United States Department of the Interior
Fish and Wildlife Service
Montana Ecological Services Office
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Helena, Montana 59601-6287
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In Reply refer to:
File: M19 Bitterroot National Forest
06E11000-2020-F-0024 Piquett Creek

December 10, 2019

Matthew Anderson, Forest Supervisor
Bitterroot National Forest
1801 North First Street
Hamilton, MT 59840

Dear Mr. Anderson:

Thank you for your request for U.S. Fish and Wildlife Service (Service) review of the proposed Piquett Creek Project (Project), located on the West Fork Ranger District of the Bitterroot National Forest (Forest). The Service received a letter on September 5, 2019, requesting formal consultation on the project. In the biological assessment, the Forest analyzed the effects of this proposed action on species listed under the Endangered Species Act of 1973, as amended (Act), in the action area and determined the project *may affect, and is likely to adversely affect* bull trout (*Salvelinus confluentus*) and *may affect, is not likely to adversely affect* designated bull trout critical habitat.

The proposed action includes two primary activities to manage vegetation and reduce fuels within the project area: timber harvest and prescribed burning (which may be preceded by commercial or non-commercial thinning). Subsequent activities would include timber haul along forest roads, construction of temporary roads, and road maintenance and best management practices (BMPs) on roads used for haul. While the exact location of vegetation treatment areas has not been determined at this time, the proposed action includes a suite of project design elements that are sufficient in detail to allow us to assess the effects to listed species in the action area.

In particular, the proposed action would include the following key elements, which are detailed in the biological assessment:

- Installation and/or upgrade of BMPs on all haul routes prior to haul.
- No temporary roads within riparian habitat conservation areas (RHCAs).
- A maximum of 500 log truck loads to be hauled from the project area on identified routes only, during dry conditions, in one April-November season.
- No helicopter ignition or timber removal in RHCAs.
- No hand thinning or burning within 50 feet of streams.

Project activities are expected to begin as early as 2020, and could last up to 10 years for prescribed burning, although timber harvest and haul would be completed in one to two years. All temporary roads and trails would be obliterated after use, which would generally be limited to one operating season. Temporary roads and trails would be closed to public use by a closure order enforceable by law enforcement.

Bull Trout Critical Habitat

The 2010 final rule for the designation of critical habitat for the Columbia River population of bull trout (Federal Register 75 FR 63898, Vol. 75, No. 200, October 18, 2010) designated the Lower West Fork Bitterroot River as critical habitat. It is within the Bitterroot River Critical Habitat Sub-Unit, which is within the larger Clark Fork River Basin Critical Habitat Unit (Unit 31). The Lower West Fork Bitterroot River is classified as foraging, migrating, and overwintering (FMO) habitat for bull trout; it also may contain some rearing habitat for juvenile bull trout. As part of the Clark Fork River Basin Critical Habitat Unit, critical habitat in the Lower West Fork Bitterroot River is important for maintaining bull trout distribution within this unique geographic region that represents the evolutionary heart of the migratory adfluvial form of bull trout. Piquett Creek, a tributary, is not designated critical habitat.

Effects to bull trout critical habitat are expected to be insignificant, given the narrow scope of effects, and the minimal impacts to (PCEs). The sediment delivery that may occur in Piquett Creek is expected to be so small that by the time any sediment gets transported downstream into FMO critical habitat in the West Fork Bitterroot River, it would have an inconsequential and discountable effect on bull trout rearing habitat. Minimization measures that are part of the proposed action are expected to further attenuate any sediment delivery, including application of BMPs. The amount of sediment generated by the project that would be available to transport downstream to critical habitat is so minimal that it would not be recorded in cobble embeddedness sampling. Therefore, the effects to PCEs that pertain to sediment would be insignificant or discountable.

The proposed action will not preclude PCEs 1 through 9 from becoming fully functional; however, they will remain below optimal conditions and will not fully provide their intended recovery function. The Service encourages the Forest to continue to assess and address opportunities to improve PCEs for critical habitat, and to work collaboratively with the Service and other partners to do so.

Conclusions

The Service has reviewed the biological assessments and concurs with the determinations that the proposed action is *not likely to adversely affect* designated critical habitat for bull trout. Therefore, pursuant to 50 C.F.R. § 402.13 (a), formal consultation is not required. The Service bases its concurrence on the information and analysis in the biological assessment prepared by Mike Jakober, Fisheries Biologist, on the West Fork Ranger District, and information in our files.

This concludes informal consultation for bull trout critical habitat, pursuant to the regulations implementing section 7(a) (2) of the Act (50 C.F.R. 402.13). This Project should be re-analyzed if new information reveals effects of the action that may affect listed or proposed species or designated or proposed critical habitat in a manner or to an extent not considered in this consultation; if the action is subsequently modified in a manner that causes an effect to a listed or proposed species or designated or proposed critical habitat that was not considered in this consultation; and/or, if a new species is listed or critical habitat is designated that may be affected by this Project.

The Forest also concluded that the project *may affect, and is likely to adversely affect* bull trout. The attached biological opinion addresses the effects of the proposed action on bull trout. The biological opinion was prepared in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). A complete project file of this consultation can be found at the Service's Montana Ecological Services Office.

We appreciate your efforts to ensure the conservation of threatened and endangered species as part of our joint responsibilities under the Act. If you have questions or comments related to this consultation, please contact Carly Lewis (USFS/USFWS Liaison) at carly_lewis@fws.gov or (406) 329-3091. Otherwise, please coordinate with the Montana Ecological Services Office.

Sincerely,

for Jodi L. Bush,
Office Supervisor

Endangered Species Act- Section 7 Consultation

Biological Opinion
for
Effects to Bull Trout
from the
Piquett Creek Project
Bitterroot National Forest
2019

U.S. Fish and Wildlife Service Reference:

06E11000-2020-F-0024 Piquett Creek

Action Agency:

U.S. Forest Service, Bitterroot National Forest, West Fork Ranger District

Consultation Conducted By:

U.S. Fish and Wildlife Service, Montana Ecological Services Office

Date Issued:

December 10, 2019

CONTENTS

I. Introduction & Consultation History

This document represents the U.S. Fish and Wildlife Service's (Service) biological opinion (BO) for the effects to threatened bull trout (*Salvelinus confluentus*) from the proposed Piquett Creek Project (project) on the West Fork Ranger District of the Bitterroot National Forest (Forest). Consultation was initiated on September 5, 2019, the date the Service received the Forest's biological assessment (BA).

Section 7(b)(3)(A) of the Endangered Species Act (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. If the Secretary determines "no jeopardy," then regulations implementing the Act (50 C.F.R. § 402.14) further require the Director to specify "reasonable and prudent measures" and "terms and conditions" necessary or appropriate to minimize the impact of any "incidental take" resulting from the action(s). This biological opinion (BO) addresses only the impacts to federally listed bull trout and does not address the overall environmental acceptability of the proposed actions.

Updates to the regulations governing interagency consultation (50 CFR part 402) became effective on October 28, 2019 [84 FR 44976]. This consultation was pending at that time, and we are applying the updated regulations to the consultation. As the preamble to the final rule adopting the regulations noted, "[t]his final rule does not lower or raise the bar on section 7 consultations, and it does not alter what is required or analyzed during a consultation. Instead, it improves clarity and consistency, streamlines consultations, and codifies existing practice." We have reviewed the information and analyses relied upon to complete this biological opinion in light of the updated regulations and conclude the opinion is fully consistent with the updated regulations.

Consultation History: The Service received a draft biological assessment (BA) regarding bull trout and bull trout critical habitat for the Piquett Creek Project in July of 2019. Carly Lewis visited the project area with fisheries biologist, Mike Jakober, for field review as part of the Level 1 team meeting in July of 2019. The Forest submitted a final biological assessment to the Service on September 5, 2019. The Service provided the Forest a draft biological opinion for review on November 22, 2019. The Forest provided written feedback via email on November 25, 2019, and discussed in-person at the Level 1 meeting on November 26, 2019.

II. Description of the Proposed Action

This section describes the proposed Federal action, including any measures that may avoid, minimize, or mitigate adverse effects to listed species or critical habitat, and the extent of the geographic area affected by the action (i.e., the action area). The term "action" is defined in the implementing regulations for section 7 as "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas. Examples include, but are not limited to: (a) actions intended to conserve listed species or their habitat; (b) the promulgation of regulations; (c) the granting of licenses, contracts, leases, easements, rights-of-way, permits, or grants-in-aid; or (d) actions directly or indirectly causing modifications to the land, water, or air.” (50 CFR 402.02).

A. Proposed Activities

The proposed action includes two primary components designed to manage vegetation within the project area: timber harvest and prescribed fire. Either or both of these tools could be used to meet objectives on any National Forest System (NFS) lands within the project areas. The Forest has not yet identified the exact location and timing of each type of activity, but rather has identified a suite of sideboards or constraints, which are described below.

Timber harvest would consist of a mix of tractor and skyline yarding systems. The cutting prescription would primarily be thinning using an improvement harvest to thin smaller trees from the understory and thin overstory until the desired density is reached. The objective of this treatment is to retain the largest diameter ponderosa pine and Douglas fir trees and promote fire-resilient stands by reducing the number of stems without creating enough space to regenerate the stand. Opening the forest canopy increases space between tree crowns and the distance between the forest floor and the bottom of the canopy (canopy base height). This treatment reduces the density of the forest canopy and the ability of the forest to support a crown fire.

Timber harvest would require the use of four primary roads for timber haul. These roads, FR 49, FR 731, FR 5720, and FR 5724, are described in detail in the biological assessment (USFS 2019). Timber haul could also occur on spur roads to these four primary roads, as well as on temporary roads with yet-to-be-determined locations. The biological assessment describes the points on each of the four primary roads where the roads encounter riparian habitat conservation areas (RHCAs) and potentially contribute sediment to waterbodies in the action area.

Prescribed burning is a general category that includes manual thinning (with chainsaws), piling, and pile burning of sub-merchantable ladder fuel trees, as well as broadcast burning. As with timber harvest, these activities could on any NFS lands in the project area as long as it complies with the design elements listed below.

The design elements must be met before the tools could be applied:

Timber harvest

- No timber harvest in RHCAs.[1]
- No log landings in RHCAs.
- No yarding of logs or driving skidders in RHCAs.
- No temporary roads or tracked line machine trails in RHCAs. They may be constructed elsewhere in the project area as long as they avoid RHCAs.
- No construction of permanent (i.e. system) roads.

[1] Default RHCA widths (USDA Forest Service, 1995; pgs A-5 and A-6) would apply to all water bodies in the project area. The default RHCA width on intermittent streams would be 100 feet. Appendix A of the Biological Assessment for the Piquett Creek Project (USFS 2019) displays the RHCAs in the project area.

Log Haul

- A maximum of 500 log truck loads could be harvested and hauled from the project area. A truck load is defined as one log truck driving into the landing empty, and then driving back out loaded with logs and headed to the mill.
- Hauling would be restricted to FRs 49, 731, 5720, and 5724 and their spurs.
- Hauling would occur in summer and autumn when roads are adequately dry. Hauling would cease during periods that are wet enough to produce movement of fines on the road surface.
- There would be no hauling after November 15th and no snow plowing.
- All stream crossings mapped on the NHD layer must be graveled prior to hauling over them.
- All ditch relief culverts along FR 49 must have straw bale check dams installed below their outlets whenever hauling is occurring.
- The following Best Management Practices (BMP) upgrades must occur on FRs 49 and 5720 before hauling can occur:

    FR 49:
    - Gravel aggregate will be applied between mileposts 0.2 and 1.1.
    - Drive thru dips will be installed on both approaches of the bridge crossing of Piquett Creek at milepost 1.0.
    - The road prism will be graded and shaped.
    - Straw bale check dams will be installed below the outlets of any ditch relief culverts located within 100 feet of Piquett Creek.

    FR 5720:
    - Drive thru dips will be installed on both approaches of the bridge crossing of Piquett Creek at milepost 0.01.

Prescribed Burning

Prescribed burning and manual thinning, piling, and pile burning of sub-merchantable ladder fuel trees could occur anywhere in the project area as long as it complies with the following design elements:

- No helicopter ignition in RHCAs.
- Hand ignition is allowed in RHCAs but will not occur within 50 feet of streams and wetlands. Fire will be allowed to back into and burn across the RHCAs if it so desires.
- All hand lines will be re-contoured and covered with slash after use.
- Hand line is not prohibited in RHCAs, but fire managers should minimize its use in RHCAs as much as possible. Hand lines in RHCAs must avoid wetlands and be re-contoured and covered with slash after use.
- No manual thinning or slash piling within 50 feet of streams and wetlands.
- If drafting from streams occurs, intake hoses will be fitted with a screen mesh equal to or smaller than 3/32 inch.

B. Conservation Measures

Conservation measures are actions to benefit or promote the recovery of listed species that are included by the Federal agency as an integral part of the proposed action. These actions will be taken by the Federal agency or applicant, and serve to minimize or compensate for, project effects on the species under review. These may include actions taken prior to the initiation of consultation, or actions which the Federal agency or applicant have committed to complete in a biological assessment or similar document. The design elements described above, and detailed in the biological assessment, are considered the conservation measures for the Piquett Creek Project.

C. Term of the Proposed Action

The estimated time for completion of project activities is 10 years, roughly 2020 thru 2029. It is estimated that timber harvest and haul would occur in one to two years, with all haul occurring in the April-November 15 season.

III. Range-wide Status of Bull Trout

A. Status of the Species

The bull trout was listed as a threatened species in the coterminous United States in 1999 (64 FR 58910-58933; USFWS 1999). Throughout its range, bull trout are threatened by the combined effects of habitat degradation, fragmentation, and alterations associated with dewatering, road construction and maintenance, mining, grazing, the blockage of migratory corridors by dams or other diversion structures, poor water quality, incidental angler harvest, entrainment, and introduced non-native species. Since the listing of bull trout, there has been very little change in the general distribution of bull trout in the coterminous United States, and we are not aware that any known, occupied bull trout core areas have been extirpated (U.S. Department of Interior, Fish and Wildlife Service, 2015).

The 2015 recovery plan for bull trout identifies six recovery units within the listed range of the species (U.S. Department of Interior, Fish and Wildlife Service, 2015). Each of the recovery units are further organized into multiple bull trout core areas, which are mapped as non-overlapping watershed-based polygons, and each core area includes one or more local populations. Within the coterminous United States, we currently recognize 109 occupied core areas, which comprise 600 or more local populations of bull trout (ibid.). Core areas are functionally similar to bull trout metapopulations, in that bull trout within a core area are much more likely to interact, both spatially and temporally, than are bull trout from separate core areas.

