area scale. As a result, the Service concludes that implementation of this proposed action is not likely to reduce survival and recovery of bull
trout at the scale of the following core areas: Upper Clark Fork River, Rock Creek, Blackfoot River, Clearwater River and Lakes, Middle Clark Fork River, West Fork Bitterroot River, Bitterroot River, Lower Clark Fork River (includes Lake Pend Oreille), Hungry Horse, Holland Lake, Swan Lake, Flathead Lake, Frozen Lake, Kootenai Lake and River, Bull Lake, and Lake Koocanusa. Therefore, the Service concludes that the proposed road-related maintenance actions will not appreciably reduce both the survival and recovery of the coterminous United States population of the bull trout in the wild (see 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 annual program of work will be reviewed by the Forest and BLM to ensure adverse activities in a given core area are not unexpectedly concentrated (exceeding the 5 percent threshold) within a local population or “other important population”. If the 5 percent or more of the perennial streams that support a local population are anticipated to be adversely affected, the Service will be notified to discuss whether additional or separate consultation is required.
- Design criteria for all road-related activities will be implemented and are likely to be effective in reducing sediment related impacts. Annually, the Level 1 Team will specifically discuss the road-related activities in the BA (including effectiveness of design criteria) and processes that could be improved to benefit bull trout and their habitat.
- Culvert removals/replacements may increase the amount of accessible habitat available for spawning and rearing and may provide opportunities to increase bull trout distribution.
- The risk of localized population decline will be reduced by reducing sediment input from roads and reconnecting fragmented stream segments by remediying fish passage barriers and reduce the risk of culvert failure.

**B. Conclusion for Designated Critical Habitat**

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. 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.”
The range-wide status of designated critical habitat for the bull trout is variable among and within CHSUs, which were designated in five states in a combination of reservoirs/lakes and streams/shoreline. Designated bull trout critical habitat is of two primary use types: (1) spawning and rearing; and (2) foraging, migration, and overwintering. The conservation role of bull trout critical habitat is to support viable core area populations. The core areas reflect the metapopulation structure of bull trout and are the closest approximation of a biologically functioning unit for the purposes of recovery planning and risk analyses. Thirty-two CHUs and 78 associated subunits are designated as critical habitat under the 2010 final rule for designation of bull trout critical habitat (75 FR 63898). The status of habitat conditions and the PCEs of designated critical habitat in the action area are marginal.

The effects of the proposed action on critical habitat will result in temporary degradation of PCEs from road-related maintenance activities. The proposed action will result in short-term sediment inputs from the activities on road segments in close proximity to the streams and reductions in large woody debris recruitment. Sediment delivery would result in minor degrades to the function of PCEs 3 and 6. Reducing large woody debris recruitment would result in degrades to PCE 4. Minor improvement to PCE 2 and 9 would occur as a result of improved habitat access from barrier removal. In addition minor improvements to PCE 7 would occur as a result of reduced road densities and disconnecting the road system from the stream through the installation of road drainage features (i.e. BMPs) at least as long as the BMPs remain effective.

After reviewing the current status of bull trout, the environmental baseline for the action area, the effects of implementing the proposed action, and the cumulative effects, the Service concludes that the actions as proposed are not likely to destroy or adversely modify bull trout critical habitat. This conclusion is based, in part, on the magnitude of the effects from the proposed action in relation to the designated critical habitat at the Columbia River Basin and Kootenai River Basin.

IX. 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 a listed species by annoying it 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 non-discretionary, and must be undertaken by the Forest and BLM so they become binding conditions of any contract issued for the exemption in section
7(o)(2) to apply. The Forest and BLM has a continuing duty to regulate the activity covered by this incidental take statement. If the Forest and BLM (1) fails to assume and implement the terms and conditions or (2) fails to require applicants to adhere to the terms and conditions of the incidental take statement, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Forest and BLM 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)].

A. Amount or Extent of Take Anticipated

The Service anticipates that activities associated with the proposed action will result in incidental take of bull trout in the form of harm, harassment or mortality related to expected degradation of aquatic habitat parameters, including substrate quality, rearing habitat and food supply and the related risk to bull trout life history stages. The levels of sedimentation generated by road-related maintenance activities such as stream crossing replacement/removal, road surfacing, ditch maintenance, road closure, road obliteration, and similar sediment generating activities are anticipated to adversely affect and likely result in take of the egg, larval, juvenile and adult bull trout by harming or impairing feeding and sheltering patterns. In addition, the Service anticipates a low level of take from the reduction of large woody debris recruitment that result in a reduction of pool frequency and quality over the long-term. Reductions in this habitat indicator will impair feeding and sheltering patterns of juvenile and adult bull trout to the extent that injury or mortality (harm and/or harassment) may occur. The amount of take in the core areas scheduled for activity that may result from implementation of the proposed action is difficult to quantify for the following reasons:

- The amount of sediment produced or delivered is determined by a number of factors that are not only influenced by local site parameters such as topography and soil type, but are influenced by weather, time of implementation and effectiveness of the mitigation measures.

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

- 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. Furthermore, 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.

- Impacts from the existing road network cannot be completely separated from impacts associated with maintenance activities.

For these reasons, the Service has determined that the actual amount or extent of the anticipated incidental take is difficult to quantify. In cases where we determine the level of take is difficult to quantify, the Service uses surrogates to measure the amount or extent of incidental take and whether the amount of take anticipated has been exceeded. In this biological opinion we use the miles of stream by habitat type within a core area with anticipated adverse effects.
Table 9. Authorized annual amounts of anticipated incidental take based on the miles of stream with anticipated adverse effects by habitat type in occupied bull trout streams for each core area.

<table>
<thead>
<tr>
<th>Habitat</th>
<th>SR</th>
<th>FMO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Clark Fork River</td>
<td>3.9</td>
<td>1.5</td>
</tr>
<tr>
<td>Rock Creek</td>
<td>9.9</td>
<td>0</td>
</tr>
<tr>
<td>Blackfoot River</td>
<td>13.1</td>
<td>2.0</td>
</tr>
<tr>
<td>Clearwater River and Lakes</td>
<td>5.9</td>
<td>0</td>
</tr>
<tr>
<td>West Fork Bitterroot River</td>
<td>3.9</td>
<td>1.5</td>
</tr>
<tr>
<td>Bitterroot River</td>
<td>9.8</td>
<td>1.5</td>
</tr>
<tr>
<td>Middle Clark Fork River</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Flathead Lake</td>
<td>4.0</td>
<td>3.7</td>
</tr>
<tr>
<td>Frozen Lake</td>
<td>1.4</td>
<td>1.0</td>
</tr>
<tr>
<td>Hungry Horse Reservoir</td>
<td>3.0</td>
<td>2.7</td>
</tr>
<tr>
<td>Doctor Lake</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Big Salmon Lake</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Swan Lake</td>
<td>4.4</td>
<td>2.9</td>
</tr>
<tr>
<td>Lindbergh Lake</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Holland Lake</td>
<td>0</td>
<td>2.9</td>
</tr>
<tr>
<td>Lower Clark Fork /Lake Pend Oreille</td>
<td>5.0</td>
<td>4.4</td>
</tr>
<tr>
<td>Lake Koocanusa</td>
<td>5.8</td>
<td>3.5</td>
</tr>
<tr>
<td>Kootenai River</td>
<td>7.9</td>
<td>2.9</td>
</tr>
<tr>
<td>Bull Lake</td>
<td>3.7</td>
<td>0</td>
</tr>
</tbody>
</table>

The miles of stream with anticipated take is a function of the proposed activities occurring within each core area as described in Appendix F (columns titled miles/sites with potential measureable impact to perennial and intermittent streams). The Service does not anticipate that all of the annual program of work (Appendix F) would occur every year in the same local population watersheds (see map in Appendix K). The Forest and BLM will review a list of proposed road-related maintenance actions (Appendix B) that meet design criteria measures 1 through 5 for the upcoming field season to ensure that proposed activities would not affect 5 percent or more of the perennial streams that supports a local population and that the levels of anticipated take described in Table 9 above will not be exceeded. The pre-season review of the proposed road-related activities ensures that take of bull trout will not exceed for a given core area and that effects in any one local population or other important population are not such that a population level of affect is a concern or unusual concentrated. If 5 percent or more of the perennial streams that supports a local population or other important population would be affected, the Service will be notified to discuss whether additional or separate consultation is required. The proposed action requires that each land management unit will monitor projects to assure design criteria are implemented and findings are documented.
B. Effect of the Take

In the preceding biological opinion, the Service determined that the extent and type of incidental take described is not likely to result in jeopardy to bull trout or destruction or adverse modification of critical habitat. The proposed level of stream miles with anticipated incidental take described in Table 9 above will not appreciably reduce the survival and recovery of bull trout in any of the core areas and by extension not likely to appreciably reduce the survival and recovery of bull trout at the Clark Fork River and Kootenai River Management Unit and the larger scale of the Columbia River Interim Recovery Unit.

C. Reasonable and Prudent Measures

The Service concludes that the following reasonable and prudent measures (RPM) are necessary and appropriate to minimize the take of bull trout caused by the proposed action.

1. Identify and implement means to reduce the potential for incidental take of bull trout that results from increases in sedimentation and or loss of pool habitat due to reduced large woody debris recruitment as a result of road maintenance actions.

2. Monitor road-related maintenance actions and projects (including those that have been determined to Not Likely to Adversely Affect bull trout) in a manner that complies with the design criteria described in the BA and Appendix A of the BO.

3. Implement annual reporting requirements.

D. Terms and Conditions

To be exempt from the prohibitions of section 9 of the Act, the Northern Region Forest Service (Bitterroot, Beaverhead-Deerlodge, Helena, Flathead, Lolo and Kootenai National Forests) and BLM Missoula Field Office must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

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

a. During all road-related maintenance actions, the Forest and BLM shall implement road-related activities as described in the BA with all appropriate soil and water Best Management Practices (U.S. Forest Service 2012) and appropriate design criteria as described in Appendix A of the BA (U.S. Forest Service 2014) and reiterated in Appendix A of this BO.

b. Prior to road-related actions, the Forest and BLM shall verify stream channel locations in relation to the proposed road-related activity and ensure that all appropriate design measures are incorporated into the plan of work for the upcoming season.
To fulfill reasonable and prudent measure #2, the following terms and conditions shall be implemented:

a. The Forest and BLM shall review the annual program of work to insure that planned road-related activities do not exceed the anticipated levels of take (as described in Table 9) and the levels of activities described in Appendix F.

b. The Forest and BLM shall review the annual program or work to ensure that the proposed annual road-related maintenance activities in a given core area are not unexpectedly concentrated within a local population or other important population. This review will include determining the percent of perennial streams that are anticipated to receive adverse effects. A guideline for an unusual concentration of activities is when projected adverse effects in a local population constitute 5 percent or more of that local population’s perennial stream network. Local population or other important population is generally comprised of one or more 6th field Hydrological Unit Codes (HUCs) (see map in Appendix I). If 5 percent or more of the perennial streams that support a local population are affected, the Service will be notified to discuss whether additional or separate consultation is required.

c. The Forest and BLM shall develop an effectiveness monitoring strategy for road-related activities using the design criteria as described in Appendix A by May 15 of 2015. This strategy will include a process to monitor and evaluate the effectiveness of BMPs and design criteria. Effectiveness monitoring shall occur annually on at least one management unit per year. Should monitoring demonstrate that design criteria is not effective in maintaining the desired effect, then new and/or improved criteria will be developed by a committee of the members of the Western Montana Bull Trout Level 1 Team or their representatives.

To fulfill reasonable and prudent measure #3, the following terms and conditions shall be implemented:

a. Annually, the Level 1 team will specifically discuss the BA/BO and processes that could be improved to benefit bull trout and their habitat. The team will schedule one or more field reviews for the upcoming field season. The site will rotate among administrative units and be based on the location of the most pressing issues. During this meeting the Forest and BLM will review information on the season’s annual amount of road-related activities (Appendix B), and review the effectiveness monitoring information (as described above in Term and Conditions 2, c.).

b. Upon locating dead, injured or sick bull trout or upon observing destruction of redds, notification must be made within 24 hours to the Montana Field Office at 406-449-5225. The Forest and BLM shall record the date, time, and location of dead or injured bull trout when found, and possible cause of injury or death of each fish and provide this information to the Service.
The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, proposed action is 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 Forest and BLM 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.

