United States Department of the Interior

FISH AND WILDLIFE SERVICE
Montana Ecological Services Field Office
585 Shepard Way, Suite 1
Helena, Montana 59601–6287

In Reply Refer to:
FWS/IR05/IR07
M.17 FHWA;
06E11000-2018-F-0146

November 17, 2020

Heidy Bruner
Federal Highway Administration
Montana Division
585 Shephard Way, Suite 2
Helena, MT 59601

Dear Ms. Bruner,

This responds to your October 24, 2017 letter requesting that the US Fish and Wildlife Service (Service) reinitiate formal consultation for bull trout (*Salvelinus confluentus*) and grizzly bears (*Ursus arctos horribilis*) for the US 93 Evaro to Polson (RP 6.8 to 59.0) (NH 5-2(159)37; UPN 8008000) project. The impetus for this request was the exceedance of incidental take of grizzly bears, due to grizzly bear-vehicle collisions, in 2012, and regulatory changes concerning bull trout critical habitat designation. The biological opinion for bull trout (Chapter II) was previously issued on September 4, 2018, and is re-attached here for clarity.

The Montana Department of Transportation (Department), in cooperation with the Federal Highway Administration (Administration), is proposing to reconstruct approximately 11.9 miles of US Highway 93 North in Lake County, which is referred to as the US 93 Ninepipe/Ronan Corridor. The corridor lies within the Flathead Indian Reservation and begins at Red Horn Road/Dublin Gulch Road (reference post [RP] 36.8) and extends north to Baptiste Road/Spring Creek Road (RP 48.7). The proposed work will include replacement of the Post Creek bridge.

The attached biological opinion for grizzly bears is based on the biological assessment prepared by Mark Traxler of RESPEC for the Department, biological assessment addendums prepared by Joe Weigand of the Department, additional information received during the consultation process, and information in our files. The biological opinion was prepared in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act) (16

U.S.C. 1531 et seq.). A complete project file of this consultation is on file at the Service's Montana Ecological Services Office.

Section 7(b)(3)(A) of the Act requires that the Secretary issue biological opinions on any action(s) funded, authorized or carried out by Federal agencies 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. 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).

There have been 17 grizzly bear-vehicle collisions resulting in 20 known mortalities, and one undetermined result, in the action area on US Highway 93 between 1998 and 2019. Our biological opinion anticipates (in part) that a six-year moving average of four grizzly bears per year will be hit by vehicles in the US Highway 93 Evaro to Polson corridor in the future (i.e., with some years of no strikes and some years with more than four strikes, resulting in a six-year moving average of four per year). This level of incidental take is expected to be perpetual and has the potential to affect the occupancy and distribution of grizzly bears in the Mission Range Bear Management Unit of the NCDE Recovery Zone. While the Service concluded this level of mortality will not jeopardize the continued existence of the grizzly bear (given current population and trends), it is among the most significant levels of incidental take of grizzly bears ever exempted by the Service.

Because the proposed action involves uncertain out-year planning and budgeting, it was impossible for the Administration and the Department to commit to all specific measures that would minimize the level of incidental take. It is therefore imperative that the Administration and Department utilize their authorities in furtherance of the purposes of the Act by working with the Service to incorporate the best available science into the design and implementation of the future proposed crossing structures and associated minimization measures in order to minimize the level of incidental take of grizzly bears within the action area.

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 further questions related to this consultation or your responsibilities under the Act, please contact Mike McGrath at (406) 449-5225, extension 201, or at mike_mcgrath@fws.gov.

Sincerely,

for Jodi L. Bush
Office Supervisor

cc: Confederated Salish and Kootenai Tribes, Wildlife Program, Polson, MT (Attn: Dale Becker)

Montana Department of Transportation, Helena, MT (Attn: Bill Semmens, Joe Weigand)

Montana Fish, Wildlife & Parks, Kalispell, MT (Attn: Cecily Costello)

ENDANGERED SPECIES ACT SECTION 7 CONSULTATION

BIOLOGICAL OPINION

on the

Revised US 93 Evaro to Polson (RP 6.8 to 59.0)

NH 5-2(159)37; UPN 8008000

TAILS Number: 06E11000-2018-F-0146

Action Agency:

Federal Highway Administration
Montana Division
Helena, Montana

Consultation Conducted by:

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

November 16, 2020

Chapter I. Introduction

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A. INTRODUCTION

The U.S. Fish and Wildlife Service (Service) has prepared this biological opinion on the effects of the Federal Highway Administration (Administration) and Montana Department of Transportation (Department) revised US 93 Evaro to Polson corridor project (NH 5-2(159)37; UPN 8008000; project) on the listed species identified (Table I-1), in accordance with the Endangered Species Act of 1973, as amended (Act), (16 U.S.C. 1531 et seq.).

The Administration submitted a Biological Assessment (BA) documenting that the proposed project is likely to adversely affect two listed species: grizzly bear (*Ursus arctos horribilis*) and bull trout (*Salvelinus confluentus*), and would have *no effect* on designated critical habitat for bull trout. Further, the BA determined that the proposed project would have *no effect* on Canada lynx (*Lynx canadensis*), water howelia (*Howellia aquatilis*), Spalding's Campion (*Silene spaldingii*), the meltwater lednian stonefly (*Lednia tumana*), and yellow-billed cuckoo (*Coccyzus americanus*). The BA also determined that the proposed project is not likely to jeopardize wolverine (*Gulo gulo luscus*) and whitebark pine (*Pinus albicaulis*). The Final BA and letter requesting formal consultation under section 7 of the Act was received by the Service on October 24, 2017. As described in this biological opinion, and based on the BA and other information collected during the consultation process, the Service has concluded that the proposed project, as proposed, is not likely to jeopardize the continued existence of grizzly bears or bull trout.

Updates to the regulations governing interagency consultation (50 CFR part 402) were 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 new 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.

Section 7 of the Act requires Federal agencies to use their authorities to carry out conservation programs to benefit endangered and threatened species. There is also an explicit requirement for Federal agencies to ensure, in consultation with the Fish and Wildlife Service or the National Marine Fisheries Service, that any action they authorize, fund, or carry out will not be likely to jeopardize the continued existence of a listed species, or destroy or adversely modify designated critical habitat. As a result, Federal agencies have a unique opportunity and obligation to assist recovery implementation by addressing threats that result from their programs and actions.

Section 7(b)(3)(A) of the Act requires that the Secretary 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) is based on information provided in the Administration's BA (RESPEC 2017) for the proposed action, the related final Environmental Impact Statements (EIS) (Federal Highway Administration 1996 and 2008), an amendment to the BA received on July 30, 2020, personal communications with researchers and experts, and scientific literature, unpublished reports, field investigations, and other sources of information cited herein. This biological opinion (BO) addresses only the impacts to federally listed species and does not address the overall environmental acceptability of the proposed actions.

Table I-1. Federally designated species in Missoula and Lake counties, Montana.

Common Name	Scientific Name	ACT Status	Designated Critical Habitat?
Grizzly bear	*Ursus arctos horribilis*	Threatened	No
Canada lynx	*Lynx canadensis*	Threatened	Yes, (79 FR 54782, Sept. 12, 2014)
Bull trout	*Salvelinus confluentus*	Threatened	Yes, (75 FR 63898, Oct. 18, 2010)
Yellow-billed cuckoo	*Coccyzus americanus*	Threatened	No
Spalding's champion (or "catchfly")	*Silene spaldingii*	Threatened	No
Water howellia	*Howellia aquatilis*	Threatened	No
Meltwater lednian stonefly	*Lednia tumana*	Threatened	N/A
Wolverine	*Gulo gulo luscus*	Proposed	N/A
Whitebark pine	*Pinus albicaulis*	Candidate	N/A

Endangered - Any species that is in danger of extinction throughout all or a significant portion of its range.
Threatened - Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Candidate - Those taxa for which the Service has sufficient information on biological status and threats to propose to designate them as threatened or endangered. We encourage their consideration in environmental planning and partnerships, however, none of the substantive or procedural provisions of the Act apply to candidate species.
Proposed - Once a species is proposed, a year-long review period commences at the end of which the Service will make a final listing determination. ACT regulation 50 C.F.R. 402.10(a) states: "Each Federal Agency shall confer with the Secretary on any agency action which is likely to jeopardize the continued existence of any species proposed to be listed." Conferencing is not required for anything less than a jeopardy call, but conferencing or concurrence may be requested by the action agency.
Candidate - A species for which the Service has sufficient information on the biological status and threats to propose them as endangered or threatened under the ACT, but for which development of a proposed listing is precluded by other higher priority activities.
Critical Habitat - The specific area (i) within the geographic area occupied by a listed species, at the time it is listed, on which are found those physical or biological features (I) essential to conserve the species and (ii) that may require special management considerations or protection: and (iii) specific areas outside the geographic area occupied by the species at the time it is listed upon determination that such areas are essential to conserve the species.

B. CONSULTATION HISTORY

The history of the section 7 consultation on the proposed action is summarized chronologically in Table I-2. A complete record of this consultation is on file at the Service's Montana Ecological Services Office in Helena, Montana. The consultation summary below includes meetings between the Administration, Department, Confederated Salish and Kootenai Tribes (CSKT), and Service.

Table I-2. Summary of the consultation between the Federal Highway Administration (Administration) and the USFWS Montana Ecological Services Office (Service) on the US 93 Evaro to Polson corridor.