The Service has also identified a number of marine or mainstem riverine habitat areas outside of bull trout core areas that provide foraging, migration, and overwintering (FMO) habitat that may be shared by bull trout originating from multiple core areas. These shared FMO areas support the viability of bull trout populations by contributing to successful overwintering survival and dispersal among core areas (ibid.).

For a detailed account of bull trout biology, life history, threats, demography, and conservation needs, refer to Appendix A: Status of the Species—Bull Trout.

B. Previous Consultations and Conservation Efforts
This section includes a discussion on previously consulted upon actions and subsequent effects that have been analyzed through section 7 consultation. 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 biological opinion received by the Region 1 and Region 6 Forest Service Offices, from the time of listing until August 2003; this totaled 137 biological opinions. Of these, 124 biological opinions (91 percent) applied to activities affecting bull trout in the Columbia Basin population segment, 12 (9 percent) applied to activities affecting bull trout in the Coastal-Puget Sound population segment, seven (5 percent) applied to activities affecting bull trout in the Klamath Basin population segment, and one (< 1 percent) applied to activities affecting the Jarbidge and St. Mary-Belly population segments (Note: these percentages do not add to 100 because several Biological Opinions 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.

The current bull trout recovery plan (2015) modified the previous demographic units used in the interim recovery plan. Based on the current recovery plan, there have been 72 biological opinions that issued take in the Upper Clark Fork Geographic Region of the Columbia Headwaters Recovery Unit from August 2003 until now. Of these, 21 have occurred within the Bitterroot River Core Area where the project is located. Most of the Biological Opinions 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.

IV. Analytical Framework for 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 on bull trout of future non-federal activities reasonably certain to occur in the action area. 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, taken together with 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.

Recovery Units (RU) for bull trout were defined in the final Recovery Plan for the Coterminous United States Population of [the] bull trout (U.S. Department of Interior, Fish and Wildlife Service, 2015a). Pursuant to Service policy, when a proposed federal action impairs or precludes the capacity of a RU 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 proposed action affects not only the capability of the RU, but the relationship of the RU to both the survival and recovery of the listed species as a whole.

The jeopardy analysis for bull trout in this BO considers the relationship of the action area and affected core areas (discussed below under the Status of the Species section) to the RU and the relationship of the RU 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 above context, the Service also considers how the effects of the proposed federal action and any cumulative effects impact bull trout local and core area populations in determining the aggregate effect to the RU(s). Generally, if the effects of a proposed federal action, taken together with cumulative effects, are likely to impair the viability of a core area population(s) such an effect is likely to impair the survival and recovery function assigned to a RU(s) and may represent jeopardy to the species (70 C.F.R. 56258).

V. Analytical Framework for the Environmental Baseline and Effects of the Action

A. Action Area

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 C.F.R. § 402.02). It is based upon the geographic extent of the physical, chemical, and biological effects to land, air, and waters resulting from the proposed action, including direct and indirect effects.

For bull trout, 5th or 6th field Hydrologic Unit Code (HUC) watersheds are the recommended analysis scale (U.S. Department of Interior, 1998). Consistent with this recommended scale of analysis, watershed baseline conditions (U.S. Forest Service 2000) and the Conservation Strategy for Bull Trout on USFS lands in Western Montana (USDA-USFWS, 2013) occur at the 6th field sub- watershed scale.

The proposed action will occur in the Piquett Creek watershed (HUC 170102050303, hereafter "HUC 0303"), and in portions of the West Fork Bitterroot-Lloyd Creek watershed (HUC 170102050305, hereafter "HUC 0305"). The action area (displayed in Figure 1) includes all of the aquatic habitats that could potentially be affected by the Piquett Creek Project, and consists of the following 6th code HUCs or portions of those HUCs:

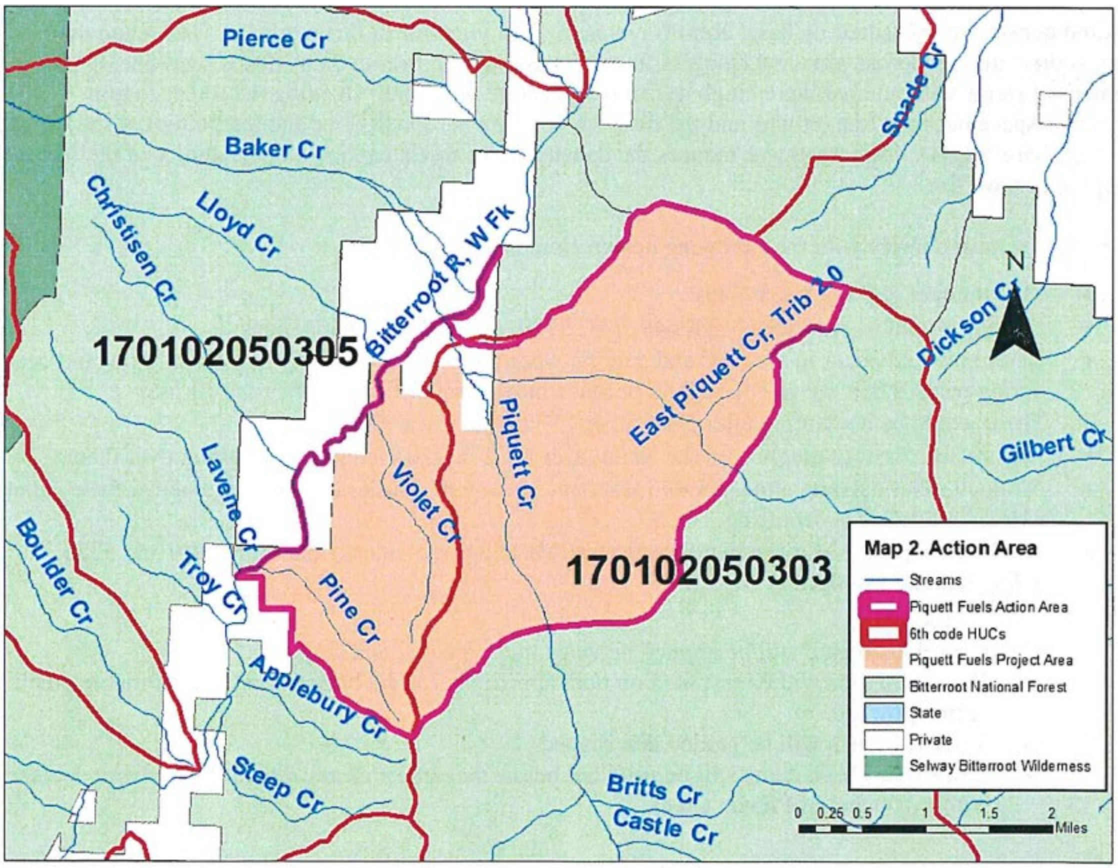
- The portion of HUC 0303 downstream from the Forest Road (FR) 5720 bridge crossing on Piquett Creek;
- The Pine Creek and Violet Creek drainages in HUC 0305; and
- The West Fork Bitterroot River between Pine Creek and one mile below Piquett Creek. This four mile long section of river is located in HUC 0305.

The following areas are located upstream from the action area and are not included in the action area because no project activities or project effects would occur in those areas:

- All portions of HUC 0303 upstream from the FR 5720 bridge crossing on Piquett Creek;
- All portions of HUC 0305 upstream from the mouth of Pine Creek.

The West Fork Bitterroot River downstream from Trapper Creek is not included in the action-area because any potential sediment delivery to the river from project activities would be completely indistinguishable from background sediment levels at that far of a distance downstream.

Figure 1. Action area for the Piquett Creek project on the Bitterroot National Forest.



B. Relationship of Action Area to Recovery Area

The bull trout recovery plan considers a hierarchical order of demographic units extending from the entire range of bull trout within the coterminous United States down to local populations. This stepdown organization is important for implementing recovery, tracking consultation under section 7 of the Act, identifying and protecting critical habitat, and other aspects of planning and coordination.

Core areas represent the closest approximation of a biologically functioning unit for bull trout, containing habitat that could supply all elements for the long-term security of one or more local bull trout populations (U.S. Department of Interior, Fish and Wildlife Service, 2015b). Local populations are considered the smallest group of fish that are known to represent an interacting reproductive unit. The combination of core habitat and a core population (one or more designated local bull trout populations that exist within core habitat) constitutes the basic unit on which to gauge recovery within a recovery unit. Generally smaller, more adjunct resident populations of bull trout that do not meet the criteria for designation as local populations by the U.S. Fish and Wildlife Service may also occur within core areas.

The action area lies within the Bitterroot River core area located within the Upper Clark Fork Geographic Region within the Columbia Headwaters Recovery Unit, as shown in Table 1. The West Fork Bitterroot River population is recognized as a local population in the Bull Trout Recovery Plan (U.S. Department of Interior, Fish and Wildlife Service, 2015a). The population in Piquett Creek is not recognized as a local population, but individuals could contribute to the West Fork Bitterroot population because the streams are connected.

Table 1. Relationship of action area to the hierarchy of bull trout analysis units.

Bull Trout Analysis Scale	Hierarchical Relationship
Coterminous United States (DPS)	Range of bull trout
Columbia Headwaters Recovery Unit	One of 6 Recovery Units in the range of the species within the coterminous United States
Upper Clark Fork Geographic Region	One of 5 Geographic Regions in the Columbia Headwaters Recovery Unit
Bitterroot Core Area	One of 7 complex core areas within the Upper Clark Fork Geographic Region
Lower West Fork Bitterroot River population Piquett Creek population	One of 14 local populations in the Bitterroot Core Area A population of bull trout not identified in Recovery Plan documents

C. Indicators of Baseline Conditions and Effects to Habitat and Species
To assist in the assessment of baseline conditions for bull trout and bull trout critical habitat, the Service created "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 1998). The framework provides a stand-alone method to systematically assess baseline conditions and project-related effects meaningful to bull trout using four Species Indicators and 19 Habitat Indicators. Ratings of the species and habitat indicators are then used to derive an "Integration of Species and Habitat Conditions" ratings. This single value integrating habitat and subpopulation conditions is intended to help arrive at a determination of the potential effects of land management activities on bull trout. Baseline ratings are typically assessed for each of four species indicators, 19 habitat indicators, and an integration of species and habitat indicators for every 6th field HUC within an analysis area.

Each Species and Habitat Indicator is rated as "functioning appropriately" (FA), "functioning at risk" (FAR), and "functioning at unacceptable risk" (FUR). Indicators rated FA provide habitats that maintain strong and significant populations, are interconnected and promote recovery of a proposed or listed species or its critical habitat to a status that will provide self-sustaining and self-regulating populations. When a habitat indicator is FAR, they provide habitats for persistence of the species but in more isolated populations and may not promote recovery of a proposed or listed species or its habitat without active or passive restoration efforts. FUR indicates the proposed or listed species continues to be absent from historical habitat, or is rare or being maintained at a low population level; although the habitat may maintain the species at this low persistence level, active restoration is needed to begin recovery of the species.

Although the same indicators are used to assess effects to both bull trout and designated critical habitat, the determinations are independent because the analysis for jeopardy determination and adverse modification are conducted independently. The results of neither analysis affect the outcome of the other. Additionally, the magnitude and context of the indicators are used differently for addressing effects to the species and to critical habitat. For the determination of effects to the species, influences to individual indicators and their resulting effects to bull trout are assessed. To assess the physical and biological features ascribing bull trout critical habitat, assemblages of indictors indirectly describe the attributes within each PCE of critical habitat. The combined influence to these multiple indicators assesses the effects to critical habitat. Subsequently, the jeopardy determination for bull trout and the adverse modification of designated critical habitat determination are independent analyses.

Project effects are considered to either "maintain," "restore," or "degrade" habitat indicators relative to existing or baseline conditions. Effects are characterized as either "major" effects that will likely produce a change in one functional level to baseline conditions (e.g., change FAR to FA), or "minor" effects that may result in an incremental or cumulative effect but will not result in a functional change within the HUC. Together, the influence of project effects to the individual habitat indicators, subpopulation characteristics, Integrated Status of Habitat Conditions, and Integration of Species and Habitat Indicators provide a way to systematically assess the effects of proposed actions.

Due to natural variability and large spatial extent of 6th field HUCs, a Geographical Information System (GIS) modeling approach was used to provide a structured, single determination of habitat indicators for each HUC within the range of bull trout in Montana. Ratings were determined by the Forest Service for HUCs dominated by federal ownership (>50%). The Natural Resources Conservation Service (NRCS) determined ratings for HUCs containing 50% or greater non-federal ownership using a slightly modified version of the Forest Service method to account for differences in data availability. Ratings should be considered surrogates for actual conditions and as a modeled average of the natural variability that occurs within any watershed. Field data should be used when possible, especially within activity area boundaries, to update modeled values.

VI. Environmental Baseline

Environmental baseline refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02, as revised by 84 FR 44976 in 2019).

For this biological opinion, environmental baseline conditions for bull trout were assessed using information in the biological assessment (U.S. Forest Service 2019), Bull Trout Core Area Templates (U.S. Fish and Wildlife Service 2009), Bull Trout Recovery Plan for the Columbia Headwaters Recovery Unit (U.S. Fish and Wildlife Service 2015a), Conservation Strategy for Bull Trout on USFS lands in Western Montana (U.S. Forest Service 2013), the monitoring report for implementation of the Bitterroot National Forest's Travel Management Plan terms and conditions (USFS 2016), and additional information in our files.

A. Baseline Conditions in the Core Area

Population Status and Trend

The Bitterroot River core area is nested within the Columbia Headwaters Recovery Unit. The Bitterroot River core area is a complex unit, containing a mixture of fluvial, adfluvial, and resident populations of bull trout. Fourteen local populations are identified, but bull trout occupancy occurs at some level in more tributaries. Bull trout in this core area are no longer detected in six sub-watersheds that were previously occupied in the early 1990s and 2000s (U.S. Forest Service 2013).

The Bitterroot River core area is an example of a watershed where systematic decline of the migratory life history form of bull trout has resulted in the increased prominence of isolated and fragmented populations of resident fish (US Forest Service 2013). A study showed there were no physical barriers to migratory fish, indicating that other downstream mortality factors such as predation or temperature plated a bigger role in the extirpation of those stocks (Nelson, McMahon, & Thurow, 2002). They suggested that the isolated, non-migratory remnants of the population were at increased risk of extinction, and that restoration of the migratory form was an important conservation goal.

At this time, monitoring indices for this core area are considered largely inadequate for monitoring trend, due in part to the mix of sparse fluvial and fragmented resident populations of bull trout. The population is estimated to be between 250 and 1,000 individuals in the core area (US Fish and Wildlife Service 2008). With what is known about the population, the trend appears to be declining and at very low numbers. Bull trout have disappeared from at least one local population over the past 15 years (Rye Creek; US Forest Service 2013).