X. 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. The following 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.

- To assist in meeting the Forest and BLM responsibilities under Section 7(a)(1) of the Act, pursue opportunities to increase the understanding of road maintenance best management practices among local governments. The Service supports efforts to improve the implementation of BMPs for road maintenance actions through the use of existing programs (i.e. Secure Rural Schools and Community Self-Determination Act). In addition, the Service strongly recommends that the Forest and BLM work proactively to minimize the effects to listed species and sensitive aquatic habitats when road maintenance actions involve cost-share roads.

- When planning road-related projects at the watershed scale, consider actions designed to result in timely and effective improvement in the functional condition of habitat baseline conditions for bull trout (e.g., FUR to FAR).

- Implement the Bull Trout Conservation Strategy (May 2013) developed for those watersheds on Forest Service lands in western Montana that contain populations of bull trout.

- Consider development of a fish habitat and population monitoring strategy to better understand the impacts of road maintenance actions on aquatic resources, especially in the high activity, high risk core areas.

- Consider implementation of recovery actions identified in the Service’s draft bull trout recovery plan, and assist the Service in identifying future recovery actions.

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.
XI. Reinitiation Notice

This concludes formal consultation for bull trout on the Road-related Activities that May Affect Bull Trout and Bull Trout Critical Habitat in Western Montana, proposed by the U.S. Forest Service, Northern Region, and Bureau of Land Management Missoula Field Office. 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. The Service retains the discretion to determine whether the terms and conditions listed in (1) through (3) have been met and re-initiation of formal consultation is required. In instances where the amount or extent of incidental take is exceeded re-initiation of consultation is required.
XII. References


Conference Proceedings.


Fischenich, J. D. 2003. Effects of riprap on riverine and riparian ecosystems. U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi.


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.


U.S. 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


U.S. Forest Service. 2006. Northern Region Culvert/Aquatic Organism Passage Assessment October 2006. Region 1 Forest Service, Missoula Montana.


U.S. Forest Service 2014. U.S. Forest Service, Northern Region (Forest) and Bureau of Land Management Missoula Field Office (BLM) Road-related Activities that May Affect Bull Trout and Bull Trout Critical Habitat in Western Montana Biological Assessment. Region 1 Forest Service, Missoula, Montana.


Appendix A. Detailed Description of Road-Related Activities Included in the Proposed Action (U.S. Forest Service 2014).

This section does not include the full explanation of the effects of the activities. Effects of the activities are documented in section V of the BA.

For review, the Activities were grouped into three type classes, as listed below.

<table>
<thead>
<tr>
<th>Type I</th>
<th>Type II</th>
<th>Type III</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Road drainage and cross-drain installation and maintenance</td>
<td>• Surface and ditch maintenance</td>
<td>• Stream crossing structure replacement- upgrade</td>
</tr>
<tr>
<td>• Snow removal</td>
<td>• Surface restoration and reconditioning, and paving</td>
<td>• Road decommissioning</td>
</tr>
<tr>
<td>• Brushing</td>
<td>• Fill and cut-slope maintenance</td>
<td>• Road storage or closure</td>
</tr>
<tr>
<td>• Planting vegetation</td>
<td>• Road reconstruction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Bridge, culvert, and ford maintenance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Channel maintenance near roads</td>
<td></td>
</tr>
</tbody>
</table>

1.  Road drainage and cross-drain installation and maintenance

The purpose of drainage structures and cross drains is to remove flowing and standing water from the road surface in a hydraulically efficient manner, thus reducing the erosion of the road surface, ditch, or associated feature. Proper spacing, placement, and maintenance of drainage structures and cross drains maintain their functionality.

Cross drains and drainage structures route water to the downhill side of the road, toward or sometimes within the riparian area.

Ideally, sediment-laden water from the road surface is routed to areas where it can be retained prior to entering the floodplain.

When material from within the cross drain or drainage structure is removed, it shall be replaced on the road surface or in an area that is stable (flat and vegetated) and not wasted into the stream channel or into areas where it can be routed back into the active channel.

Design Criteria:

6  Sediment material retained in cross-drain culverts cannot enter the stream.
7  Direct drainage to areas with vegetation rather than directly into channels or onto bare slopes.
8  When surface runoff flows directly into a stream consider in-sloping roads and construction of sediment catch basins to avoid delivery of road sediment to stream channels.
9  Install more cross drains, build sediment catch basins, gravel ditches and/or build check dams when erosion has occurred or is likely.
12 Areas cleared of vegetation by maintenance or other activities will be seeded with an approved weed-free seed mix. Immediately covering seeded areas with approved weed-free straw mulch is recommended. Consider the use of
shrub and trees also.

13 Brush along streams will retain a minimal woody “stubble height” of no less than the height needed to maintain the sediment filtering capacity of the shrub base, and long-term viability of bank-supporting shrubs.

14 Construct berms, sediment basins, or sediment traps to contain sediment.

2. Snow removal

Removal of snow from the road and turnouts may include removal of snow slides, minor earth slides, fallen timber, and boulders.

Snow plowing can result in increased erosion of the road surface and fill slope. As plowed roads begin to thaw in spring, water can flow down vehicle ruts in the ice covered road surface for long distances, eventually cutting off the road onto fill slopes at sites not necessarily designed to handle flows, increasing sediment delivery to streams. Additionally, poor implementation of design criteria or extreme winter conditions can result in side-casted snow partially blocking culverts or adding to culvert icing problems and thereby increasing risk of culvert/road washout during thawing or rain-on-snow conditions when runoff increases rapidly.

_The chronic deposition of traction sand, de-icing chemicals, and inorganic material from the snow and ice covered road into the stream is not an activity covered in this programmatic BA. This practice needs site specific measures to address the issue of sediment and de-icer chemical delivery._

_Design Criteria:_

32 Open culverts and ditches restricted by snow or ice to allow proper drainage.

33 Leave 2 inches of snow on roadways during winter plowing operations to protect the road surface from mechanical disturbance.

34 Side-casting of snow will be avoided where there is potential for snow or ice damming in adjacent stream channels.

35 Openings in snow berms will be provided and maintained as required for surface drainage. Avoid drainage outlets on erodible fills. If the snow berm can be satisfactorily pushed off the road shoulder without sidecasting into streams or causing snow and ice damming of stream channels, openings in the snow berm may not be needed. This must be assessed on a case-by-case basis by the fisheries biologist.

36 Restore damage from snow removal by the following summer. Examples of this are damage or excessive erosion of road surface, damage to cross drain structures and damage or excessive erosion on cut and fill slopes.

3. Brushing

Removing brush from the roadside is a common practice intended to increase sight distance for vehicular traffic on corners and narrow sections of the road and to reduce encroachment of trees and shrubs into the road prism. Pruning around culverts is an accepted practice to ensure the free flow. This work when done by hand (including chainsaws) is not restricted.
Brushing typically involves a machine. Handwork is used where limited amounts of vegetation need to be removed, or when material is too large for machine brushing equipment.

The Forest have adopted three specific design criteria to reduce the potential impacts of brush removal along roads near streams. These criteria focus on restricting streamside brushing to those areas and situations where public safety is an overriding concern, and emphasizing site-specific rather than broad scale action. Brush removal will retain a minimal woody “stubble height” of no less than the height needed to maintain the sediment filtering capacity of the shrub base, and long-term viability of bank-supporting shrubs.

**Design Criteria:**

13 Brush along streams will be cut to a height of no less than the height needed to maintain the sediment filtering capacity of the shrub base, and long-term viability of bank-supporting shrubs.

17 Limit brushing to areas that affect safe site-distance or that are imperative to maintain a road surface and drainage system.

18 Vegetation between the road edge and the stream will be retained when roads are near (as defined by the biologist) the high water mark, except where safety is an overriding concern (see number 17, above). This distance may be greater where site specific issues exist, such as near laterally migrating channels.

4. **Planting vegetation**

Plantings are regularly planned with large ground disturbing activities. However, there are times when planting within or near road prisms are required to establish or fortify past projects or migrating channels. Vegetation inhibits soil erosion by providing obstructions to flow, reducing velocity and the capability of runoff to transport sediment, and by binding soil particles with subsurface vegetative growth. There are no design criteria to minimize effects of this activity.

5. **Surface and ditch maintenance**

This activity type removes ruts created by wheeled vehicles or flowing water to reduce the potential for water to become channelized flow. As a rutted travel way can produce as much as twice the volume of fine sediment as a smooth surface travel way that is maintained by regular blading (Burroughs and King1989). Regular surface blading also can reduce fill slope erosion (*Ibid.*). Surface blading may be repeated during the year.

Ditch maintenance includes ditch “pulling” and ditch “heeling.” Ditch pulling involves the use of a bladed machine, such as a road grader, that cleans the ditch by running the blade along the bottom and sides of the ditch, thereby pulling material onto the road surface. Ditch healing uses machinery to push material away from the road and onto the back-slope. Both techniques may be employed in the same road section to reshape the ditch and restore water drainage.

Ditch cleaning maintenance can generate large amounts of fine sediment within and adjacent to the ditch and along the road surface. When vegetation is cleaned from the ditch and base of the cut-slope in fine-grained soils, erosion from cleaned ditches can exceed erosion from road surfaces.
Sediment production in ditches can be reduced by retaining surface roughness within the ditch, thereby slowing the flow of ditch water and reducing the sediment transport capacity. The most common method of artificially increasing surface roughness is by lining ditches with rock (Anderson et al. 1970). There is a d50 size relationship for roadside ditch armoring with rock that has been demonstrated to reduce sediment generation and reduce long-term maintenance costs (Anderson et al. 1970).

Dust abatement is also part of surface maintenance, but shall not include use of petroleum-based compounds. Vegetative material or rocks that have fallen into the roadway or shoulders almost always need to be moved. Placement of this material in the stream channel may result in adverse effects to bull trout habitat.

**Design Criteria:**

8 When surface runoff flows directly into a stream, consider in-sloping roads and building sediment catch basins to avoid delivery of road sediment to stream channels.

15 Place large woody debris or rock that must be removed from the road prism, into the stream channel only under the direction of a fisheries biologist.

16 Utilize sediment filter fence, weed-free straw bales or other means to reduce delivery of sediment to streams or channels.

20 Side-casting of road materials smaller than 4 inches in diameter is prohibited on road segments within or abutting RHCAs. Material greater than 4 inches from surface or ditch maintenance will not be side-cast where there is a potential to enter the stream. Large boulders may be side cast under the direction of a fisheries biologist.

23 Incorporate material from the ditch into the road surface, or if not incorporated, put it on a designated site where it will not be delivered to stream channels.

24 When pulling ditches, the cut slope will not be undercut.

28 Where directed by the fisheries biologist, rolling (surface compaction) of the road surface needs to be included as part of the blading for roads that are located in RHCAs.

29 Foot valves must be appropriately screened.

30 A network of water drafting sites will be designated and approved by the fisheries biologist.

6. **Surface restoration and reconditioning, and paving**

Surface restoration may involve adding aggregate to the road’s subsurface and surface, applying chloride compounds or other binding agents, and the roto-milling process. Unlike the previous version, this programmatic includes activities involved with chip sealing and asphalt projects.

Addition of aggregate to an unimproved road surface can reduce sediment production. Anderson et al. (2012) demonstrated that placing a six-inch lift of 1.5-inch minus crushed rock on an unimproved road surface reduced sediment production by 70 percent over a five-month period. Burroughs and others (1985 in Burroughs and King 1989) measured a reduction in sediment production of 79 percent with the placement of a four-inch lift of 1.5-inch minus...
crushed rock in a simulated rainfall exercise.