Date	Event
October 11, 1995	A BA for the US 93 Evaro to Polson corridor was prepared by Morrison-Maierle Environmental Corp., Helena, Montana. This document was never submitted to the Service
May 9, 2001	The Administration submitted an updated BA to the Service and requested formal consultation. This BA was prepared by Herrera Environmental Consultants for Skillings Connolly, Inc. and the Department.
May 17, 2001	The Service requested additional project information from the Department that was necessary to fully assess project-related impacts to listed species. The supplemental BA information was received by the Service on August 31, 2001.
October 19, 2001	The Service issued a biological opinion for effects to bull trout, grizzly bear, Canada lynx, and gray wolf. Grizzly bear incidental take was for two bears in any 10-year period. Lynx incidental take was for one lynx in any 10-year period.
October 22, 2003	The Administration submitted an analysis of effects on proposed bull trout critical habitat to the Service with a request for formal conferencing. The Service issued a conference opinion on March 5, 2004.
January 11, 2005	A biological assessment that addressed bull trout and grizzly bears was prepared by Herrera Environmental Consultants, on behalf of the Department, for the Ninepipe/Ronan portion of the corridor and submitted to the Service for formal consultation

Date	Event
August 29, 2005	The Service issued a biological opinion for effects to bull trout and grizzly bears. The opinion restated that grizzly bear incidental take would be two bears in any 10-year period.
Fall 2005	A biological assessment addressing bull trout critical habitat, designated in September 2005, was prepared by Herrera Environmental Consultants on behalf of the Department for the Ninepipe/Ronan portion of the corridor and submitted to the Service for formal consultation.
June 27, 2006	The Service issued a biological opinion for effects to bull trout critical habitat.
June 19, 2012	Following the death of an adult male grizzly bear on Highway 93 from a vehicle collision on May 5, 2012, a site visit was made by the Service, Department, members of CSKT's Wildlife Management Program, and Marcel Huijser from the Western Transportation Institute. Discussions included the recent mortality, grizzly bear use of the Mission Valley, and the effectiveness of the new crossing structures.
September 21, 2012	The Department notified the Service via email that a total of three grizzly bears had been killed on US 93 in the Evaro to Polson corridor within a 10-year period (2003 – 2012). This level of take exceeded the allowable take as permitted in the 2001 and 2005 biological opinions. Formal consultation was reinitiated with the Service at that time.
November 10, 2015	A meeting was held in Pablo, Montana to discuss grizzly bear crossing areas within the Evaro to Polson corridor, and ways to potentially improve utilization of existing crossing structures by grizzly bears. The meeting was attended by representatives from the Federal Highway Administration, the Department, the CSKT Wildlife Management Program, the Service, and Montana Fish, Wildlife and Parks.
October 24, 2017	The statutory 135-day formal consultation timeline begins{50 CFR 402.14 (e-g)} with receipt of the biological assessment and request to reinitiate formal consultation from the Federal Highway Administration.
March 12, 2018	A biological assessment addendum and supporting materials are received from the Department that submit a test pile program process for the proposed Post Creek Hill Bridge.
May 22, 2018	The Service sent a request to extend the formal consultation time frame to the Administration.
May 23, 2018	The Service received a letter from the Administration extending the time frame for the formal consultation.
June 25, 2018	The Service sent draft biological opinions for bull trout and grizzly bears to the Administration, Department, and Confederated Salish and Kootenai Tribes (CSKT) for review and comment.
June 27, 2018	The Service met with representatives of the CSKT's Wildlife Management Program to go through the draft opinions.
Summer and Fall 2018	Five grizzly bear vehicle collisions occurred within the action area that removed 8 grizzly bears from the population.

Date	Event
August 2, 2018	The Service received comment from the CSKT Tribal Chairman regarding the draft grizzly bear biological opinion.
August 17, 2018	The Service received comments from the Department regarding the draft bull trout and grizzly bear biological opinions.
September 4, 2018	The Service issued the final bull trout biological opinion.
Fall 2018	The Service met several times with representatives of the Administration and Department to discuss the idea offered up by the CSKT Wildlife Management Program to develop an interagency and intergovernmental collaborative group that would meet to work through outstanding issues concerning project development and grizzly bear mitigations.
January 29, 2019	The Service responded to the CSKT Tribal Chairman's comments on the draft grizzly bear biological opinion.
March 26, 2019	Representatives from the Service, Administration, CSKT Wildlife Management Program, and Department met at the Ninepipes Lodge to receive updates on grizzly bear activities, project developments, and to discuss possible solutions.
March 4 and 25, 2020	The Service met with representatives of the Administration and the Department to discuss the potential for the Department to develop a voluntary compensatory mitigation program in an effort to reduce other forms of human-caused grizzly bear mortality on the Flathead Indian Reservation.
March 18, 2020	The Service and Montana Division of the Administration met with members of the Administration's Resources Center to discuss the potential for the Resources Center to facilitate meetings between the CSKT, the Department, Administration, and the Service to work through outstanding issues concerning project development and grizzly bear mitigations in an effort to hasten project development and implementation.
May 6, 2020	The Department informed the Service that it would not be pursuing the development of a voluntary compensatory mitigation program in an effort to reduce other forms of human-caused grizzly bear mortality on the Flathead Indian Reservation.
May 18 – July 30, 2020	Iterative review, comment, and response of the draft terms and conditions among the Administration, Department, and Service.
July 14, 2020	Meeting among the Administration, Department, and Service to clarify and answer questions regarding the draft terms and conditions.
July 30, 2020	Final comments regarding the draft terms and conditions received from the Department. Biological assessment amendment received from the Department regarding the proposed St. Ignatius wildlife fencing project.
August 13, 2020	Biological assessment amendment received from the Department addressing changes in listing status of meltwater lednian stonefly since the BA was originally submitted.

C. ORGANIZATION OF THIS BIOLOGICAL OPINION

This biological opinion includes three chapters. This is the introductory chapter, Chapter I. Chapter I of the biological opinion provides a description of the proposed action. This section describes the project area, the species in the project area, and an overview of the proposed project. The biological opinion for bull trout is contained in Chapter II, the biological opinion for grizzly bear is contained in Chapter III. This biological opinion also contains appendices that include supporting material cited throughout the various chapters. The species-specific chapters (i.e., Chapters II and III) provide additional descriptions of the proposed action relative to measures contained in the proposed project to address the conservation needs of the species. Each species-specific chapter will contain its own literature cited section.

D. DESCRIPTION OF THE PROPOSED ACTION

This section describes the project area, and provides background on the development of the proposed project.

1. Description of the Project Area

The south end of the Evaro to Polson corridor begins in the Jocko Valley at Evaro and extends northward through coniferous forest and agricultural land to Arlee, Montana. From the community of Arlee, the project corridor crosses the Jocko River and a low open bench in the northern Jocko Valley. North of the Jocko Valley, the project corridor enters the narrow, steep-sided Ravalli Canyon where the existing highway and a railroad closely parallel the Jocko River in a constricted passage excavated into the canyon walls. North of Ravalli, the project corridor climbs steeply to a low pass in grassy, dry terrain and enters the Mission Valley (Morrison Maierle Environmental Corp. 1995).

Most of the land in the Mission Valley is agricultural, traversed by wooded riparian areas associated with Mission, Sabine, Post, Crow, and Mud Creeks and other perennial streams. North of the Post Creek Hill, the project corridor enters the Ninepipe National Wildlife Refuge, which is an area of glacial potholes and wetland/grassland complexes. From the Ninepipe area, the alignment passes through predominantly agricultural land to the outskirts of Polson, Montana (Morrison Maierle Environmental Corp. 1995). For a more detailed discussion of upland and wetland communities occurring within the Ninepipes/Ronan Action Area, refer to pages 21 – 24 of the 2005 biological assessment (Herrera Environmental Consultants 2005).

For aquatic resources, the Evaro to Polson corridor is located in the greater Clark Fork River drainage, with a majority of the corridor occurring in the Lower Flathead River Basin (Herrera Environmental Consultants 2001). The Polson area lies within the Upper Flathead River Basin. The Flathead River flows from Flathead Lake, a natural lake encompassing 191 square miles, for approximately 4 miles to the Kerr Dam (Herrera Environmental Consultants 2001) now known as Seli'š Ksanka Qlispe'. US 93 crosses the Flathead River at the lake outlet on the north side of the community of Polson, Montana. This bridge crossing lies outside the Evaro to Polson corridor. Seli'š Ksanka Qlispe' regulates flows in the Flathead River for 72 river miles downstream to its confluence with the Clark Fork River near the small community of Paradise, Montana (Herrera Environmental Consultants 2001). The US 93 corridor loosely parallels the lower Flathead River between river mile 29, where the river turns west, and river mile 72, at the Seli'š Ksanka Qlispe', at an average distance of 10 miles to the east (Herrera Environmental Consultants 2001).

The principal irrigation canal in the Evaro to Polson corridor is the Pablo feeder canal located at the base of the Mission Mountains. This canal runs north/south and bisects or is fed by nearly all of the streams flowing from the Mission Mountains. Major tributaries that drain to the Flathead River within the Evaro to Polson corridor (from south to north) include the Jocko River, Mission Creek, and Crow Creek (Herrera Environmental Consultants 2001). All of the major tributaries are impounded at their headwaters or at mid-valley, and canal diversion and irrigation returns intersect them throughout their drainage areas (Herrera Environmental Consultants 2001). Other perennial streams that cross underneath US 93 in the Evaro to Polson corridor include Finley, Jocko Spring, Copper, Frog, Schley, East Fork Finley, Agency, Sabine, Post, Ronan Spring, and Mud Creeks. Streams located in the Action Area for the Ninepipes /Ronan project include Ashley, Post, Crow, and Ronan Spring Creeks.

Post Creek represents the most significant fisheries resource in the Action Area and supports a variety of species, including resident and migratory populations of northern pikeminnow (*Ptychocheilus oregonensis*), largescale sucker (*Catostomus macrocheilus*), longnose sucker (*Catostomus catostomus*), mountain whitefish (*Posopium williamsoni*), brown trout (*Salmo trutta*), and rainbow trout (*Oncorhynchus mykiss*). Post Creek also supports a resident population of brook trout (*Salvelinus fontinalis*). In addition, the area provides seasonal nodal (for migratory juveniles and adults) habitat for bull trout and westslope cutthroat trout (*Oncorhynchus clarki lewisi;* Barfoot 2014). Crow and Ronan Spring Creeks have similar species assemblages but do not provide habitat for bull trout or westslope cutthroat trout. Ninepipe Reservoir supports largemouth bass (*Micropterus salmoides*), pumpkinseed (*Lepomis gibbosus*), yellow perch (*Perca flavescens*), and rainbow trout. The fish species present in the Ninepipes/Ronan corridor is listed in Table 3 on page 27 of the 2005 biological assessment for this project (Herrera Environmental Consultants 2001).

Between 2006 and 2010, as part of the overall reconstruction of US 93 between Evaro and Polson, a total of 42 wildlife crossings of various types and dimensions have been constructed. The goal of these crossings is to help wildlife safely move between cross-highway habitats, while at the same time improving habitat connectivity and improving public safety by minimizing animal/vehicle collisions. Approximately 18 miles of wildlife guide fencing has been installed to help route animals to the wildlife crossing structures. Approximately 60 wildlife jumpouts have been installed to provide an escape route for animals within the right-of-way between sections of fencing, and double cattle guards or wildlife guards/grates have been installed at numerous private and public access roads to prevent animals from accessing the roadway where breaks in the fence occur. These constructed crossings and associated features represent a significant change to the baseline conditions in the corridor because they did not exist at the time the last biological assessment was conducted for the corridor.