The high frequency of resident bull trout populations in this drainage makes interpretation of status and trend information difficult. The strong presence of resident populations suggests that fragmentation has eliminated much of the former migratory component (Nelson et al. 2002). Nelson et al. (2002) suggested that the isolated, non-migratory remnants of the population were at increased risk of extinction, and that restoration of the migratory form was an important conservation goal. Resident populations depend on smaller, less fecund resident fish and are general at higher risk of loss because of isolation.

The distribution of populations throughout the core area is probably significantly different from historic patterns, as many streams which may have historically contained bull trout, especially the migratory form, now have none, or if they do have bull trout they are typically limited to a very short reach of the stream system.

There are thirteen local populations within the core area on the Bitterroot National Forest. They include: East Fork Bitterroot River (headwater complex from Meadow Creek upstream), Tolan, Warm Springs, lower West Fork Bitterroot River, Nez Perce Fork, Boulder, Tin Cup, Lost Horse, Sleeping Child, Skalkaho, Blodgett, Fred Burr, Burnt Fork, and Lolo Creek. Fluvial bull trout populations include resident and migratory life history forms. While fluvial bull trout do spawn in other tributaries, these fourteen streams support the majority of the spawning, and redd numbers within them likely represent over 85 percent of the total fluvial spawning that occurs in the core area.

Primary Threats
Much of the fragmentation that occurs in this watershed is due to natural dewatering of groundwater-fed tributaries that go subsurface before reaching the Bitterroot River. Several of these are exacerbated by irrigation and there are large irrigation structures and flumes that mix water sources and complicate connectivity. Most of the irrigation diversions are not screened. In general, adult migratory abundance is expected to decline in this core area due to high rates of development on private lands, complications of complex, multiple ownership patterns, heavy demands for irrigation water, and other factors (U.S. Army Corps of Engineers 2009; U.S. Fish and Wildlife Service 2005a).

Risk of Extirpation
The Bitterroot Core Area is ranked ***At Risk*** (U.S. Fish and Wildlife Service 2009). This ranking is defined as "*Core area 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 2009). Of all the core areas in Montana, the Bitterroot is near the top in terms of climate change risk. Populations are already highly fragmented and reverting to the resident life history form, often restricted to small isolated headwater patches of habitat. A major portion of the mainstem habitat is largely unsuitable for occupancy by bull trout in summer. Substantial increase in maximum summer water temperature is occurring over a relatively short period of time, exacerbated by recent landscape scale fire impacts (Mahlum et al. 2008). All of these factors combine to greatly increase vulnerability of this core area to extirpation. The 2015 Columbia Headwaters Recovery Unit Implementation Plan for Bull Trout concluded little had changed in regard to individual core area status in the interim between the year rankings were calculated and completion of the current Recovery Unit Implementation Plan (U.S. Fish and Wildlife Service 2015a).

B. Baseline Habitat Conditions and Status of the Species in the Action Area

There are two bull trout populations in the action area that could be affected by the Piquett Creek Project. One of the populations (Lower West Fork Bitterroot River) is officially recognized as a local population in the Columbia Headwaters Recovery Unit Implementation Plan (USFWS 2015b), the other population (the bull trout in Piquett Creek) is not officially recognized as a local population. Both of the populations are described in the following paragraphs.

Lower West Fork Bitterroot River Local Population

The Lower West Fork local population occupies the 23 miles of the West Fork Bitterroot River below Painted Rocks Dam. It is estimated that there are < 50 adult bull trout in the local population (USDA Forest Service, 2000). Montana Fish, Wildlife, and Parks biologists typically capture 2-3 bull trout (mostly juveniles< 12 inches) per mile of river during their electroshocking surveys.

The bull trout in the Lower West Fork local population are fluvial (migratory) fish. Both adults and juveniles are present but rare. The few adults that remain in the local population live in the West Fork Bitterroot River for most of the year, and spawn in the tributaries in September and October. Spawning habitat is not thought to be present in the West Fork itself, only in a few of the larger tributaries. The West Fork functions as a migratory corridor for adult migratory bull trout, and also provides overwintering habitat for adults and a limited amount of overwintering and rearing habitat for juveniles. The West Fork is the migratory corridor that connects good spawning and rearing habitat in the Nez Perce Fork drainage with overwintering habitat in the upper Bitterroot River. Generally, it may be assumed that low numbers of juvenile bull trout are present in all portions of the West Fork at all times of the year. Adult bull trout are less numerous and more incidental than juveniles. An adult may be present in the action area except for the autumn staging and spawning period (generally August through October) when they are likely to be in the Nez Perce Fork drainage or holding in the large pool at the base of Painted Rocks Dam.

There is one long-term Forest Plan fish population monitoring reach in the West Fork below the dam, and it consists of the 2.85 mile long segment of river between Conner (river mile 1.2) and the Trapper Creek Job Corps Center (river mile 4.0). Fish populations in the reach are periodically sampled by Montana Fish, Wildlife, and Parks biologists using mark/recapture estimates. A 22-inch and 28-inch bull trout were captured in the reach in 1986. Since then, the largest bull trout captured has only been 16 inches long, and most are < 12 inches.

The biological assessment (U.S. Forest Service 2019) provides details on the number of bull trout, brook trout *(Salvelinus fontinalis),* brown trout *(Salmo trutta),* and bull trout x brook trout hybrids that have been captured in the lower West Fork monitoring reach. The data are not statistical estimates; however, they do show trends. Bull trout have declined since 1986 while brown trout have at least doubled. Brook trout were uncommon in 1986 and have remained so over the past three decades. Brown trout have replaced bull trout as the dominant predatory fish in the West Fork below Painted Rocks Dam.

Piquett Creek population

Piquett Creek contains a small bull trout population that is not officially recognized as a local population in the Bull Trout Recovery Plan. The total size of the population is estimated to be between 50 and 500 adult bull trout, with all or nearly all being resident fish (U.S. Forest Service 2000). Very few bull trout remain in the action area portion of Piquett Creek; the vast majority reside in the upper 3.6 miles of suitable habitat that is located above the Piquett Creek trailhead, which is about two miles upstream from the action area. There still may be some potential for an adult migratory bull trout from the West Fork Bitterroot River to swim into Piquett Creek and spawn because there is at least a partial connection to the river during the higher water times of the year. However, adult migratory bull trout are very rare in the West Fork near Piquett Creek, and none have not been seen or captured in the Piquett Creek watershed despite numerous electroshocking surveys. Overall, Piquett Creek provides about 7.6 miles of spawning and rearing habitat, with the best habitat occurring upstream of the action area.

Brook trout, a non-native competitor, have replaced bull trout as the dominant charr species in the lower half of Piquett Creek. In that portion of the stream, brook trout outnumber bull trout by at least a 20:1 ratio, with a few hybrids also present. Upstream of the Piquett trailhead, bull trout probably still outnumber brook trout (U.S. Forest Service 2019). Brown trout used to be incidental and rare in the lower end of Piquett Creek, but July, 2019 electrofishing indicates that the species is increasing in abundance, at least in the lower two miles of Piquett Creek (U.S. Forest Service 2019). The brown trout are invading from the nearby West Fork Bitterroot River. It is unknown at this time how far upstream they have spread.

Castle Creek is the largest tributary to Piquett Creek. It enters Piquett about two miles upstream of the action area. The lower half mile of Castle Creek provides a limited amount of spawning and rearing habitat for a few juvenile bull trout. East Piquett Creek is the second largest tributary to Piquett Creek. It is located in the action area but does not contain bull trout. Westslope cutthroat trout are the most numerous species in East Piquett Creek, followed by brook trout. Brown trout are also appearing at low numbers in the portion of East Piquett Creek below the FR 731 road crossing.

Long-term Forest Plan fish population monitoring reaches are located in the lower ends of Piquett and East Piquett creeks. Both of the reaches are located in the action area. The Piquett Creek reach is located above the FR 49 bridge at stream mile 1.3; the East Piquett Creek reach is located above the USFS boundary at stream mile 0.2. Fish populations in both reaches are periodically sampled by Bitterroot NF and Montana Fish, Wildlife, and Parks biologists using mark/recapture estimates. Bull trout are present in the Piquett Creek reach, but not the East Piquett Creek reach. Bitterroot NF and Montana Fish, Wildlife, and Parks biologists conducted a mark/recapture estimate in the Piquett Creek reach in July, 2019, and the data is included in the BA. The data are not statistical estimates, but they do show trends. Bull trout have remained rare in the reach over the past 30 years.

Baseline Habitat Conditions

The BA provides detailed information regarding the functional condition of the habitat indicators in the two 6th code HUC watersheds affected by this project. This baseline incorporates effects of past and ongoing activities within the Bitterroot NF, and relies primarily on GIS layers related to various features on the Forest, including: barriers to fish movement, road density and proximity to streams, and the portion of watersheds in equivalent clearcut condition. The layers and their GIS-derived functional ratings were reviewed by Forest biologists and refined, where appropriate, with locally collected data. This information was then used to assess the most important attributes of bull trout habitat: temperature, barriers, pools, and sediment (Table 3). These attributes mirror the well-established “four Cs” that summarize good bull trout habitat –

cold, clean, complex, and connected.

Table 3 summarizes the current functional ratings for the two 6th code HUCs that occur within the action area. The BA provides rationale for one change to the functional ratings in the baseline. In HUC 0303, the Temperature indicator should be downgraded from "Functioning Appropriately (FA)" to "Functioning at Risk (FAR)". This change is highlighted in **BOLD** in Table 3; the GIS rating that is being changed is in parenthesis.

Table 2. Functional Ratings for primary habitat indicators in the action area.

Indicator	*HUC 0303*	*HUC 0305*
Temperature	***FAR*** *(FA)*	*FUR*
Barriers	*FA*	*FUR**
Pools	*FAR*	*FAR*
Sediment	*FUR*	*FAR*

** no barriers exist on the Forest Service portion of the action area*

Extensive information can be found in the BA regarding these habitat indicators and other data for the affected HUCs. A summary of the baseline condition for temperature and sediment will be reiterated here, and the remaining information from the BA is incorporated by reference.

Temperature monitoring reported in the BA shows that mean-maximum temperatures typically range between 15-16° C in Piquett Creek (USFS boundary, stream milepost 1.3) and 15-17° C (USFS boundary, stream milepost 0.2) in East Piquett Creek. A comparison of temperatures in Piquett Creek with temperatures in similar-sized reference streams suggests that there may be a small amount of anthropogenic warming that occurs in the lower reaches of Piquett Creek. In the action area, about 0.56 miles (2,944 feet) of FR 49 is located within 100 feet of Piquett Creek. These near-stream road segments have resulted in some patchy reductions in overstory shade along the lower four miles of Piquett Creek, and road impacts may also contribute to warmer temperatures in East Piquett Creek.

Forest roads are the main source of sediment in the action area. There is a consistent relationship in the scientific literature between roads and the amount of sediment in streams (see authors cited in Quigley and Arbelbide, 1997: pgs 1102, 1253, and 1345). In general, the more roads in a watershed; the higher the sediment levels in the streams. The road density in the Piquett Creek watershed (HUC 0303) is 2.3 miles/mile 2; the road density in the lower West Fork Bitterroot River watershed (HUC 0305) is 2.7 miles/mile 2. These densities are considered to be moderate-to-high.

Forest roads are an example of a press disturbance, meaning that the road system delivers sediment to streams indefinitely throughout time whenever storm and runoff events occur. The most negative aspect of the press disturbance is that it never goes away. Fire, in contrast, is an example of a pulse disturbance. A pulse disturbance delivers a large slug of sediment in a short period of time, but then goes away and always streams to flush the sediment out of their system. The 2007 Rambo Fire is a good example of a pulse disturbance. The burned hillslopes delivered elevated amounts of sediment to Piquett Creek from 2007 to about 2012, but since then, erosion rates have returned to pre-fire levels and most of the sediment that was delivered to Piquett

Creek has been transported out of the system. Some sediment is still being stored in the bottoms of pools and low velocity habitat types and only moves during high flows.

VII. Effects of the Action

Effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 C.F.R. § 402.01, as revised by 84 FR 44976). This section will describe and analyze the effects of project on bull trout and bull trout critical habitat.

Factors considered during the analysis of direct and indirect effects of the proposed action on the species and/or critical habitat and its interrelated and interdependent activities include:

Magnitude - The severity and intensity of effects of the proposed action to each life stage of the species or critical habitat, including "delivery" sites and the "downstream" magnitude.

Proximity of the Action – Location of the action relative to the species, management units, or designated critical habitat units.

Distribution - The geographic area(s) in which the disturbance would occur (may be several small or one large area).

Timing - When the effect would occur in relation to the species' life-history patterns.

Nature of the Effect - Effects of the action on elements of a species' lifecycle, population size or variability, or distribution; or on the primary constituent elements of the critical habitat, including direct and indirect effects.

Disturbance Frequency - How often the effect would occur. Is this a onetime event or a chronic source of disturbance?

Duration - The effects of a proposed action on listed species or critical habitat depend largely on the duration of its effects. Three potential categories of effects are: (1) a short-term event whose effects are relaxed almost immediately (pulse effect), (2) a sustained, long-term, or chronic event whose effects are not relaxed (press effect), or (3) a permanent event that sets a new threshold for some feature of a species' environment (threshold effect). A "permanent event is essentially a long-term press effect.

This BO analyzes the effects of the Piquett Creek Project on bull trout. The proposed action includes several project elements (e.g. timber harvest, temporary road construction, road maintenance/rehabilitation, road use, prescribed burning) that have the potential to result in effects to habitat indicators, which in turn can have effects to the species. Five habitat features have the potential to be affected by the proposed action, and will be discussed further: sediment, water temperature, water chemistry, woody debris recruitment, and migration barriers. As shown in Table 2 and detailed in the BA, the proposed action would not affect other indicators.

Table 3. Matrix of indicators for bull trout in the three watersheds affected by the Piquett Creek Project. Numbers next to the indicators reflect the corresponding PCEs for bull trout critical habitat.