The depth and quality of the aggregate applied to an unimproved road surface determine the effectiveness of the aggregate in reducing sediment production. Anderson et al. (2012) found that a two inch lift of 1.5- inch minus crushed rock on a sandy loam road surface was not effective in reducing sediment, whereas a six-inch lift of the same material and on the same surface reduced sediment production by an estimated 92 percent. Aggregate quality is determined by composition and parent material (Foltz, 1996).

Road surface restoration and reconditioning through the application of aggregate is a primary means to reduce sediment delivery from road surfaces.

**Design Criteria**

9. Install more cross drains, build sediment catch basins, gravel ditches and/or build check dams when erosion has occurred or is likely.

16. Use sediment filter fence, weed-free straw bales or other means to reduce delivery of sediment to streams or channels.

28. Where directed by the fisheries biologist, rolling (surface compaction) of the road surface needs to be included as part of the blading for roads that are located in RHCA's.

31. Where the road surface becomes wider than originally designed, measures such as pulling in shoulders, developing rock berms with frequent drainage outlets, or installing carsonite delineators will be used to restore the original design road width.

41. Areas (other than the travel way surface) cleared of vegetation by maintenance or other activities will be seeded with an approved weed-free seed mix. Immediately covering seeded areas with approved weed-free straw mulch is recommended. Consider the use of shrubs and trees also.

42. When using chloride or other binding agents, written hazardous materials response plans are required for each unit (FSM 2165.04). These plans will at a minimum describe emergency communications, locations of clean-up equipment, and a description of the actions to take (FSM 2165.12).

7. **Fill and cut-slope maintenance**

Fill slopes are typically exposed surfaces that are created to form the road prism during road construction. Fill slopes adjacent to streams or floodplains are chronic sources of sediment (Burroughs and King, 1989; Meehan et al., 1991).

Management of fill slope erosion is best accomplished by management of road surface drainage. Fill slope erosion could be minimized by directing flow away from the fill slope surface, sloping the road surface inward, to the uphill side of the road. In-road sloping concentrates surface runoff as ditch flow, which can result in the potential for elevated sediment production at or downhill from the collection area (Anderson et al. 2012).

Roads which parallel streams often have segments that are susceptible to damage from high water events. Often, such roads have one shoulder that leads directly to the stream channel.
Following high water events, maintenance, in the form of buttressing and the addition of additional inorganic material may be required to retain the road prism in place. Bioengineering techniques should be investigated and used when possible.

Fill slopes often exceed the existing preconstruction hill slope gradient; failure of fill slopes is common in steep terrain, especially on secondary roads (Meehan et al. 1991). Maintenance of the fill slope is intended to reduce soil loss on the downhill side of the road and to replace soil lost from erosion. Inorganic material from the road surface or uphill ditch is routed on to the fill slope during surface blading to replace soil lost through erosion. Maintenance may be required to address chronic erosion of the feature or damage resulting from a natural or man caused event. Damage may range from partial erosion of the road fill to entire washouts of the road prism.

Fill slopes may be stabilized with structures such as ballast rock, gabions or other forms of retaining walls. In these cases, initial stabilization actions are likely to reduce maintenance requirements in the long-term.

The treatments to address fill slope maintenance include constructing more frequent water handling devices, ditch relief culverts, and leadoff ditches in the road surface. Increasing the frequency of structures reduces the volume of water leaving the road surface at any individual drainage structure, and thus reduces the potential for soil erosion at that point. Additional maintenance treatments include armoring scoured areas below culverts, and covering erosion-prone surfaces with erosion control mat and vegetation.

Cut-slope maintenance is designed to reduce or alleviate the loss of soil from the cut slope. Cut slope failures (slumps, slides) may require extensive work to correct the immediate and underlying problem. When a cut slope failure has occurred resulting in excess material in the ditch or roadway, a temporary ditch may be constructed around the slide to channel surface run off around the blockage. Generally, excess material is removed and the original ditch function is restored. Removal of excess material (undercutting) from the toe of a cut slope carries a risk of slope destabilization.

9 Install more cross drains, build sediment catch basins, gravel ditches and/or build check dams when erosion has occurred or is likely.
12 Areas cleared of vegetation by maintenance or other activities will be seeded with an approved weed- free seed mix. Immediately covering seeded areas with approved weed-free straw mulch is recommended. Consider the use of shrub and trees.
16 Utilize sediment filter fence, weed free straw bales or other means to reduce delivery of sediment to streams or channels.
19 Encourage vegetative growth to improve long-term stability of cuts and fills and ditches. Consider planting shrubs and trees, use of erosion-control mats, in addition to seeding.
20 Side-casting of road materials smaller than 4 inches in diameter is prohibited on road segments within or abutting RHCAs. Material greater than 4 inches from surface or ditch maintenance will not be side-cast where there is a potential to
enter the stream. Large boulders may be side cast under the direction of a fisheries biologist.

21 Reduce the erosion of loose dirt from ditches following ditch maintenance (e.g. roll ditch with grader wheel).

25 Unless mutually agreed to by the engineer, hydrologist, and fisheries biologist, do not allow rip rap to narrow or confine the existing floodplain or stream channel.

26 Rip rap may be considered when mutually agreed to by the engineer, hydrologist, and fisheries biologist.

31 Where the road surface becomes wider than originally designed use measures such as pulling in shoulders, developing rock berms with frequent drainage outlets, or installing carsonite delineators will be used to restore the original design road width.

8. Road reconstruction

Road repair activities include drainage improvements, subgrade preparation and improvements, localized slope repair and stabilization, and vegetation reestablishment. Under this activity type, actions include simple reconstruction of a short section of road to improve the alignment at the stream crossing.

This activity type may also include major road reconstruction projects. Road reconstruction activities that include significant new disturbance to a site (such as relocation or addition of travel way width over extended lengths) may require a more detailed project description and additional effects analysis and may tier to this programmatic. A supplemental BA with project details will be submitted to the Service for review to determine if the scope of the reconstruction activities could be included in this programmatic BA.

These types of road reconstruction projects are likely to use many of the design criteria from Appendix D, however, additional design criteria may be developed for major activities.

Design Criteria:

11 When adjacent to or upstream of known or potential bull trout spawning and rearing areas conduct sediment-producing activities between May 15 and August 31.

31 If advantages of other timing have been vetted with the MTFWP counterpart and are likely to outweigh risks, the U.S. Fish and Wildlife Service Level 1 representative may sanction an alternate work window, on a case by case basis, without using the variance process. Alternate timing will be in the annual report. “Upstream” is defined as generally ¼ mile, but is based on biologist’s judgment that includes project magnitude.

12 Areas cleared of vegetation by maintenance or other activities will be seeded with an approved weed-free seed mix. Immediately covering seeded areas with approved weed-free straw mulch is recommended. Consider the use of shrubs and trees also.

16 Utilize sediment filter fence, weed-free straw bales or other means to reduce
delivery of sediment to streams or channels.
19 Encourage vegetative growth to improve long-term stability of cuts, fills and ditches. Consider planting shrubs and trees, use of erosion-control mats, in addition to seeding.
22 When a structure is removed from the stream channel, inspect the reconstructed channel, stream banks, fill slopes and road approaches at the modified stream crossing periodically until the sites are stable and vegetated.
25 Unless mutually agreed to by the engineer, hydrologists, and fisheries biologist, do not allow rip rap to narrow or confine the existing floodplain or stream channel.
26 Rip rap may be considered when mutually agreed to by the engineer, hydrologist, and fisheries biologist.
27 If rock weirs are used (e.g. to help stabilize a stream channel or provide grade control), design so they will pass substrate and do not form a fish barrier to weaker swimming species during low flows.
43 Restore appropriate stream gradient, entrenchment ratios, width/depth ratios, and pool/riffle frequencies.
44 When removing culverts, stabilize side slopes by landscaping them to mimic terraces upstream and downstream of the site.
46 Live water will be diverted around work sites using a lined ditch, coffer dam, pumps, or pipes to the degree that is possible. During bridge replacements and culvert removals, live water is typically not diverted around the work site because of the substantial size and disturbance that a diversion channel would entail.
47 Construct new or replacement stream crossing structures to accommodate a 100-year flood, including the associated bedload and debris
51 Bridge abutments will be removed if adversely affecting the channel, floodplain function, or fish habitat. Abutments may be left in place if the hydrologic function and fish habitat is not adversely affected.
53 Large Wood (LWD) removed from the stream or floodplain during the course of road-related activities should be placed in the stream channel when feasible at another location nearby where risk to the road or structures is not high. In the case where the LWD was cut and removed in pieces, plan for an installation of replacement LWD in a nearby location.

9. Bridge, culvert, and ford maintenance
Bridge maintenance includes the removal of material from the bridge deck surfaces, running plank replacement, spot painting (including sanding, wire brushing, sand blasting, and priming) and clearing abutments and piers of accumulated debris.

The Forest and BLM units recognize that these activities may be conducted with a degree of urgency at times should the loss of the structure be imminent. As such, the Forest and BLM units propose that cleaning of the bridge “... may occur anytime, when delaying maintenance will result in significant impacts to bull trout habitat.”

Bridge and culvert maintenance also includes rip-rapping of piers and abutments to reinforce or repair the structural integrity of these features. These activities also may be conducted with
a degree of urgency when loss or damage to the structure may be imminent. Rip-rapping of piers and abutments directly impacts stream channels in the immediate vicinity of existing structures, and likely result in inorganic material entering the channel.

**Design Criteria:**

11 When adjacent to or upstream of known or potential bull trout spawning and rearing areas conduct sediment-producing activities between May 15 and August 31. If advantages of other timing have been vetted with the FWP counterpart and are likely to outweigh risks, the USDI Fish and Wildlife Service Level 1 representative may sanction an alternate work window, on a case by case basis, without using the variance process. Alternate timing will be in the annual report. “Upstream” is defined as generally ¼ mile, but is based on biologist’s judgment that includes project magnitude.

15 Place large woody debris or rock that needs to be removed from the road prism, into the stream channel only under the direction of a fisheries biologist.

37 Culvert or bridge cleaning may occur anytime, when delaying maintenance will result in significant impacts to bull trout habitat.

38 When lead-based paints are removed, introduction of these materials into stream courses is controlled by using Tech Tips (Beckley and Groenier 2007) guidelines.

39 When treated wood materials are used near or in water, follow the Best Management Practices for the Use of Treated Wood in Aquatic Environments (July 1996).

40 When replacing or reinforcing rip rap, avoid narrowing or confining the stream channel; the design and implementation must be mutually agreed upon by the engineers, hydrologists, and fisheries biologists.

52 When riprap is used the design and implementation must be mutually agreed upon by the engineers, hydrologists, and fisheries biologists.

53 Large Wood (LWD) removed from the stream or floodplain during the course of road-related activities should be placed in the stream channel when feasible at another location nearby where risk to the road or structures is not high. In the case where the LWD was cut and removed in pieces, plan for an installation of replacement LWD in a nearby location.

10. **Channel maintenance near roads**

Activities in this category include beaver dam alteration and removal, bank protection, accumulated bedload removal, and culvert cleaning (this refers to culverts larger than cross-drains addressed in above).

Beaver Dam Removal: Beaver dam removal is only done in conjunction with identified risks to road-overflow onto the existing road surface. Removal of those dams can release large amounts of sediment and cause short-term pulses of turbidity to the stream, but is preferable to the effects of a road wash-out.
Bank Protection: Bank protection is generally conducted on sections of road prism that encroach into the channel migration zone. Occasionally, flow events actively erode stream banks associated with a stream crossing structure or the base of a road. The most common type of bank protection is rip rap. Design criteria 40, 52, and 53 would minimize the use of rip rap and or incorporate design techniques that include the use of rootwads and cross-veins.