Figure I-1 shows the location of all 42 wildlife crossing structures along with the future crossing structures that are proposed in the Action Area. The figure also identifies the existing wildlife

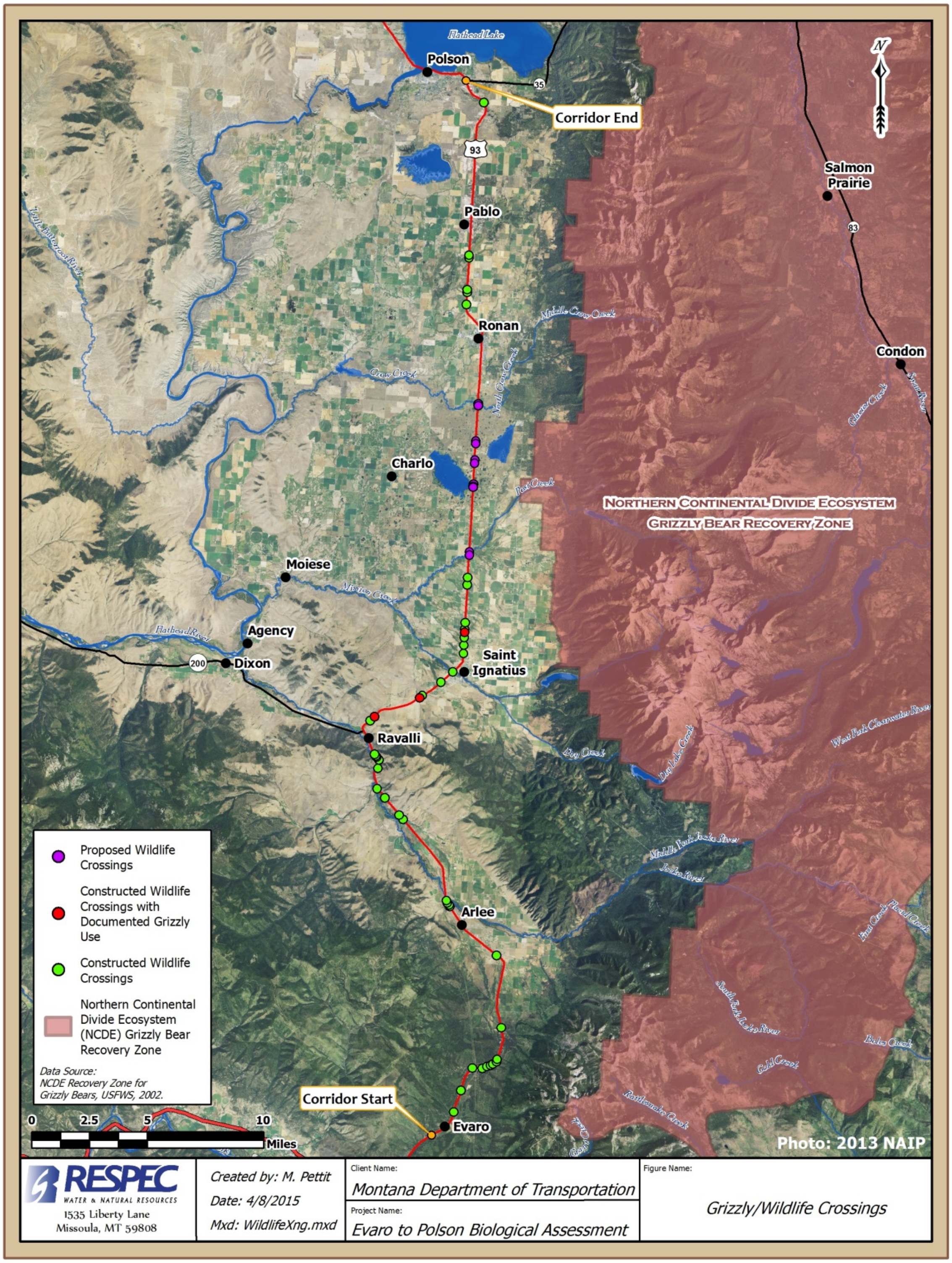

Figure I-1. Wildlife crossing structures along the US 93 Evaro to Polson corridor (RESPEC 2017:21).

crossing structures where grizzly bears have been documented using the structures. A summary of all 42 crossing structures and 2 additional stockpasses is provided in Appendix A and provides the locations by milepost, type of crossing, and size of structure.

The Department, in cooperation with the CSKT, Western Transportation Institute, and Montana State University, has monitored wildlife usage at 29 of the crossing structures in the corridor since 2009. Currently, over 50,000 wildlife uses have been recorded, involving more than 30 species of wildlife (Peoples Way Partnership 2015).

2. Species in the Project Area

As described in the Introduction, seven listed species can be found within the project area: grizzly bear, Canada lynx (lynx), bull trout, yellow-billed cuckoo, Spalding's campion, meltwater lednian stonefly, and water howelia. Additionally, the proposed wolverine, and candidate species whitebark pine can also be found in the project area (Table I-1)

The Evaro to Polson corridor is located in the Lake Pend Oreille bull trout core area, and crosses the Jocko River, which is bull trout critical habitat. The Lake Pend Oreille core area is considered to be a "complex" core area as defined in the bull trout Recovery Plan (USFWS 2015). A core area is the closest approximation of a biologically functioning unit for bull trout, meaning it has both the habitat that could supply all elements for the long-term security of bull trout and a group of one or more local bull trout populations.

The Evaro to Polson corridor is located within ten miles of the grizzly bear North Continental Divide Ecosystem (NCDE) recovery zone's western boundary, and is within Zone 1 as set for in the Conservation Strategy.

3. Description of the Proposed Action

The description of the proposed action is taken from the biological assessment (RESPEC 2017). The Department and the Administration, in cooperation with the CSKT, are proposing to reconstruct approximately 11.9 miles of US 93 in Lake County, Montana, which is referred to as the US 93 Ninepipe/Ronan corridor. The corridor lies within the Flathead Indian Reservation and begins at Red Horn Road/Dublin Gulch Road (reference post [RP] 36.8) and extends north to Baptiste Road/Spring Creek Road (RP 48.7). The purpose of the project is to improve US 93, for traffic flow and roadway safety, and to reduce future road maintenance needs (Herrera Environmental Consultants 2005). The Ninepipe/Ronan segment of US 93 was previously part of a larger reconstruction project that extended from Evaro (RP 6.5) to Polson (RP 62.8). The Evaro to Polson corridor previously had an Environmental Impact Statement prepared for it (FHWA 1996) and underwent formal consultation pursuant to section 7 of the Act in 2001. Between 2004 and 2010, nine individual reconstruction projects were completed in the Evaro to Polson corridor (Table I-3).

Table I-3. Completed Montana Department of Transportation projects on US 93 between Evaro and Polson, Montana through 2016.

Project Name	Year Constructed	Location (RP)	Total Length (Miles)
US 93-Minesinger Trail to MT 35	2005-2006	56.0 to 58.1	2.1
Mud Creek Structures	2006-2007	50.7 to 51.1	0.4
US 93-Spring Creek Rd-Minesinger Trail	2007-2009	48.3 to 56.0	7.7
US 93 Medicine Tree-Vic Red Horn Rd	2006-2007	31.4 to 36.8	5.4
US 93-South of Ravalli-Medicine Tree	2006-2007	26.7 to 31.4	4.7
US 93-Vic White Coyote Rd-S Ravalli	2006-2007	20.0 to 26.7	6.7
US 93-N Arlee-Vic White Coyote Rd	2004-2005	18.5 to 20.0	1.5
US 93-McClure Rd-N Arlee Couplet	2008-2009	12.8 to 18.5	5.7
US 93-Evaro – McClure Road	2008-2010	6.4 to 12.8	6.4

This Ninepipe/Ronan segment has been divided into four primary projects with the potential for more splits to occur in the future (Table I-4). This segment was excluded from the original EIS. A Supplemental Environmental Impact Statement (SEIS) was prepared for the Ninepipe/Ronan Improvement project and released in 2008. This segment was subject to formal consultation, and a biological opinion was issued in 2005 (Service 2005).

Table I-4. Proposed Montana Department of Transportation projects on US 93 between Evaro and Polson, Montana.

Project Name	Year of Proposed Construction	Location (RP)	Total Length (Miles)
US 93 N-Post Creek Hill	2021+	37.1 to 40.4	3.3
Remainder of Ninepipe/Ronan corridor (projects named in future)	2022+	40.4 to 44.6	4.2
Ronan-Urban	2022+	44.6 to 47.2	2.6
Ronan-North	2021+	47.2 to 48.3	1.1

The US 93 Ninepipe/Ronan project corridor has been divided into rural and urban portions. The rural section has been further divided into two segments: the Post Creek Hill segment and the Ninepipe segment. The urban portion, referred to as Ronan-Urban, extends from Brook Lane northerly through Ronan to the Baptiste Road/Spring Creek Road intersection. Each of these segments has several alternative designs that have been proposed and are currently being analyzed by the Department. What is analyzed herein is based on the preliminary preferred alternative that includes the Rural 10 Alternative for the rural portion and the Ronan 4 Alternative for the urban portion (Herrera Environmental Consultants 2005).

Rural Segments

The rural portion of the preliminary preferred alternative would include reconstructing the existing roadway. The reconstruction would provide for curvilinear horizontal alignment roughly following the existing roadway to minimize impacts to adjacent lands. Roadway shoulders would be constructed sufficiently wide to accommodate bicycles and pedestrians. The design speed would be 62 miles per hour. Left-turn lanes would be constructed at all public road intersections. The vertical alignment would be revised to accommodate wildlife crossing structures, including single- and multiple-span bridges and large culverts, at Post Creek, Ninepipe Reservoir, two separate Kettle Ponds, and Crow Creek, with additional structures at intermediate locations throughout the project length. At the wildlife crossing locations, these bridges and large culverts would provide a minimum vertical clearance of 8 feet. Where stormwater will discharge to sensitive waters, such as Post Creek, treatment facilities would be constructed (Herrera Environmental Consultants 2005).

The rural portion of this proposed project would be composed of a two-lane roadway with some sections of auxiliary lanes and a four-lane divided roadway as described below:

- A 0.5-mile two-way, left-turn lane (TWLTL) extending from Dublin Gulch Road/Red Horn Road (RP 37.1) northward to a business entrance driveway on the east side of US 93 at RP 37.5.
- A 1.8-mile northbound passing lane from West Post Creek Road/East Post Creek Road (RP 38.2) to the top of Post Creek Hill (RP 40.0).
- A 1.2-mile southbound passing lane from the top of Post Creek Hill (RP 40.0) to Eagle Pass Trail (RP 41.2).
- A 0.9-mile section of four-lane divided roadway from Innovation Lane (RP 45.1) to the south Ronan city limits (RP 46.0).

The rural portion of the preliminary preferred alternative would represent a combination of the following two typical roadway cross sections:

- The two-lane roadway would be undivided with one travel lane in each direction. Each lane would be 12 ft wide with 8 ft shoulders, and the typical pavement width would be 40 ft. Where auxiliary lanes would be provided, turning lanes would be 14 ft wide. The minimum preferred right-of-way width would be 160 ft; however, narrower widths have been used at selected sensitive locations to keep the new roadway within the existing right-of-way to minimize impacts. Also considered in the preliminary preferred alternative is a variation of the two-lane roadway that would include one 12-ft passing lane. Where the passing lane would be added, the minimum preferred right-of-way width would increase to 180 ft with some narrower areas at selected sensitive locations to keep the new roadway within the existing right-of-way.
- The four-lane divided roadway would include two travel lanes in each direction. Each lane would be 12 ft, depressed center median, 8-ft outside shoulders, and 4-ft inside

shoulders. At intersections where left-turn lanes would be provided, the turning lane would be located within the center median area. The typical cross-section width would be 110 ft and the minimum right-of-way width would be 220 ft (Herrera Environmental Consultants 2005).