	Piquett Creeek HUC 0303	West Fork Bitterroot River-Lloyd Creek HUC 0305
Subpopulation Characteristics		
Subpopulation Size	FAR (m)	FUR (m)
Growth & Survival	FAR (m)	FUR (m)
Life History Diversity & Isolation	FAR (m)	FAR (m)
Persistence & Genetic Integrity	FUR (m)	FUR (m)
Water Quality		
Temperature[2,3,5,8]	FAR (m)	FUR (m)
Sediment[2,3,6,8]	FUR (d/m)	FAR (m)
Chemical Contamination/Nutrients[1,2,3,8]	FA (m)	FA (m)
Habitat Access		
Physical Barriers	FAR (m)	FUR (r)
Habitat Elements		
Substrate Embeddedness[1,3,6]	FUR (d/m)	FA (m)
Large Woody Debris[4,6]	FAR (m)	FAR (m)
Pool Frequency & Quality[3,4,6]	FAR (m)	FAR (m)
Large Pools[4,5]	FAR (m)	FAR (m)
Off Channel Habitat[4]	FUR (m)	FUR (m)
Refugia[2,5,9]	FAR (m)	FAR (m)
Channel Condition & Dynamics		
Wetted Width/Depth Ratio[2,4,5]	FAR (m)	FAR (m)
Streambank Condition[1,4,5,6]	FUR (m)	FUR (m)
Floodplain Connectivity[1,3,4,5,7,8]	FUR (m)	FUR (m)
Flow Hydrology		
Change in Peak/Base Flows [1,2,5,7,8]	FAR (m)	FUR (m)
Drainage Network Increase[1,7,8]	FAR (m)	FUR (m)
Watershed Conditions		
Road Density & Location[1,5,7]	FUR (m)	FAR (m)
Disturbance History[4,7,8,9]	FAR (m)	FA (m)
Riparian Conservation Areas[1,3,4,5,7]	FUR (m)	FUR (m)
Disturbance Regime[4,7,8]	FAR (m)	FAR (m)
Integration of Species and Habitat Conditions	FUR (m)	FUR (m)

FA = Functioning Appropriately, FAR = Functioning at Risk, FUR = Functioning at Unacceptable Risk.
r = restore, m = maintain, d = degrade. Lower case = minor effects, uppercase = major effects.

A. Effects of Harvest and Other Vegetation Management Activities

Vegetation management activities proposed under the project are not expected to affect bull trout, for reasons detailed in the BA and summarized here. Treatments such as commercial harvest, pre-commercial thinning, and prescribed fire would incorporate protective Riparian Habitat Conservation Areas (RHCAs) of 100 to 300 feet (for intermittent to fish-bearing streams, respectively). There would no felling of commercial-sized trees, and no skidding, yarding, or placement of log landings within RHCAs. This design feature would prevent timber harvest activities from being able to deliver sediment into streams.

Prescribed fire and manual thinning treatments could occur within RHCAs as long as the activities comply with the design elements listed in Section 3 of the BA, including no hand thinning, pile burning, or lighting fire within 50 feet of streams. With the application of those design elements, prescribed burning (and its associated manual thinning treatments) is unlikely to add measurable quantities of sediment to streams. Burning within the RHCAs is expected to be fairly low intensity, with little chance of burning hot enough to kill overstory trees or affect shading in riparian areas. Therefore, no additional effects to temperature are expected.

No timber harvest activities would occur in RHCAs, and the design elements for prescribed burning and manual thinning would preserve riparian shading. Thus, effects to stream temperatures would be discountable, as detailed in the BA. Woody debris recruitment would likewise experience discountable effects from the project, as only non-merchantable trees would be cut within RHCAs, and prescribed burning is not expected to be hot enough to kill significant numbers of mature trees in riparian areas. Changes to forest vegetation structure and amount of live vegetation affected would have little, if any effect on flow and hydrology parameters in the action area. Therefore, overall the effects of *Harvest and Other Vegetation Management* activities would not change any Framework/Matrix indicators and are insignificant or discountable to bull trout.

B. Effects of Road and Trail Use, Construction, and Maintenance

Sediment—

If sediment delivery of significant magnitude, intensity and duration occurs during project implementation when bull trout are spawning or eggs are in gravel, spawning success could be reduced by potentially killing individual eggs or lengthening the time it takes for eggs to hatch. This could reduce recruitment of new individuals to the population and ultimately reduce subpopulation size if enough individuals are negatively affected. Increased fine sediment affects developing bull trout eggs by filling interstitial spaces within stream substrate that reduces or eliminates the flow of water through the redd, thus limiting the supply of oxygen to developing eggs and removal of waste products. Elevated fine sediment (<6.4 mm) in spawning gravels can lead to reduced egg survival (Rieman and McIntyre 1993), reduced emergence success of bull trout (Weaver and White 1985 as cited in Rieman and McIntyre 1993), and limit access to substrate interstices that provide important cover during rearing and over-wintering periods (Goetz 1994, Jakober et al. 1998). Greater and more persistent mortality of salmonid embryos can occur from chronic sediment delivery compared to pulse events (Maturana et al. 2013).

Sediment can also affect juvenile and adult bull trout. High levels of sediment can result in direct mortality to fish by damaging delicate gill structures. Sediment decreases pool habitat quality, an essential rearing and cover component for bull trout which provides protection from predators and the elements. Fine sediments may reduce the availability of wintering habitat for adult and juvenile fish by increasing substrate embeddedness.

Sediment can affect bull trout populations through impacts or alterations to the macroinvertebrate communities or populations. Aquatic insect abundance can decline by approximately 50 percent when substrate embeddedness reaches a level of one-third (Waters 1995). Decreased growth rates can occur when increased substrate embeddedness leads to a reduction in aquatic insect production (Bjornn et al. 1977, Weaver and Fraley 1991, Bowerman et. al 2014). Higher turbidity and suspended sediment can reduce primary productivity by decreasing light intensity and periphytic (attached) algal and other plant communities (Anderson et al. 1976, Henley et al. 2000, Suren and Jowett 2001). Sedimentation can alter the habitat for macroinvertebrates, changing the species density, diversity and structure of the area (Waters 1995, Anderson et al. 1976, Reid and Anderson 1999, Shaw and Richardson 2001).

Sediment effects to bull trout depend on the amount of sediment produced, but more importantly on the amount actually delivered to streams. Proximity of sediment producing location to streams, duration of sediment production, and management actions to reduce sediment delivery all influence the amount of sediment delivered to streams. The timing of sediment delivery to streams is also an important factor to consider for bull trout.

Temporary roads and tracked line machine (TLM) trails will be built as part of the proposed action. Design features will ensure that none of these will be constructed within RHCAs, and monitoring presented in the BA shows a history of RHCA buffers being effective at attenuating any sediment before it can be delivered to streams. Thus we expect the effects of temporary roads and TLM trails to be discountable.

The existing road system poses a relatively high risk of chronic erosion and consequential increased fine sediment loading to action area streams. Roads are a chronic source of erosion, particularly those that occur within 100 feet or less of streams. Road maintenance actions (e.g. blading, installing dips, clearing ditch lines) are expected to de-compact road surfaces and allow fine particles to mobilize during subsequent rain events. The weight and frequent trips of log trucks grinds larger road surface aggregates into fine particles which are then similarly available for transport (Luce and Black 2001b). These fine particles can then be delivered to streams by water when roads are located adjacent to streams or at stream crossings. Up to 500 log truck loads (defined as one log truck driving in empty and then driving back out loaded) would be hauled from the project area. This amount of log truck traffic will be a substantial increase over the baseline, but is not expected to deliver substantial amounts of sediment to the streams due to design features described below.

Forest Road (FR) 49 is the largest potential delivery source and the highest concern for the fishery in Piquett Creek and within the action area, as it occurs within 100 feet of the stream in multiple locations. In addition, two crossings of Piquett Creek offer sites for direct sediment delivery, where FR 49 crosses Piquett Creek via bridge, and where FR 5720 crosses Piquett Creek via bridge. The proposed action includes installing straw bale check dams on the outlets of the ditch relief culverts and other potential sediment delivery points. These check dams have been shown to be an effective method to minimize road sediment inputs to nearby streams (see data referenced in the BA). Timing restrictions would likewise help to minimize sediment production and delivery, as hauling would be restricted to dry periods and summer and autumn, with all hauling completed by November 15. The Forest estimates that all haul may be accomplished in one year, although it could take more than one year to complete. The Service thus anticipates haul to occur in two years, meaning two years of minor degrades to the habitat conditions.

Additional measures to ensure sediment production is minimized and sediment delivery is negligible include graveling all stream crossings on haul routes prior to hauling logs. All of FR 49 is currently graveled, and the segment closest to the stream, between mileposts 0.2 and 1.1, would receive a new lift of gravel prior to hauling logs. The gravel would make the haul routes more resistant to rutting and powdering than native surface roads, thus minimizing the amount of sediment that could be delivered to streams.

After the project is complete, the gravel lift and the Best Management Practice (BMP) upgrades would continue to be effective at reducing the amount of sediment that is delivered to streams in the action area. This may result in a slight "restore" for the sediment indicator for 10-15 years after project implementation, but because it is not a permanent measure, the sediment indicator is expected to be "maintained" in its current condition of FUR in the long-term. The proposed vegetation treatments would reduce the risk of high severity fire in the action area, particularly fire that would severely affect riparian areas. Thus the proposed action would lower the risk of fires like the Rombo Fire of 2007 that resulted in increased erosion and debris flows that affected sediment and bull trout in Piquett Creek for about five years. This would not change any of the matrix indicators, but is an important component of the project.

To summarize, the proposed action includes a suite of design features that are intended to minimize the amount of sediment produced by proposed activities, and to minimize the amount of sediment that is delivered to streams in the action area. The amount of sediment delivered is expected to be so minor as to be unmeasurable. Because the amount of sediment delivery will be unmeasurable, the effects to individual bull trout are likewise expected to be unmeasurable or undetectable, and thus insignificant. However, because the existing conditions in the watershed have elevated sediment, adverse effects would still be expected to bull trout in Piquett Creek.

Substrate Embeddedness--

Substrate embeddedness is defined as the degree to which large particles (e.g., boulders, gravel) are surrounded or covered by fine sediment, usually measured in classes according to percentage covered (U.S. Fish and Wildlife Service 2015). As sediment in the water column settles out, substrate embeddedness increases at locations sediment is deposited. The *sediment* and *substrate embeddedness* indicators are therefore closely related, with the difference lying in the habitat pathway and bull trout life stage these two indicators address. The *sediment* indicator is intended to addresses the Water Quality pathway, while *substrate embeddedness* addresses the Habitat Elements pathway (U.S. Fish and Wildlife Service 1998). Increased substrate embeddedness reduces spawning and rearing success at all life stages (effects to redds, eggs, and alevins) and may also reduce productivity of macroinvertebrates that are a food source for bull trout.

Due to their relationship, effects of the Piquett Creek Project to the indicator *substrate embeddedness* are the same as those for *sediment* and the project would result in a minor "degrade" to *substrate embeddedness* in the Willow Creek HUC. Increases to *substrate embeddedness* would be most pronounced directly below any sediment delivery points and decline further downstream. Downstream distance and magnitude of effects would depend on the amount and duration of sediment delivery and minimization measures to reduce sediment production and delivery.

Because all project-related haul would occur within the generally dry season (April – November 15), and because of the project design criteria that will help to minimize sediment delivery, any sediment that is delivered and embedded due to the proposed action would be expected to embed over the winter. That sediment would flush during spring runoff the following spring. Thus a minor degrade may occur for one to a few years, as long as timber haul is occurring in the Piquett Creek watershed. The Forest estimated all haul would likely be completed in one year, or perhaps two years. The Service thus anticipates haul to occur in two years, meaning two years of minor degrades to the habitat conditions. Because substrate embeddedness is already functioning at an unacceptable risk in Piquett Creek, the additional effects, even if very minor, would further degrade spawning habitat for bull trout. This could lead to minor reductions in the amount or distribution of spawning habitat.

The effects to bull trout are expected to be insignificant due to the unmeasurable amount of sediment expected to be delivered. BMP upgrades on the two bridges across Piquett Creek that will be used for haul routes, plus the graveling on road 49, will provide improvements to the existing condition, at least for several years. Therefore the overall conditions are expected to improve to a slight extent for roughly 10-15 years, based on previous experience and monitoring showing length of time similar BMPs have been effective on other parts of the Bitterroot NF, as well as in the Piquett project area.

Effects to Local Populations

Despite adverse effects to habitat due to baseline sediment levels in the analysis area, it is expected that bull trout populations in Piquett Creek are expected to maintain current population levels, based on past history. As described above, populations of the fish have demonstrated inherent resiliency despite long-term chronic sediment introductions from the Piquett Creek road, the pulse of sediment that resulted from the 2007 Rombo Fire in the headwaters of the watershed, and other sources. With careful implementation of the proposed action, the habitat should be resilient to project activities. Therefore *growth and survival* of bull trout in Piquett Creek and West Fork Bitterroot are expected to be maintained. No other subpopulation characteristics are expected to change.

Piquett Creek is not identified as a local population in the Bull Trout Recovery Plan (USFWS 2015), although it is occupied by bull trout and provides spawning and rearing habitat (SR). The West Fork Bitterroot River primarily serves as a migratory corridor and provides adult holding and juvenile rearing habitat. Local populations are, for the most part, independent populations that represent discrete reproductive units. Adverse effects due to the existing conditions in the Piquett Creek analysis area would continue to adversely affect individual bull trout but would not reach levels that appreciably reduce survival and recovery for the designated local populations or other important populations.

Effects to the Core Areas

The Piquett Creek Project would not reach levels that appreciably reduce survival and recovery of any designated local populations or other important populations, therefore it would not impair the viability of the Bitterroot River Core Area.

Effects to the Recovery Unit

Because the Piquett Creek Project does not impair the viability of the Bitterroot River Core Area, it will not impair or preclude the capacity of the Columbia Headwaters Recovery Unit from providing both the survival and recovery function assigned to it.

VIII. Cumulative Effects

The implementing regulations for section 7 define cumulative effects as "…those effects of future State or private activities, not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to consultation." (50 CFR 402.02). 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 the Act. It is important to note that the section 7 definition (related to the Act) is not the same as the definition of "cumulative effects" under the National Environmental Policy Act.

The action area is mostly public (National Forest) land, with private lands bordering the lower mile of Piquett Creek, the lower 0.2 miles of East Piquett Creek, and about a 0.5 mile section of the West Fork Bitterroot River below the mouth of Piquett Creek. Because these private lands are rural, agricultural lands with a few homesites on them, the reasonably foreseeable activities on private lands within the project area include road and lawn maintenance, riparian disturbance due to horse grazing and hay cutting, and water withdrawals. Effects to fish habitat resulting from these practices include reduced channel stability, decreased habitat complexity, increased nutrient inputs, increased sedimentation, increased stream temperature, and reduced base flows. Although all of these activities are likely to occur, the amount and intensity on private land would not change the scope or magnitude of effects anticipated from this proposal.

In addition, the Ravalli County Road and Bridge Department spreads traction sand on the West Fork Highway when plowing the highway in winter. This activity is certain to continue in the future. Over the course of the winter, a small amount of this sand gets into the action area portion of the West Fork Bitterroot River between the mouth of Piquett Creek and the driveway entrance to the Triple Creek Guest Ranch. The section of river affected by the traction sand, however, has low levels of sediment.