Bed-load Removal and Culvert Cleaning: Bed-load removal is required in areas where crossing structures are located in a stream’s depositional area or where an undersized stream crossing does not pass bed-load or debris efficiently. Removal of the bed-load is usually accomplished by using a backhoe or other mechanized equipment. Culvert cleaning includes mechanical removal of any material which is obstructing the flow of water through the culvert. The activity typically involves in-stream work that can cause short-term sediment pulses. This activity can reduce the risk of culvert failure providing some benefit to the fisheries resource. However, culverts that require repeated bed-load removal and cleaning are likely undersized and or misaligned with the stream channel and may require removal or replacement.

Design Criteria:

11 When adjacent to or upstream of known or potential bull trout spawning and rearing areas conduct sediment-producing activities between May 15 and August. If advantages of other timing have been vetted with the FWP counterpart and are likely to outweigh risks, the USDI Fish and Wildlife Service Level 1 representative may sanction an alternate work window, on a case by case basis, without using the variance process. Alternate timing will be in the annual report. “Upstream” is defined as generally 1/4 mile, but is based on biologist’s judgment that includes project magnitude.

40 When replacing or reinforcing rip rap, avoid narrowing or confining the stream channel; the design and implementation must be mutually agreed upon by the engineers, hydrologists, and fisheries biologists.

52 When rip rap is used the design and implementation must be mutually agreed upon by the engineers, hydrologists, and fisheries biologists.

53 Large Wood (LWD) removed from the stream or floodplain during the course of road-related activities should be placed in the stream channel when feasible at another location nearby where risk to the road or structures is not high. In the case where the LWD was cut and removed in pieces, plan for an installation of replacement LWD in a nearby location.

54 When safe to do so, remove beaver dams slowly to avoid uncharacteristically high flows downstream.

11. Stream crossing structure replacement or upgrade

Generally culvert and bridge replacement entails channel disturbance for removal of the old structure, preparation of the stream bottom, placement of the new structure, backfilling and possibly armoring the stream bank in the vicinity of the stream crossing installation. Monitoring by the Flathead (USDA 1999a) and Lolo National Forests (USDA 1999b) indicates that culvert removal can produce up to 1 to 2 tons of sediment at each crossing, with most of
the material deposited within the first 150 feet downstream of the culvert. All new or replacements for stream crossings will provide aquatic passage and follow Forest Service Region One passage construction guidelines unless biological rationale dictates that the barrier remains or be reconstructed (i.e., non-native invasion). The Forest and BLM units will work with local Fish, Wildlife and Parks and Service biologists to identify those needs at the population scale.

Although these design criteria would reduce sediment input during the replacement or removal process, it is impossible to stop all sediment input from occurring. The sediment produced by the culvert replacements is likely to cause some scattered, temporary (several weeks to months) reductions in bull trout spawning and rearing habitat near the culverts.

**Design Criteria:**

11 When adjacent to or upstream of known or potential bull trout spawning and rearing areas conduct sediment-producing activities between May 15 and August 31. If advantages of other timing have been vetted with the FWP counterpart and are likely to outweigh risks, the USDI Fish and Wildlife Service Level 1 representative may sanction an alternate work window, on a case by case basis, without using the variance process. Alternate timing will be in the annual report. “Upstream” is defined as generally ¼ mile, but is based on biologist’s judgment that includes project magnitude.

12 Areas cleared of vegetation by maintenance or other activities will be seeded with an approved weed-free seed mix. Immediately covering seeded areas with approved weed-free straw mulch is recommended. Consider the use of shrubs and trees.

16 Utilize sediment filter fence, weed-free straw bales or other means to reduce delivery of sediment to streams or channels

22 When a structure is removed from the stream channel, inspect the reconstructed channel, stream banks, fill slopes and road approaches at the modified stream crossing periodically until the sites are stable and vegetated.

25 Unless mutually agreed to by the engineer, hydrologists, and fisheries biologist, do not allow rip rap to narrow or confine the existing floodplain or stream channel.

27 If rock weirs are used (e.g. to help stabilize a stream channel or provide grade control), design so they will pass substrate and do not form a fish barrier to weaker swimming species during low flows.

43 Restore appropriate stream gradient, entrenchment ratios, width/depth ratios, and pool/riffle frequencies.

44 When removing culverts, stabilize side slopes by landscaping them to mimic terraces upstream and downstream of the site.

46 Live water will be diverted around work sites using a lined ditch, coffer dam, pumps, or pipes to the degree that is possible. During bridge replacements and culvert removals, live water is typically not diverted around the work site because of the substantial size and disturbance that a diversion channel would entail.
Construct new or replacement stream crossing structures to accommodate a 100-year flood, including the associated bedload and debris.

All new or replacements for stream crossings will provide aquatic passage and follow USFS Region 1 passage construction guidelines unless biological rationale dictates that the barrier remains or be reconstructed (i.e. non-native invasion). The Forest and BLM units will work with local Fish, Wildlife and Parks and Fish and Wildlife Service biologists to identify those needs at the population scale.

Bridge abutments will be removed if adversely affecting the channel, floodplain function, or fish habitat. Abutments may be left in place if the hydrologic function and fish habitat is not adversely affected.

12. Road decommissioning and Road storage or closure

The road closure and decommissioning activity type ranges from simple road closure with a gate or earth berm to full recontour of the road prism to approximate preconstruction hill slope gradients. Appendix E details the design criteria for the five types of road closures.
## Appendix B. Annual Report of Road-related Activities

<table>
<thead>
<tr>
<th>Forest</th>
<th>Recovery Unit &amp; Subunit</th>
<th>Core Area</th>
<th>Local Population</th>
<th>6th Code HUC</th>
<th>Waterbody</th>
<th>Road Number</th>
<th>Activity Type</th>
<th>Miles of Roads or # of sites</th>
<th>Spawning/Rearing or Forage Migrating/Overwinter</th>
<th>Effect on Bull Trout NE, NLAA, or LAA</th>
<th>Effects on Critical Habitat NE, NLAA, or LAA</th>
<th>Rationale for Determinations and the Long-term Need and Options for Improvement (Use additional sheets is necessary to describe the work needed)</th>
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</table>
Appendix C. Request for Variance (U.S. Forest Service 2014).

The Service will consider granting variances, especially when there is a clear conservation benefit or there are no additional adverse effects (especially incidental take) beyond that considered in the Service’s Biological Opinion. Variance requests can be submitted to the Service via email correspondence.

This is the initial documentation required for bull trout (ESA) consultation for activities that do not clearly fit within the descriptions (Appendix A) and extent of work proposed (Appendix F). Large scale activities with activity levels that may exceed the amounts in Appendix F may require an independent take statement or modification of the current take statement. The USDI Fish and Wildlife Service Level 1 biologist will need the following information to make that determination.

Information to Provide the U.S. Fish and Wildlife Service Level Biologist, Project Contact and Location Biologist, Project Contact and Location

a. Land management unit, project contact person, biologist associated with the project, and their phone numbers.
b. State whether the project is emergency maintenance (An emergency is a situation involving an act of God, disasters, casualties, national defense or security emergencies, etc., and includes response activities that must be taken to prevent imminent loss of human life or property. Predictable events usually do not qualify as emergencies under the section 7 regulations unless there is a significant unexpected human health risk).
c. Date of initial request and summary and dates of previous relevant conversations. d. Location information should include
e. Core Area, Local Populations affected and 6th Code HUC ID #’s.
f. Site Location (Township, Range Section, 1/4 Section) and UTM/GPS location
g. Road number and name

Project Description: Generally describe the activities proposed. Include descriptions of the design criteria that will be used (reference Biological Assessment Appendices A and D). Other essential information includes:
1. A legible map of the project area (a typical 2.64 scale is suggested).
2. The size of disturbed area (acres or square feet)
3. Maintenance Level of the road
4. Overview of the effect on the waterways and the riparian areas (e.g. RHCA), including slope distance from project to the nearest surface water and to the nearest intermittent channel.
5. State whether the activity is occurring within streambed, along a streambank, or in a floodplain.
6. State whether State 124 permit has been applied for or received.
Appendix D. List of Design Criteria for Road-related Activities (U.S. Forest Service 2014).

<table>
<thead>
<tr>
<th>Number</th>
<th>Design Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOTE:</td>
<td>Measures 1 – 5 below must be incorporated in each project</td>
</tr>
<tr>
<td>1</td>
<td>A fisheries biologist will approve mitigation measures prior to project implementation and ensure they are in compliance with this biological assessment.</td>
</tr>
<tr>
<td>2</td>
<td>A project that may affect the natural or existing shape of any stream or its banks or tributaries requires a 124 permit. All “special conditions” in the permit will be followed.</td>
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<tr>
<td>3</td>
<td>All State BMPs (and agency manual direction) applicable to any/all proposed road-related activities will be followed.</td>
</tr>
<tr>
<td>4</td>
<td>Any long-term need for road improvements should be documented in the databases and records for the management unit and referred to in future planning and maintenance prioritization efforts.</td>
</tr>
<tr>
<td>5</td>
<td>Options that would reduce or eliminate re-occurring activities or chronic sediment delivery should be documented in the databases and records for the management unit and referred to in future planning and maintenance prioritization efforts. These options should be listed regardless of whether they are considered to be immediately feasible.</td>
</tr>
<tr>
<td>NOTE:</td>
<td>Measures recommended for use in the different activity types</td>
</tr>
<tr>
<td>6</td>
<td>Sediment material retained in cross-drain culverts cannot enter the stream.</td>
</tr>
<tr>
<td>7</td>
<td>Direct drainage to areas with vegetation rather than directly into channels or onto bare slopes.</td>
</tr>
<tr>
<td>8</td>
<td>When surface runoff flows directly into a stream consider in-sloping roads and construction of sediment catch basins to avoid delivery of road sediment to stream channels.</td>
</tr>
<tr>
<td>9</td>
<td>Install more cross drains, build sediment catch basins, gravel ditches and/or build check dams when erosion has occurred or is likely.</td>
</tr>
<tr>
<td>10</td>
<td>Annually inspect water-bars or cross ditches until stabilized or vegetated to assure they remain stable and free from blockage.</td>
</tr>
<tr>
<td>11</td>
<td>When adjacent to or upstream(^1) of known or potential bull trout spawning and rearing areas conduct sediment-producing activities between May 15 and August 31. If advantages of other timing have been vetted with the FWP counterpart and are likely to outweigh risks, the USDI Fish and Wildlife Service Level 1 representative may sanction an alternate work window, on a case by case basis, without using the variance process. Alternate timing will be in the annual report.</td>
</tr>
<tr>
<td>12</td>
<td>Areas cleared of vegetation by maintenance or other activities will be seeded with an approved weed-free seed mix. Immediately covering seeded areas with approved weed-free straw mulch is recommended. Consider the use of shrub and trees also.</td>
</tr>
<tr>
<td>13</td>
<td>Brush along streams will be cut to a height of no less than the height needed to maintain the sediment filtering capacity of the shrub base, and long-term viability of bank-supporting shrubs.</td>
</tr>
<tr>
<td>14</td>
<td>Construct berms, sediment basins, or sediment traps to contain sediment.</td>
</tr>
<tr>
<td>15</td>
<td>Place large woody debris or rock, that needs to be removed from the road prism, into the stream channel only under the direction of a fisheries biologist.</td>
</tr>
<tr>
<td>16</td>
<td>Utilize sediment filter fence, weed-free straw bales or other means to reduce delivery of sediment to streams or channels.</td>
</tr>
</tbody>
</table>