The Post Creek Hill project segment will include a 10-ft wide pedestrian path on the east side of the highway. The shared-use path will butt up to the northbound travel lane across the new Post Creek bridge, and there will be jersey barrier separating traffic from pedestrians. North and south of the bridge the path will be separated from the travel lanes and will be located on the fill slopes of the new roadway.

Proposed Wildlife Crossings

The preliminary preferred alternative for this project would also include replacement and upgrade of the existing culverts and bridges. In addition, wildlife crossing structures are planned at several locations in the rural portion of the project. The vertical alignment of the roadway would be revised to accommodate these structures (e.g., large culverts or bridges of varying lengths) and provide a minimum vertical clearance of 8 feet. These wildlife crossing structures are currently proposed for five locations: Post Creek, Ninepipe Reservoir, two large kettle ponds, and Crow Creek, with additional smaller structures crossing waterways and riparian areas at intermediate locations throughout the project length. Wing fencing is proposed at all wildlife crossing structures and would vary in length depending on terrain, proximity to major county road and private road intersections, and other logical termination points. Crossings designed for large mammals include a minimum of 150 yards of wing fencing. A description of the structures proposed at these five primary locations to facilitate wildlife crossing is provided below (Herrera Environmental Consultants 2005):

- **Post Creek** (approximately RP 37.7)
  - One 500-ft multiple-span bridge. The bridge will have a maximum clearance of 14 ft where it crosses Post Creek and a minimum clearance of 8 ft at the south end of the bridge.
  - Two to three herpetile crossings are being considered and in design. Dimensions are currently unknown.
- **Ninepipe Reservoir** (approximately RP 40.8)
  - One 12-ft x 22-ft culvert
  - Two 10-ft x 12-ft culverts
  - One 660-ft multiple-span bridge with minimum clearance of 10 – 13 ft.
- **Kettle Pond 1** (approximately RP 41.7)
  - Two 59-ft single-span bridges with minimum clearance of 10 – 13 ft.
  - Two 4-ft x 6-ft culverts
- **Kettle Pond 2** (approximately RP 42.5)
  - Two 59-ft single-span bridges with minimum clearance of 10 – 13 ft.
  - Two 4-ft x 6-ft culverts
- **Crow Creek** (approximately RP 44.2)
  - One 121-ft multiple-span bridge with minimum clearance of 10 – 13 ft.
  - One 150-ft multiple-span bridge with minimum clearance of 10 – 13 ft.

Post Creek Bridge

The Post Creek channel is approximately 33-ft wide in the vicinity of US 93, and is presently conveyed under US 93 via a 50-ft long, 31-ft wide, two-span bridge. The center pier occurs within the Post Creek channel. The channel under the bridge has been narrowed and stabilized with large riprap, which will be removed as part of the proposed project. The new bridge, proposed to be a multiple-span structure 500-ft long, would not include a pier within the Post Creek channel. This much longer bridge would result in less channel constriction and allow the stream more interaction with its floodplain (Herrera Environmental Consultants 2005).

Post Creek Bridge Construction

The new Post Creek bridge will be constructed on the existing alignment to minimize wetland impacts both east and west of the highway. During construction, a 24-ft wide detour road will be located on the east (upstream) side of the highway to carry traffic during construction of the new bridge. Temporary detour and/or work bridges will span the entire Post Creek channel and will be built on either temporary piles or spread footings. The temporary detour would be constructed prior to demolition of the existing bridge and current roadway. Construction of the new bridge includes the following:

- Grading and construction practices that unnecessarily disturb natural features, promote erosion, and require extensive revegetation would be avoided or minimized.
- The new Post Creek bridge piers would be located outside the ordinary high-water mark for Post Creek, with the nearest piers located approximately 40 feet north and south of the creek banks.
- The newly constructed lanes would be graded to prepare for paving (arriving at the finished elevation and shape of roadway).
- Intersections with existing roads that would be affected by the new traffic lanes approaching the bridge would be reconfigured to meet Department standards.
- The full length of the new lanes approaching the bridge would be paved, and any new driveway connections and intersections would be created. Centerlines and fog lines would be painted and signs would be installed.
- Traffic would be relocated to the new bridge. Traffic may be routed to the new bridge before paving the roadway approaches if traffic flow would not be affected (Herrera Environmental Consultants, 2005).

Post Creek Bridge Test Pile Process

While performing soil borings and piezometer readings to aid in the design of the Post Creek Bridge, the Department discovered at least two confined artesian aquifers located at depths of 5 to 15 ft and 54 ft below the ground surface. Additional testing was completed to measure the artesian pressure, and further analysis that showed the soils are liquefiable. As such, it was determined that a pre-construction test pile program was necessary to determine the preferred driven pile foundation system. Due to contractor availability and permits, the work occurred in the Fall and Winter of 2018 (J. Weigand and M. Lloyd, Montana Department of Transportation, personal communication, May 2018). One test pad locations near Post Creek was selected; located on the east side of US Highway 93 north of Post Creek. Site work consisted of clearing vegetation along the access road and test pads and placing a separation geotextile followed by approximately two feet of granular fill material to support the construction equipment. Erosion control fencing was installed around the pad to contain normal runoff and debris from entering Post Creek. A straw bale treatment system was installed to treat potential artesian flow and spring runoff.

At the test pad site heavy equipment was utilized and the test program was set up in phases to complete compaction grouting and micropile initially. If that was successful, then pile would be driven. However, during the micropile installation another artesian spring was discovered. This halted testing because it was determined to be too risky to continue with the micropile. Only the compaction grout columns would be completed and tested. A dead weight load test and cone penetration testing (CPT) were completed to evaluate the bearing capacity of the soil and liquefaction mitigation.

Initially, after the testing was completed, the imported fill material and separation fabric was to be removed and disposed of at an approved waste site. The ground would have been graded to preconstruction contours and reseeded using CSKT-approved seed mix. However, because this is an area that will be impacted during construction, CSKT and the Department decided to leave it in place to allow site access.

Due to the risk that artesian groundwater would migrate to the surface along the outside of the test piles, a grouting system was employed to inject low-mobility grout around the piles at depths that are approximately 20 feet below grade. The compaction grouting serves as a plug to contain the pressurized groundwater. In the event the compaction grouting was unable to stop the groundwater flow, weighted bentonite grout would be pumped around the piles. In the event that groundwater could not be stopped with compaction grout or weighted grout, the straw bale treatment system was used to settle out suspended solids from the artesian flow. The system relied on flocculation chemicals to settle suspended solids into a settling basin located immediately below the straw bale gallery.

Conclusion of the foundation testing recommended that no deep foundation elements, such as driven pile, grouted micropile, or drilled shafts, be installed into the artesian aquifer surrounding the Post Creek Bridge. They recommended the bridge be supported on a spread footing foundation system due to the risk of uncontrolled artesian flow (Warren and Rice 2019).

Post Creek Bridge Removal

Removing the existing Post Creek bridge includes the following:

- Instream work required to remove the existing bridge abutments and pier would be limited to the time period identified by the tribal fisheries program permitting process. Preliminarily, the tribal fisheries program has recommended a July 1 through August 31 instream work window (Barfoot, 2014).
- The existing bridge would be removed after traffic is switched to the temporary detour east of the highway.
- Coffer dams, or similar structures, may be constructed around areas of abutment removal to control transport of sediment.

- The Department is required to cut off or remove substructures to a depth of 1 foot below the stream bed and the removal areas are to be shaped and contoured to blend with the surrounding terrain.

Urban Segment

The Ronan-Urban and Ronan–North projects will completely reconstruct the northern 3.7 miles of the US 93 Ninepipe/Ronan corridor. This existing road segment is narrow, lacks shoulders, is periodically congested, and is expected to deteriorate in the future. The Ronan projects begin south of Ronan (south of the intersection of US 93 and Brooke Lane). Reconstruction extends north through the city of Ronan past the intersection of US 93 and Spring Creek Road/Baptiste Road to connect with the rebuilt four-lane, divided road.

The proposed project follows the present alignment of US 93 while widening to a two-lane roadway with a continuous TWLTL developed south of Innovation Lane (south rural section). Closer to the Ronan city limits, the project transitions to a five-lane roadway with four through lanes and a TWLTL. For the urban portion of the project, US 93 will split into a couplet with a two-lane, one-way northbound roadway on existing US 93 and a two-lane, one-way southbound roadway on 1st Avenue SW. Within the city limits, the project will install sidewalks on both sides of the one-way couplets and connections to the east-west streets (where right-of-way is available). The project will also construct a separated, shared-use path along the entire length of reconstruction. Traffic signal control will be provided on the one-way couplet intersections with Eisenhower, Buchanan, and Round Butte Road and at the intersection with the old US 93 (3rd Avenue NW). North of old US 93, the project will transition into a four-lane divided highway with turn lanes provided at the intersection of US 93 and Spring Creek Road/Baptiste Road.

The rural and urban sections have varying typical sections and widths but all provide two, 12-foot asphalt travel lanes with shoulders. Rural sections will also include a separated, 10-foot asphalt, shared-use (bicycle/pedestrian) trail. Select urban locations will include concrete sidewalks.

The Ronan-Urban project's major hydraulics features consist of standard road crossing culverts, four irrigation crossings, and a major stream crossing, Spring Creek. The SEIS proposed that the existing Spring Creek culvert system would be replaced with an open channel and culverts to convey the stream under the two, one-way couplets and the city-block between. Preliminary analysis now recommends replacing the existing culvert system with one new culvert located in public right-of-way.

General Conservation Measures

The following measures have been or will be incorporated into design plans for the four proposed projects in the Action Area. Construction conservation measures to be implemented during construction to further minimize impacts are:

- To provide safe passage for grizzly bears and other wildlife between suitable habitats on either side of the highway, wildlife crossing structures are proposed at Post Creek, Crow

Creek, and on the Ninepipe National Wildlife Refuge. Guide fencing to route bears toward wildlife crossings is proposed at each crossing and where practical, will extend a minimum of 150 yards on each side of the proposed crossings.