Residential development is anticipated to increase throughout western Montana which can affect both the species and habitat. With human population growth and development, it is reasonable to assume that some corresponding increase in human use of NFS lands is likely to occur. This increase is likely to be gradual and incremental, and will likely be focused on areas along or near roads open to motorized traffic. Increased human use will result in increased angler pressure within the project area. Angler harvest and poaching has been identified as one reason for bull trout decline (U.S. Fish and Wildlife Service 2015b). It is likely that recreational fishing, especially in known spawning streams in the fall, will increase as the human population in western Montana increases. 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. 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 fish (Long 1997).

The harvest of bull trout, either unintentionally or illegally, could have a direct effect on the 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).

Global climate change and the related warming of our climate have been well documented. Evidence of global climate change/warming includes widespread increases in average air and ocean temperatures, accelerated melting of glaciers, and rising sea level. Given the increasing certainty that climate change is occurring and is accelerating (IPCC 2007, Battin et al. 2007), we can no longer assume that climate conditions in the future will resemble those in the past.

Cumulative effects within 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 are well documented (U.S. Fish and Wildlife Service 2015). Activities occurring on County and private lands at the same time the proposed federal activities are occurring may 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 over the long-term and will work in concert with federal actions toward recovery of bull trout in some instances.

IX. Conclusion

It is the Service's biological opinion that the Piquett Creek Project will result in adverse effects to bull trout due to increased sediment delivery to occupied bull trout habitat in the action area. The adverse effects would be limited to a single-season pulse event in which additional sediment would be delivered to Piquett Creek, and would have the potential to impair breeding, feeding, or sheltering for bull trout and reduce the quality of spawning and rearing habitat.

Jeopardy Analysis

After reviewing the current status of bull trout, the environmental baseline for the action area, the effects of the proposed management 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 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 (USFWS 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 [then] 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, the approach to the jeopardy analysis in relation to the proposed action follows a hierarchal relationship between units of analysis (i.e., geographical subdivisions) that characterize effects at the lowest unit or scale of analysis (the local population) toward the highest unit or scale of analysis (the Columbia Headwaters Recovery Unit). The hierarchal relationship between units of analysis (local population, core areas) used to determine whether the proposed action, is likely to jeopardize the survival and recovery of bull trout. If the adverse effects of the proposed action do 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), then the proposed action could not jeopardize bull trout in the coterminous United States (i.e., rangewide). Therefore, the determination is appropriately a no-jeopardy finding. However, if a proposed action causes adverse effects that are determined to appreciably reduce both survival and recovery of the species at a lower scale of analysis (i.e., local population), then further analysis is warranted at the next higher scale (i.e., core area).

Our rationale for this no jeopardy conclusion is based on the following:

- Minimization measures (i.e., required design criteria and BMPs) employed by the Forest during implementation of the proposed action are likely to be effective in reducing sediment generated by the proposed project activities. Implementation will reduce short-term adverse effects.

- Implementation of BMPs, road treatments at sediment delivery sources, will occur prior to the log hauling season.

- Implementation of the proposed action is not anticipated to substantially reduce the reproduction, numbers, or distribution of bull trout within Piquett Creek (which is not designated as a local population) to the degree that the likelihood of survival or recovery is reduced.

- As implementation of the proposed action is not anticipated to substantially reduce the reproduction, numbers, or distribution of bull trout within the local population, it is thus not likely to appreciably reduce the likelihood of survival or recovery of bull trout within the Bitterroot Core Area.

- As implementation of the proposed action is not likely to appreciably reduce the likelihood of survival or recovery of this core area, it is unlikely that the proposed action would jeopardize the continued existence of the bull trout in the Upper Clark Fork Geographic Unit, or the Columbia River bull trout population and the coterminous listing of bull trout.

The Service has reviewed the environmental baseline, the effects of the proposed action, the cumulative effects, the current status of bull trout in the action area, and their relationship to the Bitterroot Core Area. We considered effects to the Piquett Creek population, which is not a recognized local population in the Recovery Plan, but is a substantial population of resident bull trout in the Bitterroot Core Area. We also considered effects to bull trout in the West Fork Bitterroot River in the action area. The short-term effects of the proposed action may temporarily reduce the survival or reproduction of ***individuals*** within the Piquett Creek population due to some unavoidable sediment loading and thus *take* associated therein. The long-term effects of the proposed action will be to maintain the habitat and population in their current form, but will not improve the survival and thus recovery of the ***species*** at the local population scale. As a result, the Service concludes that implementation of this project is ***not likely to appreciably reduce survival, recovery, or the continued existence*** of bull trout at the scale of the Bitterroot Core Area, the Upper Clark Fork Geographic Area, nor the Columbia Headwaters Recovery Unit, respectively, and by extension, the coterminous United States Population of bull trout.

Incidental Take Statement

Amount or Extent of Take Anticipated

The Service anticipates that project activities will likely result in incidental take of bull trout in the form of harm, harassment or mortality related to the existing degraded habitat for bull trout in terms of sediment, in addition to the very minor additional sediment that is expected to be delivered to as a result of the proposed action. Activity-created sediment, when additively combined with increased background sediment (baseline conditions), may impact bull trout habitat parameters including *sediment* and *substrate embeddedness*. Sedimentation from associated project activities is anticipated to have short-term adverse effects and likely result in mortality to some individuals during the egg, larval and juvenile life history stages by harming or impairing feeding and sheltering patterns of juvenile bull trout.

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

1. The amount of sediment produced and delivered is influenced by local site parameters (e.g. topography and soil type), weather, time of implementation, and effectiveness of the mitigation measures.
2. The amount and location of sediment deposition depends on numerous factors (e.g. flow regime, size of stream, channel roughness, gradient).
3. Aquatic habitat modifications are difficult to ascribe to particular sources; chronic effects from the existing road network cannot be completely separated from project effects.
4. Identification and detection of dead or impaired species is unlikely. Losses may also be masked by seasonal fluctuations in numbers.

For these reasons, the Service has determined the actual amount or extent of incidental take is difficult to determine. In these cases, the Service uses surrogate measures to measure the amount or extent of incidental take and determine when the amount of take anticipated has been exceeded.

According to Service policy, as stated in the Endangered Species Consultation Handbook (Handbook; U.S. Fish and Wildlife Service and National Marine Fisheries Service, 1998), some detectable measure of effect should be provided, such as the relative occurrence of the species or a surrogate species in the local community, or amount of habitat used by the species, to serve as a measure for take. Take also may be expressed as a change in habitat characteristics affecting the species (Handbook, p 4-47 to 4-48).

In this biological opinion, the Service uses the following surrogate measures of take: "timely and effective implementation of best management practices (BMPs) on roads used for log hauling," "maximum number of log truck trips," and "number of years of timber haul," and "RHCAs that provide shading for streams." The level of take covered by these surrogate measures would be exceeded if:

1. Road BMPs and drainage improvements specified in Appendix B of the fisheries biological assessment are not implemented on new and/or existing roads prior to the first log haul, and/or not maintained throughout the duration of the project.
2. BMPs are determined to be ineffective and corrective action is not implemented within 10 working days or as agreed to by the Service.
3. The number of log trucks exceeds 500 loads (a load is defined as one log truck going in empty and coming out loaded).
4. Haul occurs outside of dry conditions and/or exceeds two seasons (a season is defined as April 1– November 15 of one calendar year).
5. Prescribed burning reaches a moderately high to high intensity in RHCAs within the analysis area, such that sediment is delivered to action area streams.

The Service anticipates that incidental take of bull trout would occur for the Piquett Creek population in the Bitterroot River Core Area. The continued presence of bull trout in these streams is susceptible to adverse effects from project-related effects.

Effect of the Take

In the accompanying biological opinion, the Service determined that the extent and type of take described may adversely affect individuals, but is not likely to jeopardize the continued existence of bull trout in the Bitterroot River Core Area of the Columbia Headwaters Recovery Unit.

Reasonable and Prudent Measures

Biological opinions provide *reasonable and prudent measures* that are expected to reduce the amount of incidental take. Reasonable and prudent measures are those measures necessary and appropriate to minimize incidental take resulting from proposed actions. Reasonable and prudent measures are nondiscretionary and must be implemented by the agency in order for the exemption in section 7(o)(2) to apply.

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

1) Identify and implement means to reduce the potential for incidental take of bull trout related to the magnitude of sediment delivery to streams during project implementation.

2) Monitor prescribed burning, road use, and road treatments associated with the Piquett Creek Project to ensure that actions comply with the biological assessment and biological opinion, and that the specified level of incidental take associated with these elements is not exceeded.

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

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the Forest must comply with the following terms and conditions that implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary:

To fulfill reasonable and prudent measure #1 (reduce the potential for incidental take of bull trout due to the magnitude of sediment delivery) the following terms and conditions shall be implemented:

A. The Forest will ensure that all BMPs (including those identified in Appendix1 of the biological assessment) are implemented prior to any timber haul, and that BMPs are maintained to ensure their effectiveness throughout the duration of the project.

B. Throughout the life of the timber sale, the Forest will determine if road conditions are in danger of being degraded to the point where there is a high risk of sediment deposition to streams. The Forest will temporarily suspend haul or other use until corrective actions can be implemented or until natural conditions are again conducive to use without creating sediment inputs to project area streams.

To fulfill reasonable and prudent measure #2 (monitor the project activities to ensure the incidental take associated with these elements is not exceeded), the following terms and conditions shall be implemented:

C. The Forest shall monitor the number of log truck loads hauled out of the project area. If the number reaches 500 trips, the Forest will ensure hauling is halted and will contact the Service to reinitiate consultation.

D. The Forest shall record the date that timber haul begins, and the date that timber haul ends for the season, for the Piquett Creek project.

E. The Forest shall monitor the condition and use of forest roads used for haul routes to ensure that BMPs are effectively minimizing sediment or debris delivery to streams. The frequency of monitoring shall be commensurate with risk, including frequency/intensity of road use and recent weather. The Forest will document the frequency of visits and the effectiveness of the BMPs in minimizing sediment delivery to bull trout occupied waters.

F. The Forest shall monitor the amount of burning that occurs in RHCAs, and report on 1) total acres of RHCA burned, 2) acres burned at low intensity that does not affect sediment delivery, 3) acres burned at high enough intensity to affect sediment delivery to streams.

To fulfill reasonable and prudent measure #3 (report findings to the Service), the following terms and conditions shall be implemented:

G. The Forest shall notify the Service when timber haul begins for the Piquett Creek project, and will provide a report to the Service by Dec 1 or by an alternate date as agreed upon with the Service. The report shall include BMP effectiveness monitoring information, RHCA burning information, and total number of log truck loads hauled from the project area.

H. Upon locating dead, injured or sick bull trout, or upon observing destruction of redds, notification must be made within 24 hours to the Montana Ecological Services Office at 406-449-5225. Record information relative to the date, time, and location of dead or injured bull trout.

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, the terms and conditions are not adhered to, the level of incidental take anticipated in the biological opinion may be exceeded. Such incidental take may represent new information requiring re-initiation of consultation and review of the reasonable and prudent measures provided. The Service retains the discretion to determine whether non-compliance with terms and conditions results in incidental take exceeding that considered here, and whether consultation should be re-initiated. The Forest must immediately provide an explanation of the causes of any non-compliance and review with the Service the need for possible modification of the reasonable and prudent measures.

Conservation Recommendations

Section 7(a)(1) of the Act directs federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary recommendations that: (1) identify discretionary measures a federal agency can take to minimize or avoid the adverse effects of a proposed action on listed or proposed species, or designated or proposed critical habitat, (2) identify studies, monitoring, or research to develop new information on listed or proposed species, or designated or proposed critical habitat, and (3) include suggestions on how an action agency can assist species conservation as part of their action and in furtherance of their authorities under section 7(a)(1) of the Act. The Service provides the following recommendations:

Section 2672.2 of the Forest Service Manual states: “The Forest Service must manage habitats at levels that accomplish the recovery of federally listed species so that protective measures under the Act are no longer necessary.” The Bull Trout Conservation Strategy (BTCS) on Forest Service Lands (U.S. Forest Service 2013) was intended, in part, to “help direct resources to the most important opportunities, where Forest Service management has the potential to increase habitat quality and connectivity." The BTCS (U.S. Forest Service 2013) should be reviewed for management opportunities that will improve habitat conditions that are conducive to the recovery of bull trout.

1. The Forest should continue to monitor, inventory, investigate, and document bull trout populations and spawning activities throughout the action area and other potential areas of the Forest. For example, recent techniques using eDNA provide efficient, cost-effective methods to document bull trout that other methods may not provide. The use of eDNA sampling or other methods of sampling is especially encouraged in priority watersheds on the Forest. All existing bull trout spawning surveys should be continued as a population monitoring tool using historic methods.
2. The Forest Service should work cooperatively with state, private, and other federal agencies to improve habitat conditions for bull trout on the Bitterroot National Forest, including impacts caused by lack of connectivity, drought, barriers to fish passage, irrigation related issues including irrigation withdrawal and entrainment on private and other government lands.
3. Continue to monitor large wood recruitment and density within the Burnt Fork and Willow Creek, and consider planning projects that would add large wood to these streams to improve the *large woody debris* indicator from FUR to FAR.
4. The Forest Service should identify and pursue the introduction/reintroduction of bull trout into appropriate locations in order to benefit the long conservation of bull trout.

Reinitiation Notice

This concludes formal consultation for bull trout on the Piquett Project for the Bitterroot National Forest. 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.

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Appendix A: Status of the Species—Bull Trout

This section provides information about the bull trout's life history, habitat preferences, geographic distribution, population trends, threats, and conservation needs. This includes description of the effects of past human activities and natural events that have led to the current status of the bull trout. This information provides the background for analyses in later sections of the biological opinion. The proposed and final listing rules contain a physical species description (USFWS 1998, 63 FR 31647; USFWS 1999, 64 FR 58910). Additional information can be found at https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=E065.

Listing Status and Current Range

The coterminous United States population of the bull trout (*Salvelinus confluentus*) was listed as threatened on November 1, 1999 (USFWS 1999, 64 FR 58910). The threatened bull trout occurs in the Klamath River Basin of south-central Oregon; the Jarbidge River in Nevada; the Willamette River Basin in Oregon; Pacific Coast drainages of Washington, including Puget Sound; major rivers in Idaho, Oregon, Washington, and Montana, within the Columbia River Basin; and the St. Mary-Belly River, east of the Continental Divide in northwestern Montana (Bond 1992, p. 2; Brewin and Brewin 1997, p. 215; Cavender 1978, pp. 165-166; Leary and Allendorf 1997, pp. 716-719; USFWS 1998, 63 FR 31647; USFWS 1999, 64 FR 58910; USFWS 2010, 75 FR 2269; USFWS 2015, pg. 1).

The final listing rule for the United States coterminous population of the bull trout discusses the consolidation of five DPSs into one listed taxon and the application of the jeopardy standard in accordance with the requirements of section 7 of the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 et seq.), relative to this species, and established five interim recovery units for each of these DPSs for the purposes of Consultation and Recovery (USFWS 1999, 64 FR 58930).