\(^1\) Upstream is defined as generally ¼ mile, but is based on biologist’s judgment that includes project magnitude.
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<tbody>
<tr>
<td>17</td>
<td>Limit brushing to areas that affect safe site-distance or that are imperative to maintain a road surface and drainage system.</td>
</tr>
<tr>
<td>18</td>
<td>Vegetation between the road edge and the stream will be retained when roads are near (as defined by the biologist) the high water mark, except where safety is an overriding concern (see number 17, above). This distance may be greater where site specific issues exist, such as near laterally migrating channels.</td>
</tr>
<tr>
<td>19</td>
<td>Encourage vegetative growth to improve long-term stability of cuts, fills and ditches. Consider planting shrubs and trees, use of erosion-control mats, in addition to seeding.</td>
</tr>
<tr>
<td>20</td>
<td>Side-casting of road materials smaller than 4 inches in diameter is prohibited on road segments within or abutting RHCAs. Material greater than 4 inches from surface or ditch maintenance will not be side-cast where there is a potential to enter the stream. Large boulders may be side cast under the direction of a fisheries biologist.</td>
</tr>
<tr>
<td>21</td>
<td>Reduce the erosion of loose dirt from ditches following ditch maintenance (e.g. roll ditch with grader wheel).</td>
</tr>
<tr>
<td>22</td>
<td>When a structure is removed from the stream channel, inspect the reconstructed channel, stream banks, fill slopes and road approaches at the modified stream crossing periodically until the sites are stable and vegetated.</td>
</tr>
<tr>
<td>23</td>
<td>Incorporate material from the ditch into the road surface, or if not incorporated, put it on a designated site where it cannot be delivered to a stream channel.</td>
</tr>
<tr>
<td>24</td>
<td>When pulling ditches, the cut slope will not be undercut.</td>
</tr>
<tr>
<td>25</td>
<td>Unless mutually agreed to by the engineer, hydrologist, and fisheries biologist, do not allow rip rap to narrow or confine the existing floodplain or stream channel.</td>
</tr>
<tr>
<td>26</td>
<td>Rip rap may be considered when mutually agreed to by the engineer, hydrologist, and fisheries biologist.</td>
</tr>
<tr>
<td>27</td>
<td>If rock weirs are used (e.g. to help stabilize a stream channel or provide grade control), design so they will pass substrate and do not form a fish barrier to weaker swimming species during low flows.</td>
</tr>
<tr>
<td>28</td>
<td>Where directed by the fisheries biologist, rolling (surface compaction) of the road surface needs to be included as part of the blading for roads that are located in RHCAs.</td>
</tr>
<tr>
<td>29</td>
<td>Foot valves must be appropriately screened.</td>
</tr>
<tr>
<td>30</td>
<td>A network of drafting sites will be designated and approved by the fisheries biologist.</td>
</tr>
<tr>
<td>31</td>
<td>Where the road surface becomes wider than originally designed, measures such as pulling in shoulders, developing rock berms with frequent drainage outlets, or installing carbonite delineators will be used to restore the original design road width.</td>
</tr>
<tr>
<td>32</td>
<td>Open culverts and ditches restricted by snow or ice to allow proper drainage.</td>
</tr>
<tr>
<td>33</td>
<td>Leave 2 inches of snow on roadways during winter plowing operations to protect the road surface from mechanical disturbance.</td>
</tr>
<tr>
<td>34</td>
<td>Sidecasting of snow will be avoided where there is potential for snow or ice damming in adjacent stream channels.</td>
</tr>
<tr>
<td>35</td>
<td>Openings in snow berms will be provided and maintained as required for surface drainage. Avoid drainage outlets on erodible fills. If the snow berm can be satisfactorily pushed off the road shoulder without sidecasting into streams or causing snow and ice damming of stream channels, openings in the snow berm may not be needed. This must be assessed on a case-by-case basis by the fisheries biologist.</td>
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<tr>
<td>36</td>
<td>Restore damage from snow removal by the following summer. Examples of this include damage or excessive erosion of road surface, damage to cross drain structures and damage or excessive erosion cut and fill slopes.</td>
</tr>
<tr>
<td>37</td>
<td>Culvert or bridge cleaning may occur anytime, when delaying maintenance will result in significant impacts to bull trout habitat.</td>
</tr>
<tr>
<td>38</td>
<td>When lead-based paints are removed, introduction of these materials into stream courses is controlled by using Tech Tips (Beckley and Groenier 2007) guidelines.</td>
</tr>
<tr>
<td>39</td>
<td>When treated wood materials are used near or in water, follow the Best Management Practices for the Use of Treated Wood in Aquatic Environments (WWPI 1996).</td>
</tr>
<tr>
<td>40</td>
<td>When replacing or reinforcing rip rap, avoid narrowing or confining the stream channel; the design and implementation must be mutually agreed upon by the engineers, hydrologists, and fisheries biologists.</td>
</tr>
<tr>
<td>41</td>
<td>Areas (other than the travel way surface) cleared of vegetation by maintenance or other activities will be seeded with an approved weed-free seed mix. Immediately covering seeded areas with approved weed-free straw mulch is recommended. Consider the use of shrubs and trees also.</td>
</tr>
<tr>
<td>42</td>
<td>When using chloride or other binding agents, written hazardous materials response plans are required for each unit (FSM 2165.04). These plans will at a minimum describe emergency communications, locations of clean-up equipment, and a description of the actions to take (FSM 2165.12).</td>
</tr>
<tr>
<td>43</td>
<td>Restore appropriate stream gradient, entrenchment ratios, width/depth ratios, and pool/riffle frequencies.</td>
</tr>
<tr>
<td>44</td>
<td>When removing culverts, stabilize side slopes by landscaping them to mimic terraces upstream and downstream of the site.</td>
</tr>
<tr>
<td>45</td>
<td>Place slash on top of the disturbed site to help minimize erosion. Immediately covering seeded disturbed areas with approved weed-free straw mulch is recommended.</td>
</tr>
<tr>
<td>46</td>
<td>Live water will be diverted around work sites using a lined ditch, coffer dam, pumps, or pipes to the degree that is possible. During bridge replacements and culvert removals, live water is typically not diverted around the work site because of the substantial size and disturbance that a diversion channel would entail.</td>
</tr>
<tr>
<td>47</td>
<td>Construct new or replacement stream crossing structures to accommodate a 100-year flood, including the associated bedload and debris.</td>
</tr>
<tr>
<td>48</td>
<td>All new or replacements for stream crossings will provide aquatic passage and follow R1 passage construction guidelines unless biological rationale dictates that the barrier remains or be reconstructed (i.e. non-native invasion). The Forest will work with local Fish, Wildlife and Parks and Fish and Wildlife Service biologists to identify those needs at the population scale.</td>
</tr>
<tr>
<td>49</td>
<td>Bed-load will only be cleared within the crossing structure and immediately upstream and downstream of the structure.</td>
</tr>
<tr>
<td>50</td>
<td>Bed-load will not be cleared below the depth of culvert footings in bottomless arches. Material will be deposited outside of RHCA or in other pre-approved site designated by the biologist. Stream banks will not be disturbed.</td>
</tr>
<tr>
<td>51</td>
<td>Bridge abutments will be removed if adversely affecting the channel, floodplain function, or fish habitat. Abutments may be left in place if the hydrologic function and fish habitat is not adversely affected.</td>
</tr>
<tr>
<td>52</td>
<td>When rip rap is used, the design and implementation must be mutually agreed upon by the engineers, hydrologists, and fisheries biologists.</td>
</tr>
<tr>
<td>53</td>
<td>Large Wood (LWD) removed from the stream or floodplain during the course of road related activities should be placed in the stream channel when feasible at another location nearby where risk to the road or structures is not high. In the case where the LWD was cut and removed in pieces, plan for an installation of replacement LWD in a nearby location.</td>
</tr>
<tr>
<td>54</td>
<td>When safe to do so, remove beaver dams slowly to avoid uncharacteristically high flows downstream.</td>
</tr>
</tbody>
</table>

Note: Additional design criteria are required for the different closure levels on roads. See Appendix E.
**Appendix E. Standards for Road Closures.** Standard design criteria will include reasonable implementation of the following measures (U.S. Forest Service 2014):

<table>
<thead>
<tr>
<th>Closure Level</th>
<th>Closure Device</th>
<th>Road Surface and Stream Crossing Treatment</th>
<th>Status</th>
<th>Design Criteria</th>
</tr>
</thead>
</table>
| I             | Gate           | • Blade, seed, fertilize.                  | • Remains on road system | 1. Annually check pipes and ditches to assure they remain free from blockage.  
                                                                      • Normal drainage (BMP’s)  
                                                                      • Culverts may remain in place | 2. Reseed if necessary. |
|               |                | Stabilize road surface using dips, waterbars,        | Remains on road system  
                                                                      outsloping, Scarifying (1”-3”), establishing vegetation  
                                                                      (seeding & fertilizing), and scattering slash | Road use is expected within 9 | 1. Remove or upgrade all stream crossing structures that have a  
                                                                      years after the closure | bankfull constriction ratio < 1.0.  
                                                                      Stream crossings may stay in place based on an | 2. Remove or upgrade all stream crossings structures to provide for  
                                                                      assessment of risk of failure and impacts to fish passage | aquatic species passage if structure is on a fish bearing stream.  
                                                                      | 3. Annually inspect and maintain each stream-crossing structure left in place. If annual inspection and maintenance is not feasible, | | 4. Annually inspect water-bars or cross ditches until stabilized or | | 5. Apply all the relevant design criteria for culverts and stream | | revegetated to assure they remain stable and free from blockage. | crossings (ref) | |
|               | Guardrail, concreate, earth barrier, or recontour | Stabilize road surface using dips, waterbars,        | Remains on road system  
                                                                      intersection | outsloping, Scarifying (1”-3”), establishing vegetation  
                                                                      (seeding & fertilizing), and scattering slash | Road use is expected within 9 | 1. Remove or upgrade all stream crossing structures that have a  
                                                                      Stream crossings may stay in place based on an | years after the closure | bankfull constriction ratio < 1.0.  
                                                                      assessment of risk of failure and impacts to fish passage | 2. Remove or upgrade all stream crossings structures to provide for  
                                                                      | 3. Annually inspect and maintain each stream-crossing structure left in place. If annual inspection and maintenance is not feasible, | aquatic species passage if structure is on a fish bearing stream.  
                                                                      | 4. Annually inspect water-bars or cross ditches until stabilized or | | 5. Apply all the relevant design criteria for culverts and stream | | revegetated to assure they remain stable and free from blockage. | crossings (ref) | |
|               | Recontour      | Waterbar or outslope.                       | Storage - Remains on road | All stream crossing structures would be removed at the time of closure.  
                                                                      intersection or rock/earth | Remove all stream system in long-term storage  
                                                                      barrier | decommissioning - Remove | Otherwise, the mitigation actions are the same as closure level II roads. |
|               |                | Remove all stream crossing CMP’s            | Decommissioning - Remove | | | | from road system, retain on  
                                                                      Scarify (1”-3”), seed, fertilize and/or | “historic road” system | | | | | Rip 6-12”, seed, fertilize.  
                                                                      Scatter slash on road | Road use is not expected to | All stream crossing structures would be removed at the time of closure.  
<pre><code>                                                                  | | occur for 9 years or more | Otherwise, the mitigation actions are the same as closure level II roads. |
</code></pre>
<table>
<thead>
<tr>
<th>Closure Level</th>
<th>Closure Device</th>
<th>Road Surface and Stream Crossing Treatment</th>
<th>Status</th>
<th>Design Criteria</th>
</tr>
</thead>
</table>
| IV           | Recontour at intersection or rock/earth barrier | Waterbar and outslope or selective recontouring of road segments  
Remove all CMP’s  
Scarify (1”- 3”), seed, fertilize and/or  
Rip 12-18”, seed, fertilize  
Scatter slash on slopes | Remove from road system, retain on “historic road” system until determination of no future use will be needed | Same as Mitigation Actions 4-11 for Closure Level II roads. Actions 1-3 for Level II closures do not apply here because all stream crossing structures would be removed at the time of closure. |
| V            | Recontour                           | Recontour entire prism  
Remove all CMP’s & restore channel/ watercourses  
Seed and fertilize  
Scatter slash on slopes | Remove from road system, retain on “historic road” system until resource effect no longer exist | Same as Mitigation Actions 4-11 for Closure Level II roads. Actions 1-3 for Level II closures do not apply here because all stream crossing structures would be removed at the time of closure. |
## Appendix F. Extent of Work Proposed for Each Land Management Unit. (U.S. Forest Service 2014)