- The proposed project would reduce effects on fisheries resources and grizzly bear habitats by steepening fill slopes from 6:1 (Horizontal:Vertical) to 4:1; this would be incorporated into all rural alternatives where it is justified to do so. Fill slopes for the approaches to bridge structures have also been steepened to 2:1 because these slopes would already contain protective approach guardrails necessary to provide a transition to the barrier rail on the bridges. These steeper slopes reduce the width of the roadway footprint and, consequently, reduce impacts to floodplains, wetlands, and federal and state managed lands.
- To the greatest extent possible, the Department has elected to maintain US 93 on its current alignment to minimize impacts to wetlands, riparian areas, and other important wildlife habitat. At Post Creek, the original proposal to construct the new bridge and roadway to the west of the current alignment has been changed to avoid impacts to important forested wetlands and grizzly bear habitat in the Post Creek riparian corridor. The new roadway and bridge is now proposed on the current alignment. Better wetland delineation accuracy in combination with staying on the current alignment has reduced wetland impacts by 4.15 acres.

E. SUMMARY OF PROJECT ELEMENTS FOR FEDERALLY LISTED SPECIES

Below is a summary of the conservation measures resulting from the proposed action broken down by listed species. As mentioned in the introduction, each listed species will be covered in their own chapter of this biological opinion.

1. Bull Trout

Conservation measures for bull trout are designed to avoid or minimize potential stressors that may result from the proposed construction projects. Specifically, the proposed action would implement measures that would: (1) reduce the likelihood of barotraumas induced by impact pile driving and blasting; (2) maintain water quality; and (3) reduce the likelihood of increased sediment inputs.

2. Grizzly Bear

Conservation measures and project design elements intended for grizzly bears are designed to: (1) minimize attractants during construction; (2) reduce the likelihood of vehicle collisions with grizzly bears; and (3) reduce the likelihood the traffic volumes within the project area would serve as a barrier to future westward movement by grizzly bears.

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APPENDIX A. US 93 Evaro to Polson Wildlife Crossing Summary Table (RESPEC 2017).

Structure Name	Crossing Location by Reference Post	Type	Size (ft)	Length (ft)	Project I.D.	Construction Limits by Reference Post	Years Constructed
Frog Creek	7.80	Corregated Metal Pipe	10 × 7	95	US 93-Evaro - McClure Road	6.4 to 12.8	2008–2010
North Evaro	8.75	Corregated Metal Pipe	25 × 17	85	US 93-Evaro - McClure Road	6.4 to 12.8	2008–2010
Rail Road Xing	9.68	Bridge	39 w × 23 h	340	US 93-Evaro - McClure Road	6.4 to 12.8	2008–2010
Finley Cr #1	10.05	Corregated Metal Pipe	26 × 18	105	US 93-Evaro - McClure Road	6.4 to 12.8	2008–2010
Finley Cr #2	10.25	Corregated Metal Pipe	26 × 18	72	US 93-Evaro - McClure Road	6.4 to 12.8	2008–2010
Evaro Overpass	10.35	Overpass (concrete arch)	49 wide	197 top	US 93-Evaro - McClure Road	6.4 to 12.8	2008–2010
Finley Cr #3	10.50	Corregated Metal Pipe	25 × 17	81	US 93-Evaro - McClure Road	6.4 to 12.8	2008–2010
Finley Cr #4	10.82	Corregated Metal Pipe	26 × 18	83	US 93-Evaro - McClure Road	6.4 to 12.8	2008–2010
Schley Creek	10.90	Corregated Metal Pipe	25 × 17	100	US 93-Evaro - McClure Road	6.4 to 12.8	2008–2010
EF Finley Cr	12.25	Corregated Metal Pipe	25 × 17	80	US 93-Evaro - McClure Road	6.4 to 12.8	2008–2010
Agency Creek	15.62	Concrete Box Culvert	6 × 6	115	US 93-McClure Rd-N Arlee Couplet	12.8 to 18.5	2008–2009
Jocko #1	18.82	Concrete Box Culvert	7 × 7	148	US 93-N Arlee-Vic White Coyote Rd	18.5 to 20.0	2004–2005
Jocko #2	18.86	Concrete Box Culvert	7 × 7	141	US 93-N Arlee-Vic White Coyote Rd	18.5 to 20.0	2004–2005
Jocko #3	18.90	Concrete Box Culvert	7 × 7	131	US 93-N Arlee-Vic White Coyote Rd	18.5 to 20.0	2004–2005
Jocko River	18.95	Bridge	54 w × 12h	394	US 93-N Arlee-Vic White Coyote Rd	18.5 to 20.0	2004–2005
Schalls Flats	23.00	Concrete Box Culvert	8 × 8	122	US 93-Vic White Coyote Rd - S Ravalli	20.0 to 26.7	2006–2007
Jocko/Spring Cr	23.20	Bridge	39 w × 10 h	100	US 93-Vic White Coyote Rd - S Ravalli	20.0 to 26.7	2006–2007
Ravalli Curves #1	24.20	Corregated Metal Pipe	22 × 16	72	US 93-Vic White Coyote Rd - S Ravalli	20.0 to 26.7	2006–2007

Structure Name	Crossing Location by Reference Post	Type	Size (ft)	Length (ft)	Project I.D.	Construction Limits by Reference Post	Years Constructed
Ravalli Curves #2	24.80	Corregated Metal Pipe	22 × 16	84	US 93-Vic White Coyote Rd - S Ravalli	20.0 to 26.7	2006–2007
Jocko Side Channel	25.75	Bridge	39 w × 12 h	100	US 93-Vic White Coyote Rd - S Ravalli	20.0 to 26.7	2006–2007
Ravalli Curves #3	26.06	Concrete Box Culvert	4 × 6	90	US 93-Vic White Coyote Rd - S Ravalli	20.0 to 26.7	2006–2007
Ravalli Curves #4	26.13	Concrete Box Culvert	7 × 5	82	US 93-Vic White Coyote Rd - S Ravalli	20.0 to 26.7	2006–2007
Ravalli Curves #5	26.28	Concrete Box Culvert	4 × 6	80	US 93-Vic White Coyote Rd - S Ravalli	20.0 to 26.7	2006–2007
Copper Creek	26.40	Corregated Metal Pipe	25 × 18	60	US 93-Vic White Coyote Rd - S Ravalli	20.0 to 26.7	2006–2007
Ravalli Hill #2	28.10	Corregated Metal Pipe	17 × 24	128	US 93-South of Ravalli - Medicine Tree	26.7 to 31.4	2006–2007
Ravalli Hill #1	28.40	Corregated Metal Pipe	17 × 24	102	US 93-South of Ravalli - Medicine Tree	26.7 to 31.4	2006–2007
Pistol Cr #1	30.48	Corregated Metal Pipe	17 × 24	131	US 93-South of Ravalli - Medicine Tree	26.7 to 31.4	2006–2007
Pistol Cr #2	30.65	Corregated Metal Pipe	17 × 24	131	US 93-South of Ravalli - Medicine Tree	26.7 to 31.4	2006–2007
Sabine Creek	31.75	Corregated Metal Pipe	24 × 13	48	US 93-Medicine Tree-Vic Red Horn Rd	31.4 to 36.8	2006–2007
Mission Creek	32.43	Bridge	51 w × 10 h	131	US 93-Medicine Tree-Vic Red Horn Rd	31.4 to 36.8	2006–2007
Mission Stockpass	33.42	Concrete Box Culvert	7 × 7	94	US 93-Medicine Tree-Vic Red Horn Rd	31.4 to 36.8	2006–2007
Post Cr #1	33.80	Corregated Metal Pipe	24 × 16	95	US 93-Medicine Tree-Vic Red Horn Rd	31.4 to 36.8	2006–2007
Post Cr #2	34.08	Corregated Metal Pipe	24 × 16	72	US 93-Medicine Tree-Vic Red Horn Rd	31.4 to 36.8	2006–2007
Post Cr #3	34.40	Corregated Metal Pipe	24 × 13	64	US 93-Medicine Tree-Vic Red Horn Rd	31.4 to 36.8	2006–2007
Post Cr #4	34.50	Corregated Metal Pipe	6 ×4	130	US 93-Medicine Tree-Vic Red Horn Rd	31.4 to 36.8	2006–2007
Post Cr #5	34.75	Corregated Metal Pipe	8 × 8	104	US 93-Medicine Tree-Vic Red Horn Rd	31.4 to 36.8	2006–2007
Post Cr #6	36.40	Corregated Metal Pipe	6 × 4	96	US 93-Medicine Tree-Vic Red Horn Rd	31.4 to 36.8	2006–2007
Post Cr #7	36.73	Corregated Metal Pipe	6 × 4	104	US 93-Medicine Tree-Vic Red Horn Rd	31.4 to 36.8	2006–2007

Structure Name	Crossing Location by Reference Post	Type	Size (ft)	Length (ft)	Project I.D.	Construction Limits by Reference Post	Years Constructed
Ronal Canal #1	48.75	Concrete Span Arch	28 × 10	146	US 93-Spring Creek Rd - Minesinger Trail	48.3-56.0	2007–2009
Ronan Stockpass	49.17	Concrete Culvert	14 × 14	155	US 93-Spring Creek Rd - Minesinger Trail	48.3-56.0	2007–2009
Ronal Canal #2	49.30	Concrete Span Arch	28 × 10	170	US 93-Spring Creek Rd - Minesinger Trail	48.3-56.1	2007–2009
Mud Creek	50.95	Concrete Span Arch	42 × 14	65	US 93-Spring Creek Rd - Minesinger Trail	48.3-56.1	2007–2009
Mud Creek (Old Hwy 93)	50.92	Concrete Span Arch	42 × 14	39	Mud Creek Structures	50.7-51.1	2006–2007
Polson Hill	57.75	SSPP Concrete	12 × 22	104	US 93-Minesinger Trail to MT 35	56.0-58.1	xx

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Montana Ecological Services Field Office
585 Shephard Way, Suite 1
Helena, Montana 59601-6287

In Reply Refer To:
File: M.17 FHWA
06E11000-2018-F-0146

September 4, 2018

Heidy Bruner
Federal Highway Administration
585 Shephard Way, Suite 2
Helena, Montana 59601

Dear Ms. Bruner:

This responds to your August 20, 2018 letter requesting that the US Fish and Wildlife Service (Service) issue the biological opinion for bull trout (*Salvelinus confluentus*) for the US 93 Evaro to Polson (RP 6.8 to 59.0) (NH 5-2(159)37; UPN 8008000) project. The impetus for this request is a necessity to conduct a test pile study of the Post Creek bridge in mid-September, 2018. The proposed test pile study would not change the analyses presented in the biological assessment or the March 12, 2018 biological assessment addendum, or the effects determination for bull trout. With regards to grizzly bears (*Ursus arctos horribilis*), the Federal Highway Administration (Administration), the Montana Department of Transportation (Department), and the Service, all acknowledge that the test pile study is part of the larger US 93 Evaro to Polson project, which is currently in consultation. However, due to the limited scope of work of the test pile study, short duration of activity, locations immediately adjacent to US 93 North, small areas of disturbance, and implementation of conservation measures described on page 11 through 15 of the biological assessment, the Administration has determined that an effects determination of *may affect, not likely to adversely affect* grizzly bears is warranted <u>solely for the activity of the test pile study</u>.