Six draft recovery units were identified based on new information (USFWS 2010, 75 FR 63898) that confirmed they were needed to ensure a resilient, redundant, and representative distribution of bull trout populations throughout the range of the listed entity. The final Recovery Plan for the Coterminous Bull Trout Population (bull trout recovery plan) formalized these six recovery units (USFWS 2015, pg. 36-43) (see Figure 1). The final recovery units replace the previous five interim recovery units and will be used in the application of the jeopardy standard for Section 7 consultation proceedures.

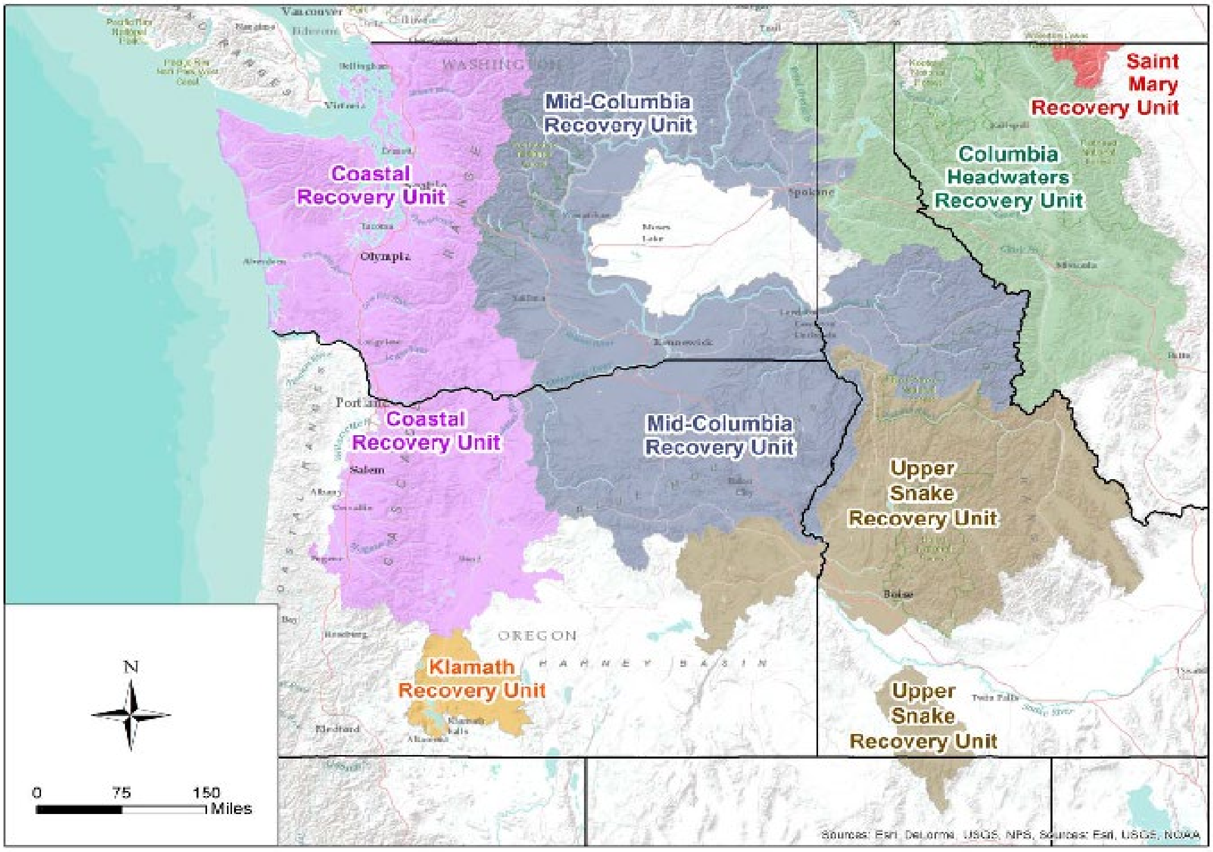

Figure 1. Locations of the six bull trout recovery units in the coterminous United States.

Reasons for Listing, Rangewide Trends and Threats

Throughout its range, the bull trout is threatened by the combined effects of habitat degradation, fragmentation, and alterations associated with dewatering, road construction and maintenance, mining, grazing, the blockage of migratory corridors by dams or other diversion structures, poor water quality; incidental angler harvest; entrainment (a process by which aquatic organisms are pulled through a diversion or other device) into diversion channels; and introduced non-native species (USFWS 1998, 63 FR 31647; USFWS 1999, 64 FR 58910). Poaching and incidental mortality of bull trout during other targeted fisheries are identified described in the bull trout recovery plan (see Threat Factors B and D) as additional threats (USFWS 2015, p. 150). Since the time of coterminous listing the species (USFWS 1999, 64 FR 58910) and designation of its critical habitat (USFWS 2004, 69 FR 59996; USFWS 2005b, 70 FR 56212; 2010, 75 FR 63898) a great deal of new information has been collected on the status of bull trout. The Service's Science Team Report (Whitesel et al 2004, entire), the bull trout core areas templates (USFWS 2005a, entire; USFWS 2009, entire), Conservation Status Assessment (USFWS 2005), and 5-year Reviews (USFWS 2008, entire; USFWS 2015g, entire) have provided additional information about threats and status. The final recovery plan lists other documents and meetings that compiled information about the status of bull trout (USFWS 2015, p. 3). As well, 2015 5-year review maintained the listing status as threatened based on the information compiled in the final bull trout recovery plan (USFWS 2015g, p.3) and the recovery unit implementation plans (RUIPs) (USFWS 2015a-f).

When first listed, the status of bull trout and its threats were reported by the Service at subpopulation scales. In 2002 and 2004, the draft recovery plans (USFWS 2002, entire; USFWS 2004, entire; USFWS 2004a, entire) included detailed information on threats at the recovery unit scale (i.e. similar to subbasin or regional watersheds), thus incorporating the metapopulation concept with core areas and local populations. In the 2008, 5-year Review, the Service established threats categories (i.e. dams, forest management, grazing, agricultural practices, transportation networks, mining, development and urbanization, fisheries management, small populations, limited habitat, and wild fire.) (USFWS 2008, entire). In the final recovery plan, threats and recovery actions are described for 109 core areas, forage/migration and overwintering areas, historical core areas, and research needs areas in each of the six recovery units (USFWS 2015, p 10-11). Primary threats are described in three broad categories: Habitat, Demographic, and Nonnative Fish for all recovery areas described in the listed range of the species. The 2015 5-year status review (USFWS 2015g, entire) references the final recovery plan and the recovery unit implementation plans and incorporates by reference the threats described therein. Although significant recovery actions have been implemented since the time of listing, the 5-year review concluded that bull trout still meets the definition of a "threatened" species (USFWS 2015g, entire).

New or Emerging Threats

The final Recovery Plan for the Coterminous Bull Trout Population (USFWS 2015, pg. 17) describes new or emerging threats, climate change, and other threats. Climate change was not addressed as a known threat when bull trout was listed. The 2015 bull trout recovery plan and RUIPs (USFWS 2015a-f) summarize the threat of climate change and acknowledge that some bull trout local populations and core areas may not persist into the future due to small populations, isolation, and effects of climate change (USFWS 2015, p. 48). The recovery plan further states that use of best available information will ensure future conservation efforts that offer the greatest long-term benefit to sustain bull trout and their required coldwater habitats (USFWS 2015, p. vii, and pp. 17-20). Mote et al. (2014) summarized climate change effects to include rising air temperature, changes in the timing of streamflow related to changing snowmelt, increases in extreme precipitation events, lower summer stream flows, and other changes. A warming trend in the mountains of western North America is expected to decrease snowpack, hasten spring runoff, reduce summer stream flows, and increase summer water temperatures (Poff et al. 2002, entire; Koopman et al. 2009, entire; PRBO Conservation Science 2011, entire). Lower flows as a result of smaller snowpack could reduce habitat, which might adversely affect bull trout reproduction and survival. Warmer water temperatures could lead to physiological stress and could also benefit nonnative fishes that prey on or compete with bull trout. Increases in the number and size of forest fires could also result from climate change (Westerling et al. 2006) and could adversely affect watershed function by resulting in faster runoff, lower base flows during the summer and fall, and increased sedimentation rates. Lower flows also may result in increased groundwater withdrawal for agricultural purposes and resultant reduced water availability in certain stream reaches occupied by bull trout (USFWS 2015b, p. B-10). Although all salmonids are likely to be affected by climate change, bull trout are especially vulnerable given that spawning and rearing are constrained by their location in upper watersheds and the requirement for cold water temperatures (Battin et al. 2007, pp. 6672-6673; Rieman et al. 2007, p. 1552). Climate change is expected to reduce the extent of cold water habitat (Isaak et al. 2015), and increase competition with other fish species (lake trout, brown trout, brook trout, and northern pike) for resources in remaining suitable habitat. Several authors project that brook trout, a fish species that competes for resources with and predates on the bull trout, will continue increasing their range in several areas (an elevation shift in distribution) due to the effects from climate change (Wenger et al. 2011, Isaak et al. 2010, 2014; Peterson et al. 2013; Dunham 2015).

Life History and Population Dynamics

Distribution

The historical range of bull trout includes major river basins in the Pacific Northwest at about 41 to 60 degrees North latitude, from the southern limits in the McCloud River in northern California and the Jarbidge River in Nevada to the headwaters of the Yukon River in the Northwest Territories, Canada (Cavender 1978, pp. 165-166; Bond 1992, p. 2). To the west, the bull trout's range includes Puget Sound, various coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992, p. 2). Bull trout occur in portions of the Columbia River and tributaries within the basin, including its headwaters in Montana and Canada. Bull trout also occur in the Klamath River basin of south-central Oregon. East of the Continental Divide, bull trout are found in the headwaters of the Saskatchewan River in Alberta and Montana and in the MacKenzie River system in Alberta and British Columbia, Canada (Cavender 1978, pp. 165-166; Brewin and Brewin 1997, entire).

Reproductive Biology

The iteroparous reproductive strategy (fishes that spawn multiple times, and therefore require safe two-way passage upstream and downstream) of bull trout has important repercussions for the management of this species. Bull trout require passage both upstream and downstream, not only for repeat spawning but also for foraging. Most fish ladders, however, were designed specifically for anadromous semelparous salmonids (fishes that spawn once and then die, and require only one-way passage upstream). 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 safe downstream passage route. Additionally, in some core areas, bull trout that migrate to marine waters must pass both upstream and downstream through areas with net fisheries at river mouths. This can increase the likelihood of mortality to bull trout during these spawning and foraging migrations.

Growth varies depending upon life-history strategy. Resident adults range from 6 to 12 inches total length, and migratory adults commonly reach 24 inches or more (Goetz 1989, p. 30; Pratt 1985, pp. 28-34). The largest verified bull trout is a 32-pound specimen caught in Lake Pend Oreille, Idaho, in 1949 (Simpson and Wallace 1982, p. 95).

Bull trout typically spawn from August through November during periods of increasing flows and decreasing water temperatures. Preferred spawning habitat consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989, p. 141). Redds are often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989, pp. 15-16; Pratt 1992, pp. 6-7; Rieman and McIntyre 1996, p. 133). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992, p. 1). After hatching, fry remain in the substrate, and time from egg deposition to emergence may surpass 220 days. Fry normally emerge from early April through May, depending on water temperatures and increasing stream flows (Pratt 1992, p. 1; Ratliff and Howell 1992, p. 10).

Early life stages of fish, specifically the developing embryo, require the highest inter-gravel dissolved oxygen (IGDO) levels, and are the most sensitive life stage to reduced oxygen levels. The oxygen demand of embryos depends on temperature and on stage of development, with the greatest IGDO required just prior to hatching.

A literature review conducted by the Washington Department of Ecology (WDOE 2002, p. 9) indicates that adverse effects of lower oxygen concentrations on embryo survival are magnified as temperatures increase above optimal (for incubation). Normal oxygen levels seen in rivers used by bull trout during spawning ranged from 8 to 12 mg/L (in the gravel), with corresponding instream levels of 10 to 11.5 mg/L (Stewart et al. 2007, p. 10). In addition, IGDO concentrations, water velocities in the water column, and especially the intergravel flow rate, are interrelated variables that affect the survival of incubating embryos (ODEQ 1995, Ch. 2 pp. 23-24). Due to a long incubation period of 220+ days, bull trout are particularly sensitive to adequate IGDO levels. An IGDO level below 8 mg/L is likely to result in mortality of eggs, embryos, and fry.

Population Structure

Bull trout exhibit both resident and migratory life history strategies. Both resident and migratory forms may be found together, and either form may produce offspring exhibiting either resident or migratory behavior (Rieman and McIntyre 1993, p. 2). Resident bull trout complete their entire life cycle in the tributary (or nearby) streams in which they spawn and rear. The resident form tends to be smaller than the migratory form at maturity and also produces fewer eggs (Goetz 1989, p. 15). Migratory bull trout spawn in tributary streams where juvenile fish rear 1 to 4 years before migrating to either a lake (adfluvial form), river (fluvial form) (Fraley and Shepard 1989, p. 138; Goetz 1989, p. 24), or saltwater (anadromous form) to rear as subadults and to live as adults (Brenkman and Corbett 2005, entire; McPhail and Baxter 1996, p. i; WDFW et al. 1997, p. 16). Bull trout normally reach sexual maturity in 4 to 7 years and may live longer than 12 years. They are iteroparous (they spawn more than once in a lifetime). Repeat- and alternate-year spawning has been reported, although repeat-spawning frequency and post-spawning mortality are not well documented (Fraley and Shepard 1989, p. 135; Leathe and Graham 1982, p. 95; Pratt 1992, p. 8; Rieman and McIntyre 1996, p. 133).

Bull trout are naturally migratory, which allows them to capitalize on temporally abundant food resources and larger downstream, and resident forms may develop where barriers (either natural or manmade) occur or where foraging, migrating, or overwintering habitats for migratory fish are minimized (Swanberg, 1997, entire; Brenkman and Corbett 2005, pp. 1075-1076; Goetz et al.