### Estimate of Annual Program of Work

**Appendix F - Continued**

<table>
<thead>
<tr>
<th>Forest</th>
<th>Core Area</th>
<th>Type I SR</th>
<th>Type I FMO</th>
<th>Type II SR</th>
<th>Type II FMO</th>
<th>Type III SR</th>
<th>Type III FMO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lolo</td>
<td>Upper Clark Fork River</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
</tr>
<tr>
<td>Beaverhead-Deerlodge</td>
<td>Upper Clark Fork River</td>
<td>10/20</td>
<td>5/10</td>
<td>20/3</td>
<td>2/2</td>
<td>5/2</td>
<td>1/1</td>
</tr>
<tr>
<td>Beaverhead-Deerlodge</td>
<td>Rock Creek</td>
<td>2/3</td>
<td>1/3</td>
<td>2/1</td>
<td>1/1</td>
<td>0/0</td>
<td>0/0</td>
</tr>
<tr>
<td>Lolo</td>
<td>Rock Creek</td>
<td>0/0</td>
<td>0/0</td>
<td>20/2</td>
<td>7/2</td>
<td>0/0</td>
<td>0/0</td>
</tr>
<tr>
<td>Helena</td>
<td>Blackfoot</td>
<td>2/3</td>
<td>1/3</td>
<td>40/10</td>
<td>4/1</td>
<td>4/1</td>
<td>1/0</td>
</tr>
<tr>
<td>Lolo</td>
<td>Blackfoot</td>
<td>4/4</td>
<td>0/0</td>
<td>13/5</td>
<td>3/5</td>
<td>0/0</td>
<td>0/0</td>
</tr>
<tr>
<td>BLM - Missoula</td>
<td>Blackfoot</td>
<td>2/9</td>
<td>0/1</td>
<td>1/3</td>
<td>0/3</td>
<td>1/1</td>
<td>1/0</td>
</tr>
<tr>
<td>Lolo</td>
<td>Clearwater</td>
<td>2/5</td>
<td>4/3</td>
<td>18/4</td>
<td>3/4</td>
<td>0/0</td>
<td>0/0</td>
</tr>
<tr>
<td>Bitterroot</td>
<td>Upper West Fork</td>
<td>5/20</td>
<td>2/5</td>
<td>10/2</td>
<td>2/2</td>
<td>3/1</td>
<td>1/1</td>
</tr>
<tr>
<td>Bitterroot</td>
<td>Bitterroot</td>
<td>10/20</td>
<td>5/10</td>
<td>20/3</td>
<td>2/2</td>
<td>5/2</td>
<td>1/1</td>
</tr>
<tr>
<td>Lolo</td>
<td>Bitterroot</td>
<td>0/0</td>
<td>5/1</td>
<td>8/3</td>
<td>4/3</td>
<td>0/0</td>
<td>0/0</td>
</tr>
<tr>
<td>Lolo</td>
<td>Middle Clark Fork River Core Area</td>
<td>3/2</td>
<td>5/1</td>
<td>32/4</td>
<td>8/4</td>
<td>0/0</td>
<td>0/0</td>
</tr>
<tr>
<td>Flathead</td>
<td>Flathead Lake Core Area</td>
<td>10/2</td>
<td>3/1</td>
<td>10</td>
<td>3/1</td>
<td>3/1</td>
<td>5/1</td>
</tr>
<tr>
<td>Flathead</td>
<td>Simple - Frozen Lake</td>
<td>1/0</td>
<td>1/0</td>
<td>2/0</td>
<td>1/0</td>
<td>2/1</td>
<td>1/0</td>
</tr>
<tr>
<td>Flathead</td>
<td>Hungry Horse</td>
<td>8/1</td>
<td>8/1</td>
<td>5/1</td>
<td>2/1</td>
<td>5/1</td>
<td>2/1</td>
</tr>
<tr>
<td>Flathead</td>
<td>Simple - Doctor</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
</tr>
<tr>
<td>Flathead</td>
<td>Simple - Big Salmon</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
</tr>
<tr>
<td>Flathead</td>
<td>Swan Lake</td>
<td>10/2</td>
<td>5/2</td>
<td>7/2</td>
<td>3/2</td>
<td>5/2</td>
<td>2/1</td>
</tr>
<tr>
<td>Flathead</td>
<td>Simple - Lindbergh</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
<td>0/0</td>
</tr>
<tr>
<td>Flathead</td>
<td>Simple - Holland</td>
<td>3/0</td>
<td>2/1</td>
<td>0/0</td>
<td>0/0</td>
<td>2/1</td>
<td>2/1</td>
</tr>
<tr>
<td>Lolo</td>
<td>Lake Pend Oreille/Lower Clark Fork</td>
<td>0/0</td>
<td>0/0</td>
<td>1/1</td>
<td>1/1</td>
<td>9/1</td>
<td>2/1</td>
</tr>
<tr>
<td>Kootenai</td>
<td>Lake Pend Oreille/Lower Clark Fork</td>
<td>10/2</td>
<td>5/1</td>
<td>20/4</td>
<td>2/2</td>
<td>30/8</td>
<td>1/1</td>
</tr>
<tr>
<td>Kootenai</td>
<td>Lake Koocanusa Core Area</td>
<td>5/15</td>
<td>0</td>
<td>5/1</td>
<td>3/1</td>
<td>3/1</td>
<td>0/1</td>
</tr>
<tr>
<td>Kootenai</td>
<td>Kootenai River</td>
<td>10/5</td>
<td>30/20</td>
<td>50/10</td>
<td>7/1</td>
<td>60/10</td>
<td>2/1</td>
</tr>
<tr>
<td>Kootenai</td>
<td>Simple - Bull Lake</td>
<td>2/3</td>
<td>1/3</td>
<td>10/1</td>
<td>2/1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

- **Type I SR**: Miles/sites within Bull Trout Watershed
- **Type I FMO**: Miles/sites with potential measureable impact to perennial & intermittent streams
- **Type II SR**: Miles/sites with potential measureable impact to perennial & intermittent streams
- **Type II FMO**: Miles/sites within Bull Trout Watershed
- **Type III SR**: Miles/sites within Bull Trout Watershed
- **Type III FMO**: Miles/sites with potential measureable impact to perennial & intermittent streams
Explanations/Rationale

Land management Unit

Missoula - BLM  
Activities rise to the level of LAA at the main Blackfoot River Road (a.k.a. McNamara Road). The road is bladed 2-3 times/year. The length of road bladed that is within the RHCA is 3/4 mile. Blackfoot River (Whitaker Bridge) that occasionally needs minor maintenance to the abutments BMPs keep NLAA (Jo Christiansen 08/2013).  

(a) Activities are based on 2014 estimates of planned projects; however, actual amounts will likely be less because of budget deficiencies. (b) The Middle Clark Fork row is not populated because the Middle Clark Fork is not delineated specifically within the Draft Recovery Plan. (c) Lower Clark Fork numbers are very conservative and noted improbably high as West Zone approximations included total road miles and didn’t reduce by segments in RCHAs. These numbers will be further refined when our fisheries vacancy is filled and the appropriate biologist can make the determinations.

Lolo  
Beaverhead-Deerlodge  
Activity amounts were based on activity conducted under the previous programmatic BA/BO.

Bitterroot  
Activity amounts were based on last few years of activity conducted under the programmatic BA/BO. **Type I** - Activity within 100 feet of streams would not exceed more than 1% of the stream length in a local population’s watershed. This is about 50% brushing and 50% snow removal. Most snow removal is for spring tree planting. "Sites" are mostly cleaned cross drains, drive through dips, or other drainage structures. Also includes several new drainage structures per year. **Type II** - LAA accounts for channel maintenance, and blading or activities that are similar in effect and occur within relatively close to streams and where grade is relatively steep (which historically 10% of the treated roads). Culvert and bridge cleaning may also be LAA. **Type III** - Activities in this type have a long-term beneficial effect. Estimate up to 3 AOP structures per year on the Forest, but all could occur in one core area, all may be LAA/Beneficial, or NLAA/Beneficial; and up to 20 fishless drainage pipes replaced (NLAA) per year on the Forest. Several miles of decommissioning and stored roads occur in some years. They often occur within 100 feet of streams, but 95% are NE/NLAA.

Flathead  
The Flathead created GIS maps of about a decade of past activities showing variability between types of activities conducted. For example, some years had a large quantity of brushing while other years had large amounts of blading.

Generally, CMRD funds are inadequate to maintain roads to the previous level. Koochanusa Core Area has Grave Creek and Wigwam River. Most of the lower end of road is paved (12 mi). Kootenai Core includes Fisher River system, Libby Creek, Quartz, Pipe, Obrien, and Callahan Creeks. Activities in these drainages are greatly reduced over historic levels. The highest risk roads are located in the Libby Creek drainage. Bull Lake Core Area lies mostly within GB core so access is limited to any portion of the upper watershed. The main road up Keeler Creek is paved to the point it leaves bull trout habitat. The LCFR consists of the Bull River, Rock Creek, Pilgrim Creek, Marten Creek, Swamp Creek, and the Vermillion River. Most road is located outside the RHCA and those within are paved or under other jurisdiction.

Helena  
The Helena used appendix B to show their expected workloads. This was converted to Appendix F.
Appendix G. Crosswalk between PCEs and Matrix of Pathways and Indicators (U.S. Fish and Wild Service 1998) and Rationale for Commonality (U.S. Forest Service 2014).