The Department, in cooperation with the Administration, is proposing to reconstruct approximately 11.9 miles of US 93 in Lake County, which is referred to as the US 93 Ninepipe/Ronan Corridor. The corridor lies within the Flathead Indian Reservation and begins at Red Horn Road/Dublin Gulch Road (reference post [RP] 36.8) and extends north to Baptiste Road/Spring Creek Road (RP 48.7). The proposed work will include replacement of the Post Creek bridge.

The attached biological opinion for bull trout is based on the biological assessment prepared by Mark Traxler of RESPEC for the Department, a biological assessment addendum prepared by Joe Weigand of the Department, additional information received during the consultation process, and information in our files. The biological opinion was prepared in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 et seq.). A complete project file of this consultation is on file at the Service's Montana Ecological Services Office. A biological opinion that provides a more thorough project description and consultation history will be issued when consultation on grizzly bears has been completed.

While formal consultation for the effects of the corridor project on grizzly bears is ongoing, the Service concurs with the Administration's determination that the activity of the Post Creek test pile study ***may affect, not likely to adversely affect*** grizzly bears. Thus, the Administration and Department may proceed with the Post Creek test pile study, but may not irreversibly or irretrievably commit resources towards the remainder of the proposed project until formal consultation on grizzly bears has been completed. The Service acknowledges your determination that the proposed project will have ***no effect*** on the threatened Canada lynx (*Lynx canadensis*), and yellow-billed cuckoo (*Coccyzus americanus*), Spaulding's campion (*Silene spaldingii*), and water howellia (*Howelliea aquatilis*). The Service also acknowledges your determination that the proposed project is ***not likely to jeopardize the continued existence*** of the proposed wolverine (*Gulo gulo luscus*) and meltwater lednian stonefly (*Lednia tumana*), and the candidate whitebark pine (*Pinus albicaulis*). We base our evaluation on the information displayed in the biological assessment and biological assessment addendum, specifically conservation measures listed on pages 11 through 15 of the biological assessment, and in our records. The Service also reminds the Administration and Department that their grizzly bear conservation measures that would locate construction staging areas, field offices, and sleeping quarters away from Post Creek would apply during the Post Creek test pile study.

The Service appreciates your efforts toward conservation of threatened and endangered species as part of our joint responsibility under the Act. If you have questions or comments related to this consultation, please contact Mike McGrath at mike_mcgrath@fws.gov or (406) 449-5225, extension 201.

Sincerely,

Ben Conard

for Jodi L. Bush
Office Supervisor

cc: AES, R-6, MS 60120 (Attn: Doug Laye)
Confederated Salish and Kootenai Tribes, Pablo, MT (Attn: Craig Barfoot, Dale Becker)
Montana Fish, Wildlife and Parks, Missoula, MT (Attn: Randy Arnold)
Montana Department of Transportation, Helena, MT (Attn: Bill Semmens, Joe Weigand)
File: 7759 Biological Opinions – 2018

Enclosure

Chapter II. Biological Opinion for Bull Trout

Table of Contents

A. CONTEXT OF THE PROPOSED ACTION FOR BULL TROUT

The Montana Department of Transportation (Department) and the Federal Highway Administration (Administration), in cooperation with the Confederated Salish and Kootenai Tribes (CSKT), determined in their revised biological assessment that activities conducted under the proposed action will be *likely to adversely affect* bull trout and have *no effect* on designated bull trout critical habitat (RESPEC 2017). Consequently, no further discussion of critical habitat will occur in this BO.

This section describes the spatial context in which the Service conducts its ESA Section 7 consultation and jeopardy analysis; describes the relationship of the project area to bull trout occurrence; and describes the desired condition for bull trout under the revised biological assessment, as well as the guidelines and standards applied at the project level to achieve desired conditions.

This biological opinion (BO) will consider the effects of implementation of the proposed framework of the US 93 Ninepipe/Ronan Improvement Project. This biological opinion provides a detailed analysis for effects of specific projects within the Ninepipe/Ronan segment of US 93.

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

1. Relationship of the Project Area to Bull Trout

The proposed action (implementation of the US 93 Ninepipe/Ronan Improvement Project) would occur across approximately 11.2 miles of US 93 in Lake County, Montana. A segment of the proposed action would occur in Post Creek, in the Lake Pend Oreille Core Area of the Columbia Headwaters Recovery Unit and would affect one bull trout local population therein (further discussed below).

2. Description of the Proposed Action

The Department and the Administration, in cooperation with the CSKT, are proposing to reconstruct approximately 11.2 miles of US 93 in Lake County, Montana, which is referred to as the US 93 Ninepipe/Ronan Improvement Project. The corridor lies within the Flathead Indian Reservation and begins at Red Horn Road/Dublin Gulch Road (reference post [RP] 37.1) and extends north to Baptiste Road/Spring Creek Road (RP 48.3). The purpose of the project is to improve level of service (LOS), mobility, traffic flow, system linkage and safety on the transportation system. This highway segment has been divided into four primary projects with the potential for more splits to occur in the future (RESPEC 2017).

The US 93 Ninepipe/Ronan project corridor has been divided into rural and urban portions. The rural section has been further divided into two segments: the Post Creek Hill segment and the

Ninepipe segment. The Post Creek Hill segment extends from Red Horn Road/Dublin Gulch Road on the south to a point approximately 2,000 feet north of Olson Road/ Gunlock Road. The Ninepipe segment extends from the northern end of the Post Creek Hill segment to Brook Lane south of Ronan. The urban portion, referred to as Ronan - Urban, extends from Brook Lane northerly through Ronan to the Baptiste Road/Spring Creek Road intersection. Each of these segments has several alternative designs that have been proposed and are currently being analyzed. This biological opinion is based on the preliminary preferred alternative that includes the Rural 10 Alternative for the rural portion and the Ronan 4 Alternative for the urban portion (RESPEC 2017). Due to the significance of the Post Creek drainage to bull trout, the removal and replacement of the Post Creek Bridge will be described in further detail below. For more information about other road construction elements within the rural and urban segments, refer to the "Introduction" of this BO.

Post Creek is presently conveyed under U.S. Highway 93 via a 15.5-meter long, 9.5-meter wide, two span bridge. The center pier occurs within the Post Creek channel. The channel under the bridge has been narrowed and stabilized with large riprap. The new bridge, proposed to be a multiple-span structure 152 meters long, would not include a pier within the Post Creek channel. This much longer bridge would result in less channel constriction and allow the stream more interaction with its floodplain (RESPEC 2017).

Post Creek Bridge Construction

To minimize wetland impacts both east and west of the highway, the new Post Creek bridge alignment will be constructed on the present alignment. During construction, a 7-meter (24-ft) wide detour road will be located on the east (upstream) side of the highway to carry traffic during construction of the new bridge. Temporary detour and/or work bridges will span the entire Post Creek channel and will be built on either temporary piles or spread footings. The temporary detour would be constructed prior to demolition of the existing bridge and current roadway. Construction of the new bridge includes the following:

- Grading and construction practices that unnecessarily disturb natural features, promote erosion, and require extensive revegetation would be avoided or minimized.

- The new Post Creek bridge piers would be located outside the ordinary high-water mark for Post Creek, with the nearest piers located approximately 12 meters (40 feet) north and south of the creek banks.

- The newly constructed lanes would be graded to prepare for paving (arriving at the finished elevation and shape of roadway).

- Intersections with existing roads that would be affected by the new traffic lanes approaching the bridge would be reconfigured to meet Department standards.

- The full length of the new lanes approaching the bridge would be paved, and any new driveway connections and intersections would be created. Centerlines and fog lines would be painted and signs would be installed.

- Traffic would be relocated to the new bridge. Traffic may be routed to the new bridge before paving the roadway approaches if traffic flow would not be affected (RESPEC 2017).

Post Creek Bridge Test Pile Process

While performing soil borings and piezometer readings to aid in the design of the Post Creek Bridge, the Department discovered at least two confined artesian aquifers located at depths of 35 ft and 50 ft below the ground surface. As such, it was determined that a pre-construction test pile program was necessary to determine the preferred foundation system. Due to contractor availability, the work will likely occur in the Fall of 2018 (J. Weigand, Montana Department of Transportation, personal communication, May 2018). Two test pad locations near Post Creek have been selected; one located on the east side of US Highway 93 north of Post Creek, and the second site on the west side of US Highway 93 south of Post Creek. Site work will consist of clearing vegetation along the access road and test pads and placing a separation geotextile followed by approximately two feet of granular fill material to support the construction equipment. Once the grading has been completed, erosion control fencing would be installed around the pad to contain normal runoff and debris from entering Post Creek. A straw bale treatment system would be used to treat potential artesian spring runoff.

At each test pad site a heavy crane and pile hammer will be used to drive five closed-end pipe piles, ranging from 16-inches to 30-inches in diameter, to a depth up to 140 feet; micro-piles may also be used. Piles will be driven on lands adjacent to Post Creek. Each pile will be dynamically tested to establish their respective load capacity, and one pile will be statically tested to verify the dynamic testing results. Once the pipe pile tests have been completed, they will be cut off below grade, capped and backfilled. Leaving the piles in place would be necessary to keep artesian flows from traveling to the surface.

To assist in determining future impacts and help establish future mitigation or avoidance strategies, hydroacoustic sound monitoring will be conducted in Post Creek while the piles are being driven.

Additional testing will be done using low-mobility compaction grouting, micropile, and concrete spread footings to determine the foundation capacity for non-pipe pile foundation systems. These alternative concrete foundation systems will undergo static load testing to determine their strength characteristics. After the tests have been completed, the concrete will be removed and/or buried at a depth below the ground surface.

After the testing is completed and equipment has been removed from the site, the imported fill material and separation fabric will be removed and disposed of at an approved waste site. The ground will be graded to preconstruction contours and reseeded using a CSKT-approved seed mix.

Due to the risk that artesian groundwater would migrate to the surface along the outside of the test piles, a grouting system would be employed to inject low-mobility grout around the piles at depths that are approximately 20 feet below grade. The compaction grouting would serve as a plug to contain the pressurized groundwater. In the event the compaction grouting is unable to stop the groundwater flow, weighted bentonite grout would be pumped around the piles. In the event that groundwater could not be stopped with compaction grout or weighted grout, a straw bale treatment system would be used to settle out suspended solids from the artesian flow. The system relies on flocculation chemicals to settle suspended solids into a settling basin located immediately below the straw bale gallery.

Post Creek Bridge Removal

Removing the existing Post Creek Bridge includes the following:

- Instream work required to remove the bridge abutments and pier would be limited to the time period identified by the tribal fisheries program permitting process. Preliminarily, the tribal fisheries program has recommended a July 1 through August 31 instream work window.

- The existing bridge would be removed after traffic is switched to the temporary detour east of the highway.