2004, p. 105, Starcevich et al 2012, entire; USFWS 2016, p. 170). For example, multiple life history forms (e.g., resident and fluvial) and multiple migration patterns have been noted in the Grande Ronde River (Baxter 2002, pp. 96, 98-106). Some river systems have retained habitat conditions that allow free movement between spawning and rearing areas and the mainstem Rivers. In these areas with connectivity bull trout can migrate between large rivers lakes, and spawning tributaries. Other migrations in Central Washington have shown that fluvial and adfluvial life forms travel long distances, migrate between core areas, and mix together in many locations where there is connectivity (Ringel et al 2014; Nelson and Nelle 2008). Such multiple life history strategies help to maintain the stability and persistence of bull trout populations to environmental changes. Benefits of connected habitat for migratory bull trout include greater growth in the more productive waters of larger streams, lakes, and marine waters; 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 (Frissell 1999, pp. 861-863; MBTSG 1998, p. 13; Rieman and McIntyre 1993, pp. 2-3). In the absence of the migratory bull trout life form, isolated populations cannot be replenished when disturbances make local habitats temporarily unsuitable. Therefore, the range of the species is diminished, and the potential for a greater reproductive contribution from larger size fish with higher fecundity is lost (Rieman and McIntyre 1993, p. 2).

Whitesel et al. (2004, p. 2) noted that although there are multiple resources that contribute to the subject, Spruell et al. (2003, entire) best summarized genetic information on bull trout population structure. Spruell et al. (2003, entire) analyzed 1,847 bull trout from 65 sampling locations, four located in three coastal drainages (Klamath, Queets, and Skagit Rivers), one in the Saskatchewan River drainage (Belly River), and 60 scattered throughout the Columbia River Basin. They concluded that there is a consistent pattern among genetic studies of bull trout, regardless of whether examining allozymes, mitochondrial DNA, or most recently microsatellite loci. Typically, the genetic pattern shows relatively little genetic variation within populations, but substantial divergence among populations. Microsatellite loci analysis supports the existence of at least three major genetically differentiated groups (or evolutionary lineages) of bull trout (Spruell et al. 2003, p. 17). They were characterized as:

i. "Coastal", including the Deschutes River and all of the Columbia River drainage downstream, as well as most coastal streams in Washington, Oregon, and British Columbia. A compelling case also exists that the Klamath Basin represents a unique evolutionary lineage within the coastal group.
ii. "Snake River", which also included the John Day, Umatilla, and Walla Walla rivers. Despite close proximity of the John Day and Deschutes Rivers, a striking level of divergence between bull trout in these two systems was observed.
iii. "Upper Columbia River" which includes the entire basin in Montana and northern Idaho. A tentative assignment was made by Spruell et al. (2003, p. 25) of the Saskatchewan River drainage populations (east of the continental divide), grouping them with the upper Columbia River group.

Spruell et al. (2003, p. 17) noted that within the major assemblages, populations were further subdivided, primarily at the level of major river basins. Taylor et al. (1999, entire) surveyed bull trout populations, primarily from Canada, and found a major divergence between inland and coastal populations. Costello et al. (2003, p. 328) suggested the patterns reflected the existence of two glacial refugia, consistent with the conclusions of Taylor and Costello (2006, pg. 1165-1170), Spruell et al. (2003, p. 26) and the biogeographic analysis of Haas and McPhail (2001, entire). Both Taylor et al. (1999, p. 1166) and Spruell et al. (2003, p. 21) concluded that the Deschutes River represented the most upstream limit of the coastal lineage in the Columbia River Basin.

More recently, the USFWS identified additional genetic units within the coastal and interior lineages (Ardren et al. 2011, p. 18). Based on a recommendation in the USFWS's 5-year review of the species' status (USFWS 2008, p. 45), the USFWS reanalyzed the 27 recovery units identified in the 2002 draft bull trout recovery plan (USFWS 2002, p. 48) by utilizing, in part, information from previous genetic studies and new information from additional analysis (Ardren et al. 2011, entire). In this examination, the USFWS applied relevant factors from the joint USFWS and NMFS Distinct Population Segment (DPS) policy (USFWS 1996, entire) and subsequently identified six draft recovery units that contain assemblages of core areas that retain genetic and ecological integrity across the range of bull trout in the coterminous United States. These six draft recovery units were used to inform designation of critical habitat for bull trout by providing a context for deciding what habitats are essential for recovery (USFWS 2010, p. 63898). These six recovery units, adopted in the final bull trout recovery plan (USFWS 2015) and described further in the RUIPs (USFWS 2015a-f) include: Coastal, Klamath, Mid-Columbia, Columbia Headwaters, Saint Mary, and Upper Snake. A number of additional genetic analyses within core areas have been completed to understand uniqueness of local populations (Hawkins and Van Barren 2006, 2007; Small et al. 2009; DeHann and Neibauer 2012).

Population Dynamics

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. 4). Increased habitat fragmentation reduces the amount of available habitat and increases isolation from other populations of the same species (Saunders et al. 1991, entire). Burkey (1989, entire) 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 for local populations may be low and probability of extinction high (Burkey 1989, entire; Burkey 1995, entire).

Metapopulation concepts of conservation biology theory have been suggested relative to the distribution and characteristics of bull trout, although empirical evidence is relatively scant (Rieman and McIntyre 1993, p. 15; Dunham and Rieman 1999, entire; Rieman and Dunham 2000, entire). A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meffe and Carroll 1994, pp. 189-190). For inland bull trout, metapopulation theory is likely most applicable at the watershed scale where habitat consists of discrete patches or collections of habitat capable of supporting local populations; local populations are for the most part independent and represent discrete reproductive units; and long-term, low-rate dispersal patterns among component populations influences the persistence of at least some of the local populations (Rieman and Dunham 2000, entire). Ideally, multiple local populations distributed throughout a watershed provide a mechanism for spreading risk because the simultaneous loss of all local populations is unlikely.

However, habitat alteration, primarily through the construction of impoundments, dams, and water diversions has fragmented habitats, eliminated migratory corridors, and in many cases isolated bull trout in the headwaters of tributaries (Rieman and Clayton 1997, pp. 10-12; Dunham and Rieman 1999, p. 645; Spruell et al. 1999, pp. 118-120; Rieman and Dunham 2000, p. 55).

Human-induced factors as well as natural factors affecting bull trout distribution have likely limited the expression of the metapopulation concept for bull trout to patches of habitat within the overall distribution of the species (Dunham and Rieman 1999, entire). However, despite the theoretical fit, the relatively recent and brief time period during which bull trout investigations have taken place does not provide certainty as to whether a metapopulation dynamic is occurring (e.g., a balance between local extirpations and recolonizations) across the range of the bull trout or whether the persistence of bull trout in large or closely interconnected habitat patches (Dunham and Rieman 1999, entire) is simply reflective of a general deterministic trend towards extinction of the species where the larger or interconnected patches are relics of historically wider distribution (Rieman and Dunham 2000, pp. 56-57). Research does, however, provide genetic evidence for the presence of a metapopulation process for bull trout, at least in the Boise River Basin of Idaho (Whiteley et al. 2003, entire), while Whitesel et al. identifies that bull trout fit the metapopulation theory in several ways (Whitesel et al, 2004, p. 18-21).

Habitat Characteristics

The habitat requirements of bull trout are often generally expressed as the four “Cs”: cold, clean, complex, and connected habitat. Cold stream temperatures, clean water quality that is relatively free of sediment and contaminants, complex channel characteristics (including abundant large wood and undercut banks), and large patches of such habitat that are well connected by unobstructed migratory pathways are all needed to promote conservation of bull trout throughout all hierarchical levels.

Bull trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993, p. 4). Habitat components that influence bull trout distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrate, and migratory corridors (Fraley and Shepard 1989, entire; Goetz 1989, pp. 23, 25; Hoelscher and Bjornn 1989, pp. 19, 25; Howell and Buchanan 1992, pp. 30, 32; Pratt 1992, entire; Rich 1996, p. 17; Rieman and McIntyre 1993, pp. 4-6; Rieman and McIntyre 1995, entire; Sedell and Everest 1991, entire; Watson and Hillman 1997, entire). Watson and Hillman (1997, pp. 247-250) concluded that watersheds must have specific physical characteristics to provide the habitat requirements necessary for bull trout to successfully spawn and rear and that these specific characteristics are not necessarily present throughout these watersheds. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993, pp. 4-6), bull trout should not be expected to simultaneously occupy all available habitats.

Migratory corridors link seasonal habitats for all bull trout life histories. The ability to migrate is important to the persistence of bull trout (Rieman and McIntyre 1993, p. 2). Migrations facilitate gene flow among local populations when individuals from different local populations interbreed or stray to nonnatal streams. Local populations that are extirpated by catastrophic events may also become reestablished by bull trout migrants. However, it is important to note that the genetic structuring of bull trout indicates there is limited gene flow among bull trout populations, which may encourage local adaptation within individual populations, and that reestablishment of extirpated populations may take a long time (Rieman and McIntyre 1993, p. 2; Spruell et al. 1999, entire). Migration also allows bull trout to access more abundant or larger prey, which facilitates growth and reproduction. Additional benefits of migration and its relationship to foraging are discussed below under "Diet."

Cold water temperatures play an important role in determining bull trout habitat quality, as these fish are primarily found in colder streams, and spawning habitats are generally characterized by temperatures that drop below 9 °C in the fall (Fraley and Shepard 1989, p. 137; Pratt 1992, p. 5; Rieman and McIntyre 1993, p. 2).

Thermal requirements for bull trout appear to differ at different life stages. Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992, pp 7-8; Rieman and McIntyre 1993, p. 7). Optimum incubation temperatures for bull trout eggs range from 2 °C to 6 °C whereas optimum water temperatures for rearing range from about 6 °C to 10 °C (Buchanan and Gregory 1997, p. 4; Goetz 1989, p. 22). In Granite Creek, Idaho, Bonneau and Scarnecchia (1996, entire) observed that juvenile bull trout selected the coldest water available in a plunge pool, 8 °C to 9 °C, within a temperature gradient of 8 °C to 15 °C. In a landscape study relating bull trout distribution to maximum water temperatures, Dunham et al. (2003, p. 900) found that the probability of juvenile bull trout occurrence does not become high (i.e., greater than 0.75) until maximum temperatures decline to 11 °C to 12 °C.

Although bull trout are found primarily in cold streams, occasionally these fish are found in larger, warmer river systems throughout the Columbia River basin (Buchanan and Gregory 1997, p. 2; Fraley and Shepard 1989, pp. 133, 135; Rieman and McIntyre 1993, pp. 3-4; Rieman and McIntyre 1995, p. 287). Availability and proximity of cold water patches and food productivity can influence bull trout ability to survive in warmer rivers (Myrick 2002, pp. 6 and 13).

All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Fraley and Shepard 1989, p. 137; Goetz 1989, p. 19; Hoelscher and Bjornn 1989, p. 38; Pratt 1992, entire; Rich 1996, pp. 4-5; Sedell and Everest 1991, entire; Sexauer and James 1997, entire; Thomas 1992, pp. 4-6; Watson and Hillman 1997, p. 238). Maintaining bull trout habitat requires stable and complex stream channels and stable stream flows (Rieman and McIntyre 1993, pp. 5-6). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997, p. 364). These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel from winter through spring (Fraley and Shepard 1989, p. 141; Pratt 1992, p. 6; Pratt and Huston 1993, p. 70). Pratt (1992, p. 6) indicated that increases in fine sediment reduce egg survival and emergence.

Diet

Bull trout are opportunistic feeders, with food habits primarily a function of size and life-history strategy. Fish growth depends on the quantity and quality of food that is eaten, and as fish grow their foraging strategy changes as their food changes, in quantity, size, or other characteristics (Quinn 2005, pp. 195-200). Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macrozooplankton, and small fish (Boag 1987, p. 58; Donald and Alger 1993, pp. 242-243; Goetz 1989, pp. 33-34). Subadult and adult migratory bull trout generally feed on various fish species (Donald and Alger 1993, pp. 241-243; Fraley and Shepard 1989, pp. 135, 138; Leathe and Graham 1982, pp. 13, 50-56). Bull trout of all sizes other than fry have been found to eat fish half their length (Beauchamp and VanTassell 2001, p. 204). In nearshore marine areas of western Washington, bull trout feed on Pacific herring (*Clupea pallasi*), Pacific sand lance (*Ammodytes hexapterus*), and surf smelt (*Hypomesus pretiosus*) (Goetz et al. 2004, p. 105; WDFW et al. 1997, p. 23).

Bull trout migration and life history strategies are closely related to their feeding and foraging strategies and their environment. Migration allows bull trout to access optimal foraging areas and exploit a wider variety of prey resources both within and between core areas. Connectivity between the spawning, rearing, overwintering, and forage areas maintains this diversity. There have been recent studies documenting movement patterns in the Columbia River basin that document long distance migrations (Borrows et al 2016, entire; Schaller et al 2014, entire; USFWS 2016, entire). For example, a data report documented a juvenile bull trout from the Entiat made over a 200-mile migration between spawning grounds in the Entiat River to foraging and overwintering areas in Columbia and Yakima River near Prosser Dam (PTAGIS 2015, Tag Code 3D9.1C2CCD42DD). As well, in the Skagit River system, anadromous bull trout make migrations as long as 121 miles between marine foraging areas in Puget Sound and headwater spawning grounds, foraging on salmon eggs and juvenile salmon along their migration route (WDFW et al. 1997, p. 25). Anadromous bull trout also use marine waters as migration corridors to reach seasonal habitats in non-natal watersheds to forage and possibly overwinter (Brenkman and Corbett 2005, pp. 1078-1079; Goetz et al. 2004, entire).

Conservation Needs

The 2015 recovery plan for bull trout established the primary strategy for recovery of bull trout in the coterminous United States: (1) conserve bull trout so that they are geographically widespread across representative habitats and demographically stable in six recovery units; (2) effectively manage and ameliorate the primary threats in each of six recovery units at the core area scale such that bull trout are not likely to become endangered in the foreseeable future; (3) build upon the numerous and ongoing conservation actions implemented on behalf of bull trout since their listing in 1999, and improve our understanding of how various threat factors potentially affect the species; (4) use that information to work cooperatively with our partners to design, fund, prioritize, and implement effective conservation actions in those areas that offer the greatest long-term benefit to sustain bull trout and where recovery can be achieved; and (5) apply adaptive management principles to implementing the bull trout recovery program to account for new information (USFWS 2015, p. 24.) .

Information presented in prior draft recovery plans published in 2002 and 2004 (USFWS 2002, 2004, 2004a) provided information that identified the original list of threats and recovery actions across the range of the species and provided a framework for implementing numerous recovery actions by our partner agencies, local working groups, and others with an interest in bull trout conservation. Many recovery actions were completed prior to finalizing the recovery plan in 2015.

The 2015 recovery plan (USFWS 2015, entire) integrates new information collected since the 1999 listing regarding bull trout life history, distribution, demographics, conservation successes, etc., and integrates and updates previous bull trout recovery planning efforts across the range of the coterminous bull trout listing

The Service has developed a recovery approach that: (1) focuses on the identification of and effective management of known and remaining threat factors to bull trout in each core area; (2) acknowledges that some extant bull trout core area habitats will likely change (and may be lost) over time; and (3) identifies and focuses recovery actions in those areas where success is likely to meet our goal of ensuring the certainty of conservation of genetic diversity, life history features, and broad geographical representation of remaining bull trout populations so that the protections of the ESA are no longer necessary (USFWS 2015, p. 45-46).