<table>
<thead>
<tr>
<th>PCE number and description</th>
<th>Associated habitat indicators</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Permanent water having low levels of contaminants such that normal reproduction, growth and survival are not inhibited</td>
<td>sediment, chemical contamination/nutrients, peak/base flows</td>
<td>The level of contaminants is addressed directly by the analysis of chemical contamination/nutrients and sediment. Sediment is considered a contaminant in spawning and rearing habitat. Effects of Accelerated Fine Sediment Transport and Delivery to Waterways in section V(D) of the BA details the effect of this PCE and the indicators. That section also discusses that roads in forested watersheds can substantially alter hill slope hydrology.</td>
</tr>
<tr>
<td>2. Water temperatures ranging from 2 to 15°C (36 to 59°F), with adequate thermal refugia available for temperatures at the upper end of this range. Specific temperatures within this range will vary depending on bull trout life history stage and form, geography, elevation, diurnal and seasonal variation, shade, such as that provided by riparian habitat, and local groundwater influence</td>
<td>temperature, refugia, average wetted width/maximum depth ratio in scour pools in a reach, streambank condition, change in peak/base flows, riparian conservation areas, floodplain connectivity</td>
<td>This PCE is addressed directly by the analysis of temperature. It is addressed indirectly through consideration of refugia, which by definition is high quality habitat of appropriate temperature. Availability of refugia is also detailed in the BTCS (USDA 2013a), which the BA references. Habitat Complexity in the BA includes analysis of the effects to the quantities of LWD that affect pool frequency and quality and large pools that affect water temperature. Average wetted width/maximum depth ratio in scour pools is an indication of water volume and energy. Channel shape indirectly affects water temperature. In conjunction with change in peak/base flows there are potential temperature and refugia concerns particularly during low flow periods. These are discussed in Effects of Accelerated Fine Sediment Transport and Delivery to Waterways in the BA. Streambank condition, floodplain connectivity and riparian conservation areas address in section V(D) of the BA are the components of shade and groundwater influence, both of which are important factors of water temperature.</td>
</tr>
<tr>
<td>PCE number and description</td>
<td>Associated habitat indicators</td>
<td>Rationale</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>3. Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures</td>
<td>large woody debris, pool frequency and quality, large pools, off channel habitat, refugia, average wetted width/maximum depth ratio in scour pools in a reach, streambank condition, floodplain connectivity, riparian conservation areas</td>
<td>The analysis of <em>large woody debris</em>, in the <em>Habitat Complexity</em> portion of the BA addresses this PCE. Large woody debris increases channel complexity and creates pools and undercut banks. <em>Pool frequency and quality</em> would also directly address this PCE. <em>Average wetted width/maximum depth ratio in scour pools in a reach</em> is an indicator of channel shape and pool quality. Low ratios suggest deeper, higher quality pools. <em>Large pools</em>, consisting of a wide range of water depths, velocities, substrates and cover, are typical of high quality habitat and are a key component of channel complexity (USDI Fish and Wildlife Service 1998). An analysis of <em>off-channel habitat</em> would describe side-channels and other off-channel areas. <em>Streambank condition</em> would analyze the stability of the banks, including such features as undercut banks. The analysis of both <em>riparian conservation areas</em> and <em>floodplain connectivity</em> would directly address this PCE. Floodplain and riparian functions include the maintenance of habitat and channel complexity, the recruitment of large woody debris and the connectivity to off-channel habitats or side channels (USDI Fish and Wildlife Service 1998). Complex habitats provide refugia for bull trout and in turn, <em>refugia</em> analysis would assess complex stream channels. Three design criteria in the BA focus on the protection of floodplains (#25, 51, and 53).</td>
</tr>
<tr>
<td>4. Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine substrate less than 0.63 cm (0.25 in) in diameter and minimal substrate embeddedness are characteristic of these conditions</td>
<td>sediment, substrate embeddedness, large woody debris, pool frequency and quality</td>
<td>This PCE is addressed directly by analysis of <em>sediment</em> in areas of spawning and incubation and considers directly the size class composition of instream sediments, particularly fine sediments ≤63 mm. This PCE is also addressed directly by analysis of <em>substrate embeddedness</em> in rearing areas, which is a function of sediment size class and bedload transport. Both of these indicators would assess substrate composition and stability in relation to the various life stages of the bull trout as well as the sediment transportation and deposition. <em>Large woody debris</em> and <em>pool frequency and quality</em> affect sediment transport and redistribution within a stream and would indirectly assess substrate composition and amounts. Sediment is considered in the <em>Effects of Accelerated Fine Sediment Transport and Delivery to Waterways</em> in section V(D) of the BA and details the effect of this PCE and the indicators.</td>
</tr>
<tr>
<td>PCE number and description</td>
<td>Associated habitat indicators</td>
<td>Rationale</td>
</tr>
<tr>
<td>----------------------------</td>
<td>------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>5. A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, a hydrograph that demonstrates the ability to support bull trout populations</td>
<td>change in peak/base flows, increase in drainage network, disturbance history, disturbance regime</td>
<td>This PCE is addressed by analysis of change in peak/base flows, which considers changes in hydrograph amplitude or timing with respect to watershed size, geology, and geography. Considering increase in drainage network and disturbance history provides further information. As addressed in the BA, roads and vegetation management both have effects strongly linked to a stream’s hydrograph. Disturbance regime ties this information together to consider how a watershed reacts to disturbance and the time required to recover back to predisturbance conditions. Habitat Complexity in the BA includes analysis of the effects to the increase in drainage network, disturbance history, disturbance regime. The Effects of Accelerated Fine Sediment Transport and Delivery to Waterways addresses the change to drainage network and hydrology.</td>
</tr>
<tr>
<td>6. Springs, seeps, groundwater sources, and subsurface water connectivity to contribute to water quality and quantity</td>
<td>floodplain connectivity, change in peak/base flows, increase in drainage network, riparian conservation areas, chemical contamination/nutrients</td>
<td>This PCE is addressed by analysis of floodplain connectivity and riparian conservation areas. Floodplain connectivity considers hydrologic linkage of off-channel areas with the main channel and overbank flow maintenance of wetland function and riparian vegetation and succession. Floodplain and riparian areas provide hydrologic connectivity for springs, seeps, groundwater upwelling and wetlands and contribute to the maintenance of the water table (USDI Fish and Wildlife Service 1998). The analysis of changes in peak/base flows would address subsurface water connectivity. Increase in drainage network would address potential changes to groundwater sources and subsurface water connectivity. Chemical contamination/nutrients would address concerns regarding groundwater water quality.</td>
</tr>
<tr>
<td>7. Migratory corridors with minimal physical, biological, or chemical barriers between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows</td>
<td>life history diversity and isolation, persistence and genetic integrity, temperature, chemical contamination/nutrients, physical barriers, average wetted width/maximum depth ratio in scour pools in a reach, change in peak/base flows, refugia</td>
<td>The biological indicator life history diversity and isolation addresses the function of migration and/or subsequent isolation with respect to the population. The biological indicator persistence and genetic integrity indirectly reflects the status of migratory corridors. Physical, biological or chemical barriers to migration are addressed directly through water quality habitat indicators, including temperature, chemical contamination/nutrients and physical barriers. The analysis of these indicators would assess if barriers have been created due to impacts such as high temperatures, high concentrations of contaminants or physical barriers. Analysis of change in peak/base flows and average wetted width/maximum depth ratio in scour pools in a reach would assess whether changes in flow might create a seasonal barrier to migration. An analysis of refugia, which considers the habitat’s ability to support strong, well distributed, and connected populations for all life stages and forms of bull trout, would also be pertinent to this PCE. The BA address migratory corridors by addressing the Effects on Habitat Connectivity and other indicators as mentioned above.</td>
</tr>
<tr>
<td>PCE number and description</td>
<td>Associated habitat indicators</td>
<td>Rationale</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>8. An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish</td>
<td>growth and survival, life history diversity and isolation, riparian conservation areas, floodplain connectivity (importance of aquatic habitat condition-indirectly covered by previous 7 PCEs)</td>
<td>An analysis of floodplain connectivity and riparian conservation areas would assess these contributions to the food base. Floodplain and riparian areas provide habitat to aquatic invertebrates, which in turn provides a forage base to bull trout (USDI Fish and Wildlife Service 1998). This PCE is indirectly addressed through the biological indicator of growth and survival and life history diversity and isolation. Both of these indicators look at habitat quality and subpopulation condition, which provides information on food base. This PCE is a synthesis of the previous PCEs. It is addressed through the analysis of biological and habitat indicators in that, if a bull trout population either exists or could exist in a watershed, then there is an adequate forage base. A healthy habitat provides a forage base for the target species. Any potential impairment to the forage base has been addressed by way of summarizing the biological and habitat indicators.</td>
</tr>
<tr>
<td>9. Few or no predatory, interbreeding, or competitive nonnative species present</td>
<td>persistence and genetic integrity, physical barriers</td>
<td>This PCE is addressed specifically by analysis of the biological indicator persistence and genetic integrity. This indicator analyzes the probability of hybridization or displacement by competitive species. An analysis of physical barriers may indirectly address non-native species in those areas where a barrier may prevent the invasion of non-native species.</td>
</tr>
</tbody>
</table>
Appendix H: Two Examples of Potential Road-Related Activities Effects in Highly Roaded Local Population Areas (U.S. Forest Service 2014).

A few overarching questions arose during the initial phases of the programmatic BA update. The questions were:

- How much type II road-related activity within the watershed of a bull trout local population is too much?
- How much could occur before a level of concern was raised?, and similarly,
- Is there a reasonable likelihood that activities could reach a level that there would be an effect on a local population of bull trout?

To frame the scale of the question, we used with somewhat worst-case scenarios to investigate the potential effect of doing a large quantity of work in a local population.

Two 5th level HUCs were used to represent large local populations. This was done because of the availability of data that is available at the HUC scale. Selection of HUCs was done by ranking local populations in the 2010 version of the GIS driven watershed baseline for western Montana. HUCs with bull trout and high road density were selected from two Forests: Bitterroot and Lolo. The HUCs were Sleeping Child (Bitterroot Core Area) and Cleareater River/Lakes (Clearwater Core Area).

Assumptions:

- Includes all system roads, which includes closed roads that would be rarely maintained by grading or other type II activities.
- Stream miles includes perennial and intermittent (NHD layer 2014) on the Forests.

Table H-1. Sleeping Child; Road density = 2.6

<table>
<thead>
<tr>
<th>Miles of Stream in FS</th>
<th>Distance from stream</th>
<th>Miles of Road</th>
<th>Paved Rd</th>
<th>Miles Gravel or Native surface</th>
<th>% of Streams within Distance from Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>205</td>
<td>100</td>
<td>18.74</td>
<td>3.35</td>
<td>15.38</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>28.75</td>
<td>4.40</td>
<td>24.35</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>56.45</td>
<td>4.40</td>
<td>52.05</td>
<td>25</td>
</tr>
</tbody>
</table>

Table H-2. Clearwater; Road density = 4.6

<table>
<thead>
<tr>
<th>Miles of Stream in FS</th>
<th>Distance from stream</th>
<th>Miles of Road near Streams</th>
<th>% of Streams within Distance from Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>389</td>
<td>100</td>
<td>52</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>95</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>300</td>
<td>236</td>
<td>77</td>
</tr>
</tbody>
</table>
Mapping of the roads within close proximity to streams was used to provide a visual perspective on the amount of area that may have the most effect to bull trout habitat. Discussion among some western Montana FS fisheries biologists and hydrologists during field reviews (Upper Rock Creek, Beaverhead Deerlodge NF, Sept 19 – 20; Skalkaho Drainage, Bitterroot NF, June 24, 2013) highlighted concerns if amounts in the neighborhood of 10% of road were to be treated. Alternately, discussions of treating near one percent along streams raised much less concern. During these discussions the biologist shared their interpretations of the literature and after the review literature was shared to support the discussion (included in BA references and Appendix I references).

The tables above display that 10% of streams could be affected, in both of these highly roaded watersheds, if the funds and desire were to do so. Therefore, it seems reasonable to conclude that type II road-related activities do need to be assessed at a local population scale if activities are concentrated within the local population.

To address this need for assessment at a local population scale each Level 1 land management unit biologist and their engineering staff will meet as needed to review and discuss the upcoming year’s activities, there will be end of season reporting, and periodic field reviews by the Level I team (section II (d)).
Figure H-1. A local population that inhabits an area with relatively high road density, like the Sleeping Child Local Population and watershed, was selected and displayed. The amount of road near streams was quantified (Table H-1) and an estimate of what that effect could be to the local population was discussed among the primary authors.
Appendix I. Guides for Determining Level of Effects for Some Routine Road-related Activities.

Guideline for Determining LAA Effects from Surface and Ditch Maintenance

Road grading is the primary action in this Activity Type
Draft 08/11/13 - After sub-team field discussion on 6/24/13; and conceptual review at Level 1 Meeting on 7/25/13.

1. Are bull trout or Critical Habitat present in this subwatershed or downstream?
   No = NE; Yes = see #2.

2. In the subwatershed of the local population, is road grading affecting less than 1% of stream length?
   Area “affecting” can be based on professional judgment if there is adequate familiarity with the roads. Or calculated by using the miles of grading within 100 feet of perennial streams; plus 300 feet for each road crossing of perennial and intermittent streams mapped on the NHD layer, then dividing that length by perennial stream length (which is Column G in the Baseline).
   AND
   Are cross drains, such as ditch relief culverts and drain dips, appropriately spaced (see attached table for guidance) and positioned, to abate delivery of sediment to perennial or intermittent streams?
   No to either statement = LAA; Yes to both statements = see #3.

3. Is road grading beyond 100 feet of Critical Habitat?,
   Are ditches being left with in a stable condition (vegetated, rock lined)?
   Are the areas within 100 feet of streams graded during ideal moisture conditions and then rolled or compacted to alleviate surface erosion?
   Is the road very low gradient (e.g. < 3%)?
   Yes to all = NLAA or NE; No to one or more = see #4.

4. Is an adequate protective floodplain present, or does monitoring show that other factors (i.e. A well-drained high standard road, and traffic management) result in a near stream road that is not contributing sediment to perennial or intermittent channels.
   Yes = NLAA; No = LAA
Background for
How Much Road Grading Equates to a May Affect, Likely to Adversely Affect (LAA) Determination for Bull Trout?

Road maintenance and traffic are two of the primary activities affecting sediment production from forest roads.

Maintenance keeps roads in a condition suitable for travel and prevents severe erosion from failure of the drainage system. Unfortunately, road grading can break up armor layers on the road surface or the ditch and temporarily increase road surface erosion.