- Coffer dams, or similar structures, may be constructed around areas of abutment removal to control transport of sediment.

- The Department is required to cut off or remove substructures to a depth of 305 millimeters (1 foot) below the stream bed and the removal areas are to be shaped and contoured to blend with the surrounding terrain (RESPEC 2017).

Conservation Measures for Protecting Bull Trout

Conservation measures and Best Management Practices (BMPs) to be implemented during removal of the existing bridge and construction of the new bridge in Post Creek include the following:

1. Impact pile driving for the construction of temporary and permanent facilities may occur between July 1 and August 31. This includes dry land and in-water impact pile driving.

2. Should piles be driven outside of the above work window:

    a. Limit the periods of driving pile to no more than 10 hours/day, except in rare circumstances, when safety issues require completion of work begun that day. Do not drive in excess of 12 hours in a day without written approval from the Project Manager.

    b. Conduct hydroacoustic monitoring. Through hydroacoustic monitoring, should it be determined that the physical harm thresholds of the cumulative sound exposure level (SEL) of 187 dB (re: 1 µPa) have been attained or exceeded, impact pile driving must be stopped for the day, with impact pile driving permitted to commence the next morning. In combination with hydroacoustic monitoring, use one of the following measures:

i. Use a vibratory hammer to drive piles to such a point when an impact hammer will be required to drive the pile to the point of completion OR;

ii. Use a “soft start” or “ramp up” pile driving (e.g., driving does not begin at 100% energy) to encourage fish to vacate the surrounding area and use the National Marine Fisheries Service Calculator Tool to determine how many pile strikes can occur during a day, based on pile type and size, prior to reaching threshold in 2) b. above. Once the number of strikes has been attained, impact pile driving must be stopped for the day. If driving pile with an impact hammer over consecutive days outside the work windows in 1) above, do not drive piling between the hours of 9:00 PM and 6:00 AM OR;.

iii. Use Department-approved noise reduction methods, such as those offered in Leslie and Schwertner (2013) (e.g., bubble curtain, cofferdams).

3. Monitor all dewatering activities visually to ensure bull trout are not trapped. In the unlikely event a live bull trout is found within a dewatering area, immediately return it to the river.

4. No construction equipment is allowed to operate within the active channel unless permitted to do so.

5. To the maximum extent practicable, disassemble and remove the existing bridge without pieces being allowed to fall into the river. If debris or portions of the existing bridge enter the river during demolition, within five (5) days completely remove them from the river without dragging the material along the streambed.

6. Any blasting required during demolition will be contained to the maximum extent practicable using some type of containment shielding device to attenuate the blast’s pressure wave within the water and to prevent debris from entering the river. Meet all applicable requirements contained within Department Standard Specifications Section 204 –Blasting.

7. Upon locating dead or injured bull trout, notify the Department Project Manager and contact the USFWS Field Office at (406) 449-5225 within 24 hours. Record information relative to the date, time, and location of dead or injured bull trout when/if found. Include any activities that were occurring at the location and time of injury and/or death of each fish and provide this information to the USFWS.

8. Conduct project-related activities outside of construction limits in a manner which will not adversely affect species and/or designated critical habitat listed under the Endangered Species Act.

<u>Water Quality</u>

1. Stormwater facilities will be designed such that direct discharges to Post Creek are eliminated.

2. Ensure best management practices (BMPs) are applied to this project, including, but not limited to:

    a. installing and maintaining appropriate structural BMPs to prevent erosion and sediment transport from entering state waters;

    b. reseeding and revegetating all disturbed areas with desirable vegetation;

    c. stabilizing disturbed channel banks using appropriate structural BMPs; and

    d. conducting work to minimize disturbance to riparian vegetation.

3. Collect and dispose of all waste fuels, lubricating fluids, herbicides, and other chemicals in accordance with all applicable laws, rules, and regulations to ensure no adverse environmental impacts will occur.

4. During active construction periods, inspect equipment daily to ensure hydraulic, fuel, and lubrication systems are in good condition and free of leaks to prevent these materials from entering any water body.

5. Locate vehicle servicing and refueling areas, fuel storage areas, and construction staging and materials storage areas to ensure that spilled fluids or stored materials do not enter any water body.

6. Keep in-water work within the river channel to the minimum amount necessary. This includes, but is not limited to, construction and removal of any temporary support structures that may be necessary. In-water construction work shall be completed in the shortest amount of time practicable.

7. Do not operate construction equipment within the active channel of any water body unless allowed by temporary facilities permits and approved by the Department Project Manager. Schedule construction activities to ensure as much of the work as practicable is completed during periods of low water levels (RESPEC 2017).

B. STATUS OF THE SPECIES

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.

1. Listing Status

The coterminous United States population of the bull trout 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, Brewin and Brewin 1997, Cavender 1978, Howell and Buchanan 1992, Leary and Allendorf 1997, USFWS 1999, 64 FR 58910).

The final listing rule for the United States coterminous population of the bull trout discusses the consolidation of five distinct population segments (DPSs) into one listed taxon, the application of the jeopardy standard under section 7 of the ESA relative to this species, and established five interim recovery units (RUs) for purposes of consultation and recovery (USFWS 1999, 64 FR 58930). However, in 2010 six RUs were identified base on the best available information. The Service determined that these six RUs were needed to ensure a resilient, redundant, and representative distribution of bull trout populations throughout the range of the listed entity (USFWS 2010, 75 FR 93898). In 2015, the six RUs were formalized in the final *Recovery Plan for the Coterminous United States Population of Bull Trout (Salvelinus confluentus)* (Recovery Plan; USFWS 2015). The final RUs replace the previous five interim RUs and are used in the application of the jeopardy standard for ESA section 7 consultation procedures.

2. Reasons for Listing

Throughout its range, the bull trout is threatened by a wide variety of factors. These include: habitat degradation and fragmentation, instream flow alterations associated with water diversions, 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 1999, 64 FR 58910). Poaching and incidental mortality of bull trout during other targeted fisheries are additional threats. Since the time of coterminous listing of the species (USFWS 1999, 64 FR 58910) and designation of its critical habitat (USFWS 2005a, 70 FR 56212; USFWS 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), the bull trout core areas templates (USFWS 2005b), Conservation Status Assessment (USFWS 2005c), and 5-year Reviews (USFWS 2008, 2015g) have provided additional information about threats and status. The final

Recovery Plan lists many other documents and meetings that compiled information about the status of bull trout (USFWS 2015). The most recent 5-year status review (USFWS 2015g) maintains the listing status as threatened based on the information compiled in the final bull trout recovery plan (USFWS 2015) 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, 2004a, 2004b) 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 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 wildfire) (USFWS 2008, 2015g). In the final Recovery Plan, threats are described at RU scale that typically incorporates multiple watersheds. The plan also describes threats for 109 core areas, local populations, forage/migration/overwintering areas, and includes research needs areas (USFWS 2015).

3. Emerging Threats

Climate change was not addressed as a known threat when bull trout were originally listed in 1999. The 2015 Recovery Plan and RUIPs summarize the threat of climate change and acknowledge that some extant bull trout core area habitats will likely change (and may be lost) over time due to anthropogenic climate change effects. It was determined that use of best available information to identify and ensure future conservation efforts will offer the greatest long-term benefit to sustain bull trout and their required cold water habitats (USFWS 2015, USFWS 2015a-f).

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, Koopman et al. 2009). 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 non-native 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 2015c). Although all salmonids are likely to be affected by climate change, bull trout are particularly 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, Rieman et al. 2007). Climate change is expected to reduce the extent of cold water habitat (Isaak et al. 2015), and increase competition with other fish species (e.g., 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 upward shift in elevation) due to the effects from climate change (Isaak et al. 2010, 2014, Peterson et al. 2013).

4. 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; Bond 1992). To the west, the bull trout's range includes Puget Sound, various coastal rivers of British Columbia, Canada, and southeast Alaska (Bond 1992). 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; Brewin and Brewin 1997).

Reproductive Biology

Bull trout typically reach sexual maturity in 4 to 7 years and may live longer than 12 years. They are iteroparous (i.e., 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; Leathe and Graham 1982; Pratt 1992; Rieman and McIntyre 1996). The iteroparous reproductive strategy (i.e., fish 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 (i.e., 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.

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). Redds are often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989; Pratt 1992; Rieman and McIntyre 1996). Depending on water temperature, incubation is typically 100 to 145 days (Pratt 1992). Post hatching, fry remain in the substrate, with time from egg deposition to emergence potentially surpassing 220 days. Fry normally emerge from early April through

May, depending on water temperatures and increasing stream flows (Pratt 1992; Ratliff and Howell 1992).

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) 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). 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). Due to their long incubation period (220+ days), bull trout are particularly sensitive to inadequate IGDO levels. An IGDO level below 8 mg/L is likely to result in mortality of eggs, embryos, and fry.

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; Pratt 1985). The largest verified bull trout is a 32-pound specimen caught in Lake Pend Oreille, Idaho in 1949 (Simpson and Wallace 1982).

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). 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). Migratory bull trout spawn in tributary streams where juvenile fish rear for 1 to 4 years before migrating to either a lake (adfluvial form), river (fluvial form) (Fraley and Shepard 1989; Goetz 1989), or saltwater (anadromous form) to rear as sub-adults and to live as adults (Brenkman and Corbett 2005; McPhail and Baxter 1996; WDFW et al. 1997).

Bull trout are believed to be naturally migratory, which allows them to capitalize on temporally abundant food resources and larger downstream habitats. However, resident forms likely develop where barriers (either natural or manmade) occur or where foraging, migrating, or overwintering habitats for migratory fish are minimized (Brenkman and Corbett 2005; Goetz et al. 2004). 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). Parts of this river system have retained habitat conditions that allow free movement between spawning and rearing areas and the mainstem Snake River. Such multiple life history strategies help to maintain the stability of bull trout populations and allow persistence following environmental changes. Benefits to 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 if local populations suffer a catastrophic loss (Frissell 1999; MBTSG 1998; Rieman and McIntyre 1993). 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).

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

1. “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.

2. “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.

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

Spruell et al. (2003) noted that within the major assemblages, populations were further subdivided, primarily at the level of major river basins. Taylor et al. (1999) surveyed bull trout populations, primarily from Canada, and found a major divergence between inland and coastal populations. Costello et al. (2003) suggested the patterns reflected the existence of two glacial refugia, consistent with the conclusions of Spruell et al. (2003) and the biogeographic analysis of Haas and McPhail (2001). Both Taylor et al. (1999) and Spruell et al. (2003) concluded that the Deschutes River represented the most upstream limit of the coastal lineage in the Columbia River Basin. More recently, the Service identified additional genetic units within the coastal and interior lineages (Ardren et al. 2011). Based on a recommendation in the 5-year review of the species’ status (USFWS 2008), the Service reanalyzed the 27 recovery units identified in the 2002 draft bull trout recovery plan (USFWS 2002) by utilizing, in part, information from previous genetic studies and new information from additional analysis (Ardren et al. 2011). In this examination, the Service applied relevant factors from the joint U.S. Fish and Wildlife Service and National Marine Fisheries Service Distinct Population Segment (DPS) policy

(USFWS 1996) 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). The six draft recovery units identified for bull trout in the coterminous United States include: Coastal, Klamath, Mid-Columbia, Columbia Headwaters, Saint Mary, and Upper Snake. These six draft recovery units were adopted, described, and identified in the final bull trout recovery plan (USFWS 2015) and RUIPs (USFWS 2015a-f).