To implement the recovery strategy, the 2015 recovery plan establishes the recovery of bull trout will entail effectively managing threats to ensure the long-term persistence of populations and their habitats, ensuring the security of multiple interacting groups of bull trout, and providing habitat conditions and access to them that allow for the expression of various life history forms within each of six recovery units (USFWS 2015, p. 50-51)." The recovery plan defines four categories of recovery actions that, when implemented and effective, should:

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

2. Minimize demographic threats to bull trout by restoring connectivity or populations where appropriate to promote diverse life history strategies and conserve genetic diversity;

3. Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on bull trout;

4. and result in actively working with partners to 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, and considering the effects of climate change (USFWS 2015, p. 50-51).

Bull trout recovery is based on a geographical hierarchical approach. Bull trout are listed as a single DPS within the five-state area of the coterminous United States. The single DPS is subdivided into six biological-based recovery units: (1) Coastal Recovery Unit; (2) Klamath Recovery Unit; (3) Mid-Columbia Recovery Unit; (4) Upper Snake Recovery Unit; (5) Columbia Headwaters Recovery Unit; and (6) Saint Mary Recovery Unit (USFWS 2015, p. 23). A viable recovery unit should demonstrate that the three primary principles of biodiversity have been met:

representation (conserving the genetic makeup of the species); resiliency (ensuring that each population is sufficiently large to withstand stochastic events); and redundancy (ensuring a sufficient number of populations to withstand catastrophic events) (USFWS 2015, p. 33).

Each of the six recovery units contain multiple bull trout recovery areas which are non-overlapping watershed-based polygons, and each core area includes one or more local population. Currently there are 109 occupied core areas, which comprise 611 local populations (USFWS 2015, p. 3, Appendix F). There are also six core areas where bull trout historically occurred but are now extirpated, and one research needs area where bull trout were known to occur historically, but their current presence and use of the area are uncertain (USFWS 2015, p. 3, Appendix F). Core areas can be further described as complex or simple (USFWS 2015, p. 3-4). Complex core areas contain multiple local bull trout populations, are found in large watersheds, have multiple life history forms, and have migratory connectivity between spawning and rearing habitat and foraging, migration, and overwintering habitats (FMO). Simple core areas are those that contain one bull trout local population. Simple core areas are small in scope, isolated from other core areas by natural barriers, and may contain unique genetic or life history adaptations.

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

A local population is a group of bull trout that spawn within a particular stream or portion of a stream system (USFWS 2015, p. 73). A local population is considered to be the smallest group of fish that is known to represent an interacting reproductive unit. For most waters where specific information is lacking, a local population may be represented by a single headwater tributary or complex of headwater tributaries. Gene flow may occur between local populations (*e.g.*, those within a core population), but is assumed to be infrequent compared with that among individuals within a local population.

Population Units

The final recovery plan (USFWS 2015) designates six bull trout recovery units as described above. These units replace the 5 interim recovery units previously identified (USFWS 1999). The Service will address the conservation of these final recovery units in our section 7(a)(2) analysis for proposed Federal actions. The recovery plan (USFWS 2015), identified threats and factors affecting the bull trout within these units. A detailed description of recovery implementation for each recovery unit is provided in separate recovery unit implementation plans (RUIPs)(USFWS 2015a-f), which identify recovery actions and conservation recommendations needed for each core area, forage/ migration/ overwinter (FMO) areas, historical core areas, and research needs areas. Each of the following recovery units (below) is necessary to maintain the bull trout's numbers and distribution, as well as its genetic and phenotypic diversity, all of which are important to ensure the species' resilience to changing environmental conditions. For more details on Federal, State, and tribal conservation actions in this unit see the actions since listing, contemporaneous actions, and environmental baseline discussions below.

Coastal Recovery Unit

The Coastal RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015a, entire). The Coastal Recovery Unit is divided into three Geographic Regions: Puget Sound, Olympic Peninsula, and the Lower Columbia River regions. This recovery unit contains 20 core areas comprising 84 local populations and a single potential local population in the historic Clackamas River core area where bull trout had been extirpated and were reintroduced in 2011. This recovery unit also has four historically occupied core areas that could be re-established (USFWS 2015, p. 47; USFWS 2015a, p. A-2).

Although population strongholds do exist across the three regions, populations in the Puget Sound region generally have better demographic status while the Lower Columbia River region exhibits the least robust demography (USFWS 2015a, p. A-6). Puget Sound and the Olympic Peninsula currently support the only anadromous local populations of bull trout. This recovery unit also contains ten shared FMO habitats which allow for the continued natural population dynamics in which the core areas have evolved (USFWS 2015a, p. A-5). There are four core areas within the Coastal Recovery Unit that have been identified as current population strongholds: Lower Skagit, Upper Skagit, Quinault River, and Lower Deschutes River (USFWS 2015, p.79; USFWS 2015a, p. A-3). These are the most stable and abundant bull trout populations in the recovery unit. The Puget Sound region supports at least two core areas containing a natural adfluvial life history.

The demographic status of the Puget Sound populations is better in northern areas. Barriers to migration in the Puget Sound region are few, and significant amounts of headwater habitat occur in protected areas (USFWS 2015a, p. A-7). The current condition of the bull trout in this recovery unit is attributed to the adverse effects of climate change, loss of functioning estuarine and nearshore marine habitats, development and related impacts (e.g., flood control, floodplain disconnection, bank armoring, channel straightening, loss of instream habitat complexity), agriculture (e.g., diking, water control structures, draining of wetlands, channelization, and the removal of riparian vegetation, livestock grazing), fish passage (e.g., dams, culverts, instream flows) residential development, urbanization, forest management practices (e.g., timber harvest and associated road building activities), connectivity impairment, mining, and the introduction of non-native species (USFWS 2015a, p. A-1 – A-25). Conservation measures or recovery actions implemented or ongoing include relicensing of major hydropower facilities that have provided upstream and downstream fish passage or complete removal of dams, land acquisition to conserve bull trout habitat, floodplain restoration, culvert removal, riparian revegetation, levee setbacks, road removal, and projects to protect and restore important nearshore marine habitats (USFWS 2015a, p. A-33 – A-34).

Klamath Recovery Unit

The Klamath recovery unit implementation plan describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015b, entire). The Klamath Recovery Unit is located in southern Oregon and northwestern California. The Klamath Recovery Unit is the most significantly imperiled recovery unit, having experienced considerable extirpation and geographic contraction of local populations and declining demographic condition, and natural re-colonization is constrained by dispersal barriers and presence of nonnative brook trout (USFWS 2015, p. 39). This recovery unit currently contains three core areas and eight local populations (USFWS 2015, p. 47; USFWS 2015b, p. B-1). Nine historic local populations of bull trout have become extirpated (USFWS 2015b, p. B-1). All three core areas have been isolated from other bull trout populations for the past 10,000 years (USFWS 2015b, p. B-3). The current condition of the bull trout in this recovery unit is attributed to the adverse effects of climate change, habitat degradation and fragmentation, past and present land use practices, agricultural water diversions, nonnative species, and past fisheries management practices (UFWS 2015b, p. B-13 – B-14). Conservation measures or recovery actions implemented or ongoing include removal of nonnative fish (e.g., brook trout, brown trout, and hybrids), acquiring water rights for instream flows, replacing diversion structures, installing fish screens, constructing bypass channels, installing riparian fencing, culver replacement, and habitat restoration (USFWS 2015b, p. B-10 – B-11).

Mid-Columbia Recovery Unit

The Mid-Columbia RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015c, entire). The Mid-Columbia Recovery Unit is located within eastern Washington, eastern Oregon, and portions of central Idaho. The Mid-Columbia Recovery Unit is divided into four geographic regions: Lower Mid-Columbia, Upper Mid-Columbia, Lower Snake, and Mid-Snake Geographic regions. This recovery unit contains 24 occupied core areas comprising 142 local populations, two historically occupied core areas, one research needs area, and seven FMO habitats (USFWS 2015, p. 47; USFWS 2015c, p. C-1 – C-4). The current condition of the bull trout in this recovery unit is attributed to the adverse effects of climate change, agricultural practices (e.g. irrigation, water withdrawals, livestock grazing), fish passage (e.g. dams, culverts), nonnative species, forest management practices, and mining (USFWS 2015c, p. C-9 – C-34). Conservation measures or recovery actions implemented or ongoing include road removal, channel restoration, mine reclamation, improved grazing management, removal of fish barriers, and instream flow requirements (USFWS 2015c, C-37 – C-40).

Columbia Headwaters Recovery Unit

The Columbia headwaters RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015d). The Columbia Headwaters Recovery Unit is located in western Montana, northern Idaho, and the northeastern corner of Washington. The Columbia Headwaters Recovery Unit is divided into five geographic regions: Upper Clark Fork, Lower Clark Fork, Flathead, Kootenai, and Coeur d'Alene geographic regions (USFWS 2015d, p. D-2 – D-4). This recovery unit contains 35 bull trout core areas; 15 of which are complex core areas as they represent larger interconnected habitats and 20 simple core areas as they are isolated headwater lakes with single local populations. The 20 simple core areas are each represented by a single local population, many of which may have persisted for thousands of years despite small populations and isolated existence (USFWS 2015d, p. D-1). Fish passage improvements within the recovery unit have reconnected some previously fragmented habitats (USFWS 2015d, p. D-42), while others remain fragmented. Unlike other recovery units in Washington, Idaho and Oregon, the Columbia Headwaters Recovery Unit does not have any anadromous fish overlap (USFWS 2015d, p. D-42). Therefore, bull trout within the Columbia Headwaters Recovery Unit do not benefit from the recovery actions for salmon (USFWS 2015d, p. D-42). The current condition of the bull trout in this recovery unit is attributed to the adverse effects of climate change, mostly historical mining and contamination by heavy metals, expanding populations of nonnative fish predators and competitors, modified instream flows, migratory barriers (e.g., dams), habitat fragmentation, forest practices (e.g., logging, roads), agriculture practices (e.g. irrigation, livestock grazing), and residential development (USFWS 2015d, p. D-10 – D-25). Conservation measures or recovery actions implemented or ongoing include habitat improvement, fish passage, and removal of nonnative species (USFWS 2015d, p. D-42 – D-43).

Upper Snake Recovery Unit

The Upper Snake RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015e, entire). The Upper Snake Recovery Unit is located in central Idaho, northern Nevada, and eastern Oregon. The Upper Snake Recovery Unit is divided into seven geographic regions: Salmon River, Boise River, Payette River, Little Lost River, Malheur River, Jarbidge River, and Weiser River. This recovery unit contains 22 core areas and 207 local populations, with over 70 percent being present in the Salmon River Region (USFWS 2015, p. 47; USFWS 2015e, p. E-1 – E-2). The current condition of the bull trout in this recovery unit is attributed to the adverse effects of climate change, dams, mining, forest management practices, nonnative species, and agriculture (e.g., water diversions, grazing) (USFWS 2015e, p. E-15 – E-18). Conservation measures or recovery actions implemented or ongoing include instream habitat restoration, instream flow requirements, screening of irrigation diversions, and riparian restoration (USFWS 2015e, p. E-19 – E-20).

St. Mary Recovery Unit

The St. Mary RUIP describes the threats to bull trout and the site-specific management actions necessary for recovery of the species within the unit (USFWS 2015f). The Saint Mary Recovery Unit is located in Montana but is heavily linked to downstream resources in southern Alberta, Canada. Most of the Saskatchewan River watershed which the St. Mary flows into is located in Canada. The United States portion includes headwater spawning and rearing habitat and the upper reaches of FMO habitat. This recovery unit contains four core areas, and seven local populations (USFWS 2015f, p. F-1) in the U.S. Headwaters. The current condition of the bull trout in this recovery unit is attributed primarily to the outdated design and operations of the Saint Mary Diversion operated by the Bureau of Reclamation (e.g., entrainment, fish passage, instream flows), and, to a lesser extent habitat impacts from development and nonnative species (USFWS 2015f, p. F-7 – F-8). The primary issue precluding bull trout recovery in this recovery unit relates to impacts of water diversions, specifically at the Bureau of Reclamations Milk River Project (USFWS 2015f, p. F-5). Conservation measures or recovery actions implemented or ongoing are not identified in the St. Mary RUIP; however, the USFWS is conducting interagency and tribal coordination to accomplish conservation goals for the bull trout (USFWS 2015f, p. F-9)

Federal, State and Tribal Actions Since Listing

Since our listing of bull trout in 1999, numerous conservation measures that contribute to the conservation and recovery of bull trout have been and continue to be implemented across its range in the coterminous United States. These measures are being undertaken by a wide variety of local and regional partnerships, including State fish and game agencies, State and Federal land management and water resource agencies, Tribal governments, power companies, watershed working groups, water users, ranchers, and landowners.

In many cases, these bull trout conservation measures incorporate or are closely interrelated with work being done for recovery of salmon and steelhead, which are limited by many of the same threats. These include removal of migration barriers (culvert removal or redesign at stream crossings, fish ladder construction, dam removal, etc.) to allow access to spawning or FMO habitat; screening of water diversions to prevent entrainment into unsuitable habitat in irrigation systems; habitat improvement (riparian revegetation or fencing, placement of coarse woody debris in streams) to improve spawning suitability, habitat complexity, and water temperature; instream flow enhancement to allow effective passage at appropriate seasonal times and prevent channel dewatering; and water quality improvement (decommissioning roads, implementing best management practices for grazing or logging, setting pesticide use guidelines) to minimize impacts from sedimentation, agricultural chemicals, or warm temperatures.

At sites that are vulnerable to development, protection of land through fee title acquisition or conservation easements is important to prevent adverse impacts or allow conservation actions to be implemented. In several bull trout core areas, it is necessary to continue ongoing fisheries management efforts to suppress the effects of non-native fish competition, predation, or hybridization; particularly brown trout, brook trout, lake trout, and northern pike (Fredenberg et al. 2007; DeHaan et al. 2010, entire; DeHaan and Godfrey 2009, entire; Fredericks and Dux 2014; Rosenthal and Fredenberg 2017). A more comprehensive overview of conservation successes from 1999-2013, described for each recovery unit, is found in the Summary of Bull Trout Conservation Successes and Actions since 1999 (Available at: (http://www.fws.gov/pacific/ecoservices/endangered/recovery/documents/USFWS_2013_summary_of_conservation_successes.pdf).

Projects that have undergone ESA section 7 consultation have occurred throughout the range of bull trout. Singly or in aggregate, these projects could affect the species' status. The Service has conducted periodic reviews of prior Federal "consulted-on" actions. A detailed discussion of consulted-on effects in the proposed action area is provided in the environmental baseline section below.

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