Roadbed gravel content, annual precipitation, time since last grading and road slope together explain more than two-thirds of the variability in sediment yield (Sugden and Woods 2007).

The decline in sediment yield after grading follows an exponential decay curve similar to that which occurs after road construction so that yields in the second and third years are typically many times lower than in the first year (Sugden and Woods 2007).

Reducing the amount of road with unnecessary ditch grading is unequivocally effective in reducing sediment production (Luce and Black 2001).

Almost all unsealed road surfaces are erodible, but not all eroded materials reach streams. This is due to deposition between the original location of the sediment, drains and streams. Factors affecting the efficiency of sediment delivery from roads include the placement and type of drainage structures, the distance from drainage outlets to streams, contributing area, hillslope slope and degree of concavity and the trapping efficiency of obstructions (Megahan and Ketcheson, 1996).

The delivery of road-derived sediment to a stream is modeled using a SDRR-S, determined by the downslope distance between the drainage outlets and the stream, based on the study of Megahan and Ketcheson (1996). Values of 100%, 35% and 10% are given when the distances between road drainage and stream are 0, 1–100, and 101–200 feet, respectively (Dubé et al. 2004).

The numerical effects of road grading are difficult to determine since they depend upon the condition of the road before and after grading. Foltz (unpublished data summary) found that grading a road with 1 inch deep ruts increased erosion 1.32 times; grading a road with a 5 inch deep rut produced 0.36 times as much sediment (reduction in erosion) (Dubé 2004).

During field review discussion it was emphasized that the proper placement of cross-drains needed to be incorporated.
During Level 1 team review it was emphasized that there needed to be an accounting of hydrologically connected road segments, especially those segments near intermittent streams. The contributing road length of 300 feet considered the proper spacing of rolling dips or cross drains (ranging from 30 m to 120 m) on 2 sides of the road (worst case scenario is the crossing is the low point in both directions), and INFISH.

Recommended Maximum Distance between Rolling Dip or Culvert Cross-Drains (meters) from:

<table>
<thead>
<tr>
<th>Road Grade %</th>
<th>Low to Non-Erosive soils</th>
<th>Erosive Soils</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3</td>
<td>120 m</td>
<td>75 m</td>
</tr>
<tr>
<td>4-6</td>
<td>90 m</td>
<td>50 m</td>
</tr>
<tr>
<td>7-9</td>
<td>75 m</td>
<td>40 m</td>
</tr>
<tr>
<td>10-12</td>
<td>60 m</td>
<td>35 m</td>
</tr>
<tr>
<td>&gt;12</td>
<td>50 m</td>
<td>30 m</td>
</tr>
</tbody>
</table>

References:


http://www.fs.fed.us/eng/road_mgt/03appdx1.pdf
Guideline for LAA Fill Slope and Cut-Slope Maintenance
Repair of fill slopes is the primary action in this Activity Type

1. Is surface activity (e.g. lead-off ditches, vegetation planting, placing erosion mat) occurring within 100 feet, or deeper seated activities (e.g. gabion placement) occurring with 300 feet, of perennial streams in bull trout occupied HUCs?
   No = NLAA or NE; Yes = see #2.

2. Are there topographic features or are mitigation measures employed to prevent more than short-term and negligible amounts of surface erosion and deeper seated creep of slopes?
   Yes = go to 3; No = LAA.

3. Is the activity expanding the area of disturbance beyond the current near-stream disturbed area, or narrowing a floodplain or channel, or in a known landslide initiation zone?
   Yes = LAA; No go to 4.

4. Is the site managed for long-term benefit to the aquatic resource (i.e. vegetation planted for erosion and shade, bioengineering for instream and floodplain complexity, monitoring planned, adaptive management practices considered)?
   No = LAA. Yes = NLAA.

Background
for
How Much Fill Slope and Cut-Slope Maintenance Equates to a May Affect, Likely to Adversely Affect (LAA)
 Determination for Bull Trout?

Fill Slope and Cut-Slope surfaces are erodible, but not all eroded materials reach streams. This is due to deposition between the original location of the sediment, drains and streams. Factors affecting the efficiency of sediment delivery from roads include the placement and type of drainage structures, the distance from drainage outlets to streams, contributing area, hillslope angle and degree of concavity and the trapping efficiency of obstructions (Megahan and Ketcheson, 1996).

The modeled delivery of road-derived sediment to a stream is determined by the downslope distance between the drainage outlets and the stream (Megahan and Ketcheson 1996). Values of 100%, 35% and 10% are given when the distances between road drainage and stream are 0, 1–100, and 101–200 feet, respectively (Dubé et al., 2004).
Compared to instream sampling, upslope monitoring of soil erosion produced data that more accurately portrayed effects of site disturbance over the study period. Instream monitoring may not account for sediment that may have been deposited between measurement sites, but stored in the channel (Corner, Bassman, and Moore, WJAF 11(1) 1996).

Roads contribute sediment to streams by two primary pathways: mass failures or surface erosion of the road prism followed by transport of this material to the channel. The relative importance of each of these processes partly depends on characteristics of the watershed. In areas of steep slopes and unstable soils, delivery of road-derived sediment to streams as a result of mass failures is often the primary cause of increased sediment loads (Megahan and Kidd 1972). In more stable terrain, where the incidence of mass failures is low, erosion of road surfaces, back cuts, and fill slopes may be the predominant management- related sediment source (Reid 1981).


Literature Cited


Draft Rule for LAA Surface Reconditioning (Short Term Disturbance W/O negative effects)
Road Grading, Ditch Disturbance, Gravel Surfacing and Chemical Application and Roto-milling are the Primary Activity Types

1. Is there road surface disturbance (roto-milling or blading and gravel surfacing) potentially affecting bull trout streams for more than 1% of perennial stream length?  
   No = see #2; Yes = see #3.

2. Do the above activities occur within 100 feet of Critical Habitat?  
   No = NLAA or NE; Yes = see #3.

3. Within the length graded and surfaced near streams, are ditches left with an erosive native surface or are there not enough appropriately spaced cross drains (with appropriate filtration/dissipation)?  
   Yes =  
   LAA;  
   No = The ditches are treated or avoided to ensure they are not erosive and cross drains are included at appropriate spacing, go to #4.

4. Are the areas within 100 feet of streams treated during ideal moisture conditions or watered to meet ideal moisture condition, and then rolled or compacted to alleviate surface erosion?  
   No = LAA. Yes = go to #5.

5. Is the road very low gradient (e.g. < 3%) and has an adequate protective floodplain, or has monitoring shown that other factors (i.e. A well-drained high standard road, and traffic management) result in a near stream road that is not contributing sediment to ephemeral or other channels.  
   Yes = NE or NLAA; No = LAA
Background for
when
Surface Reconditioning Equates to
a
May Affect, Likely to Adversely Affect (LAA)
Determination for Bull Trout?

Road surface disturbance (blading or reconstruction) and traffic are two of the primary activities affecting sediment production from forest roads.

It is understood that road surfacing will reduce rutting and sediment production and potential delivery to stream channels (Cafferta et al. 2007 and Burroughs and King 1989), but that short term effects can to create beneficial conditions can be adverse, as described above.

Road reconditioning keeps roads in a condition suitable for travel and prevents severe erosion from failure of the drainage system or rutting of the surface. Unfortunately, road grading can break up armor layers on the road surface or the ditch and temporarily increase road surface erosion.

Roadbed gravel content, annual precipitation, time since last grading and road slope together explain more than two-thirds of the variability in sediment yield (Sugden and Woods 2007).

The decline in sediment yield after grading follows an exponential decay curve similar to that which occurs after road construction so that yields in the second and third years are typically many times lower than in the first year (Sugden and Woods 2007).

Reducing the amount of road with unnecessary ditch grading is unequivocally effective in reducing sediment production (Luce and Black 2001).

Almost all unsealed road surfaces are erodible, but not all eroded materials reach streams. This is due to deposition between the original location of the sediment, drains and streams. Factors affecting the efficiency of sediment delivery from roads include the placement and type of drainage structures, the distance from drainage outlets to streams, contributing area, hillslope slope and degree of concavity and the trapping efficiency of obstructions (Megahan and Ketcheson, 1996).

The delivery of road-derived sediment to a stream is modeled using a SDRR-S, determined by the downslope distance between the drainage outlets and the stream, based on the study of Megahan and Ketcheson (1996). Values of 100%, 35% and 10% are given when the distances between road drainage and stream are 0, 1–100, and 101–200 feet, respectively (Dubé et al., 2004).

The numerical effects of road grading are difficult to determine since they depend upon the condition of the road before and after grading. Foltz (unpublished data summary) found that grading a road with 1 inch deep ruts increased erosion 1.32 times; grading a road with a 5 inch deep rut produced 0.36 times as much sediment (reduction in erosion)( Dubé 2004).
**Project Design Elements**

When chemical applications to road surfaces are to proposed for dust abatement and/or surface durability, a fishery biologist will review the proposal to ensure risk to bull trout is discountable enough to fit within the framework of this biological assessment.

If blading is required to prepare the road surface for chemical application, the surface maintenance elements apply. Surface reconditioning actions (e.g. roto-milling) will incorporate surface drainage features so that new aggregate will be maintained. Roto-milling may also produce material that is larger than desirable for the road surface; therefore this excess material will be disposed of as described in the Surface Maintenance section.

**Literature Cited**


Appendix J. Miles of Perennial Stream within a Local Population. This table is used to determine if the 5 percent level of activity is being exceeded (U.S. Forest Service 2014).

<table>
<thead>
<tr>
<th>Core Area</th>
<th>Local population and Other Important Population (in italics)</th>
<th>Perennial Miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bitterroot River</td>
<td>Bitterroot River</td>
<td>2,013</td>
</tr>
<tr>
<td>Bitterroot River</td>
<td>Blodgett Cr</td>
<td>24</td>
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<td>Bitterroot River</td>
<td>Boulder Cr</td>
<td>17</td>
</tr>
<tr>
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<td>Burnt Fork</td>
<td>53</td>
</tr>
<tr>
<td>Bitterroot River</td>
<td>East Fork Headwaters Complex</td>
<td>154</td>
</tr>
<tr>
<td>Bitterroot River</td>
<td>Fred Burr Cr</td>
<td>17</td>
</tr>
<tr>
<td>Bitterroot River</td>
<td>Lolo Cr</td>
<td>185</td>
</tr>
<tr>
<td>Bitterroot River</td>
<td>Lost Horse Cr</td>
<td>52</td>
</tr>
<tr>
<td>Bitterroot River</td>
<td>Nez Perce Fork</td>
<td>101</td>
</tr>
<tr>
<td>Bitterroot River</td>
<td>Skalkaho Cr</td>
<td>66</td>
</tr>
<tr>
<td>Bitterroot River</td>
<td>Sleeping Child Cr</td>
<td>45</td>
</tr>
<tr>
<td>Bitterroot River</td>
<td>Tin Cup Cr</td>
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</tr>
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<td>Tolan Cr</td>
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<td>Warm Springs Cr</td>
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<td>Blackfoot River</td>
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<td>1,456</td>
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<td>Gold Cr</td>
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<td>Blackfoot River</td>
<td>Landers/Copper</td>
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<tr>
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<td>Clack Cr</td>
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<td>Quartz Cr</td>
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<td>West Fisher R</td>
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<tr>
<td>--------------------------------</td>
<td>------------------------------</td>
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<td><em>Mid Kootenai R</em></td>
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<td><em>Young Cr</em></td>
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<td>Lower Clark Fork River</td>
<td>Bull R</td>
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<td>Lower Clark Fork River</td>
<td>Graves Cr</td>
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<td>Lower Clark Fork River</td>
<td>Prospect Cr</td>
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<td>Rock Cr</td>
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<td>Lower Clark Fork River</td>
<td>Swamp Cr</td>
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<td>Lower Clark Fork River</td>
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<td>Lower Clark Fork River</td>
<td>Vermilion R</td>
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Appendix K. Forest Service and Bureau of Land Management Administered Lands Where Road-related Activities are Likely to Occur (U.S. Forest Service 2014).