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). Increased habitat fragmentation reduces the amount of available habitat and increases isolation from other populations of the same species (Saunders et al. 1991). Burkey (1989) 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 in local populations may be low and the population may have a higher probability of extinction (Burkey 1989; Burkey 1995).

The metapopulation concepts of conservation biology have been suggested relative to the distribution and characteristics of bull trout, although empirical evidence is relatively scant (Rieman and McIntyre 1993; Dunham and Rieman 1999; Rieman and Dunham 2000). A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meffe and Carroll 1994). 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. Ideally, multiple local populations distributed throughout a watershed provide a mechanism for spreading risk because the simultaneous loss of all local populations is unlikely (Rieman and Dunham 2000). 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; Dunham and Rieman 1999; Spruell et al. 1999; Rieman and Dunham 2000).

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). 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) 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). 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), while Whitesel et al. (2004) identified that bull trout fit the metapopulation theory in several ways.

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). 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; Goetz 1989; Hoelscher and Bjornn 1989; Howell and Buchanan 1992; Pratt 1992; Rich 1996; Rieman and McIntyre 1993; Rieman and McIntyre 1995; Sedell and Everest 1991; Watson and Hillman 1997). Watson and Hillman (1997) 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 all watersheds. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993), 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 since migrations facilitate gene flow among local populations when individuals from different local populations interbreed or stray to non-natal streams (Rieman and McIntyre 1993). 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; Spruell et al. 1999). Migration also facilitates access to more abundant or larger prey, leading to increases in 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; Pratt 1992; Rieman and McIntyre 1993).

Thermal requirements for bull trout appear to differ among life stages. Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992; Rieman and McIntyre 1993). 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; Goetz 1989). In Granite Creek, Idaho, Bonneau and Scarnecchia (1996) 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) 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; Fraley and Shepard 1989; Rieman and McIntyre 1993; Rieman and McIntyre 1995). Availability and proximity of cold water patches and food productivity can influence bull trout ability to survive in warmer rivers (Myrick et al. 2002).

All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Pratt 1992; Rich 1996; Sedell and Everest 1991; Watson and Hillman 1997). Maintaining bull trout habitat requires natural stability of stream channels and maintenance of natural flow patterns (Rieman and McIntyre 1993). Juvenile and adult bull trout frequently inhabit side channels, stream margins, and pools with suitable cover (Sexauer and James 1997). 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; Pratt 1992; Pratt and Huston 1993). Pratt (1992) 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). Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macrozooplankton, and small fish (Boag 1987; Donald and Alger 1993; Goetz 1989). Subadult and adult migratory bull trout generally feed on various fish species (Donald and Alger 1993; Fraley and Shepard 1989; Leathe and Graham 1982). Bull trout of all sizes other than fry have been found to eat fish half their length (Beauchamp and VanTassell 2001). In near-shore 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; WDFW et al. 1997).

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 which facilitates exploitation of a wider variety of prey resources. For example, 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). 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; Goetz et al. 2004).

5. Conservation Status and Needs

Bull Trout Recovery Planning

The 2015 Recovery Plan for the Coterminous United States Population of Bull Trout (USFWS 2015) documented the primary strategy for recovery of bull trout in the coterminous United States. The Recovery Plan established the following approach: (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).

Information presented in prior draft Recovery Plans published in 2002 and 2004 (USFWS 2002, 2004a, 2004b) have served to identify recovery actions across the range of the species and to provide a framework for implementing numerous recovery actions by our partner agencies, local working groups, and others with an interest in bull trout conservation. The 2015 Recovery Plan 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 single distinct population segment (DPS) listed under the Act.

The Service has developed a recovery strategy 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 Act are no longer necessary (USFWS 2015).

To implement the recovery strategy, the 2015 recovery plan establishes four categories of recovery actions for each of the six Recovery Units (USFWS 2015):

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. Work 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

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 biologically-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 (Figure 4, USFWS 2015). 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) (ibid.).

Each of the six recovery units contains multiple bull trout core areas, 116 total, which are non-overlapping watershed-based polygons. Each core area includes one or more local populations. Currently there are 109 occupied core areas, which comprise 611 local populations (USFWS 2015). 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. Core areas are further described as either complex or simple core areas (ibid.). Complex core areas contain multiple bull trout local populations, are found in large watersheds, have multiple life history forms (i.e., fluvial, adfluvial, resident), and have migratory connectivity between spawning and rearing habitat (SR) and foraging, migration, and overwintering habitats (FMO). Simple core areas are those that contain one bull trout local population. These core areas are relatively small in scope, isolated from other core areas by natural barriers, and may contain unique genetic or life history adaptations.

A local population is a group of bull trout that spawn within a particular stream or portion of a stream system (USFWS 2015). A local population is considered to be the smallest group of bull trout that is known to represent an interacting reproductive unit. For water bodies 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 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 (USFWS 2015a-f), which identify conservation actions and 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 distribution, as well as its genetic and phenotypic diversity, all of which are important to ensure the species' resilience to changing environmental conditions.

Coastal Recovery Unit

The Coastal 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 2015a). The Coastal Recovery Unit is located within western Oregon and Washington, and is divided into three 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. Further, the recovery unit has four historically occupied core areas that could be re-established (USFWS 2015, 2015a). Core areas within 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 are outside core areas and allows for the continued natural population dynamics in which the core areas have evolved (USFWS 2015a). 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). These are the most stable and abundant bull trout populations in the recovery unit. 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 near-shore 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. Conservation measures or recovery actions implemented 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 near-shore marine habitats.

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 2015c). 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). This recovery unit currently contains three core areas and eight local populations (USFWS 2015, 2015c). Nine historic local populations of bull trout have become extirpated (USFWS 2015c). All three core areas have been isolated from other bull trout populations for the past 10,000 years (USFWS 2015c). 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. Conservation measures or recovery actions implemented 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.

Mid-Columbia Recovery Unit

The Mid-Columbia 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 2015d). 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, 2 historically occupied core areas, 1 research needs area, and 7 FMO habitats (USFWS 2015, 2015d). 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. Conservation measures or recovery actions implemented include road removal, channel restoration, mine reclamation, improved grazing management, removal of fish barriers, and instream flow requirements.

Upper Snake Recovery Unit

The Upper Snake 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 2015f). 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 (USFWS 2015), with almost 60 percent being present in the Salmon River Region. 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). Conservation measures or recovery actions implemented include instream habitat restoration, instream flow requirements, screening of irrigation diversions, and riparian restoration.

Columbia Headwaters Recovery Unit

The Columbia Headwaters 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). 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 2015b). 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 2015b). Fish passage improvements within the recovery unit have reconnected some previously fragmented habitats (USFWS 2015b), while others remain fragmented. Unlike the other recovery units in Washington, Idaho, and Oregon, the Columbia Headwaters Recovery Unit does not have any anadromous fish overlap. Therefore, bull trout within the Columbia Headwaters Recovery Unit do not benefit from the recovery actions for salmon (USFWS 2015b). The current condition of the bull trout in this recovery unit is attributed to the adverse effects of climate change, historic mining and legacy 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. Conservation measures or recovery actions implemented include habitat improvement, fish passage, and removal of nonnative species.

Saint Mary Recovery Unit

The Saint Mary 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 2015e). 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 2015e) 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.

C. ANALYTICAL FRAMEWORK FOR JEOPARDY DETERMINATION

1. 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 the bull trout were defined in the final Recovery Plan for the Coterminous United States Population of [the] Bull Trout (USFWS 2015). 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 the bull trout in this BO considers the relationship of the action area and affected core area (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).

2. Scales of Analysis

The scale of analysis for a bull trout jeopardy determination from largest to smallest is as follows: Recovery Unit, Major Geographic Region, Core Area, Local Population. The specific scales of analysis for jeopardy determination used in this BO are presented in Table II-1 in Section D.2 *Species Affected*.

D. ANALYTICAL FRAMEWORK FOR DETERMINING BASELINE CONDITIONS AND EFFECTS OF THE ACTION

The following sections describe; (1) the parameters used to assess baseline conditions and effects of the action to bull trout, (2) the action area for the proposed action, and (3) the relationship of the action area to the hierarchical approach to bull trout recovery described in the Recovery Plan for the Coterminous United States Population of Bull Trout (USFWS 2015).

1. Baseline Conditions and Effect to Species and Habitat Indicators

To assess baseline conditions and effects to 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; USFWS 1998). The Framework provides a stand-alone method to systematically assess baseline conditions and project-related effects to bull trout using four Species Indicators to assess Subpopulation Characteristics and six Habitat Pathways incorporating 19 Habitat Indicators. Habitat Indicators are generally arranged from a finer to broader scale within each Habitat Pathway. For example, under the pathway for Habitat Elements, substrate embeddedness is considered at the reach level, large woody debris, pool frequency and quality, and large pools are at the grouped reach level, off-channel habitat is for the entire stream length, and refugia is at the complete subpopulation watershed (USFWS 1998). Ratings of the species and habitat indicators are then used to derive an "Integration of Species and Habitat Conditions" rating. Individual indicators and the rating integrating habitat and subpopulation conditions are intended to help arrive at a determination of the potential effects of land management activities on bull trout.

Although the same indicators are used to assess effects to both bull trout and designated critical habitat, 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 analysis.

Baseline conditions of individual indicators and the integrated value are 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. Indicators and parameters describing indicator ratings can be found in Appendix A.

Baseline ratings have generally been determined for each of the four species indicators, 19 habitat indicators, and the Integration of Species and Habitat Indicators for every 6th field Hydrologic Unit Code (HUC) across the range of bull trout in Montana.

The Framework/Matrix can also be used to determine effects of a proposed action on habitat indicators. 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.

2. Species Affected

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 HUCs are the recommended geographic scale for analysis of effects (USFWS 1998).

This biological opinion addresses the effects on bull trout related to the revision of the US 93 Ninepine/Ronan Project biological assessment; therefore, the action area includes all potential areas that could be affected by construction of the four remaining project segments in the Ninepipes/Ronan corridor in which bull trout may occur. The Action Area includes all areas that could be affected by the proposed projects and is not limited to the actual work area or project footprint. Noise and disturbance from construction activities have the potential to extend beyond the construction limits (RESPEC 2017).

The action area for this biological opinion has been determined by several factors. Temporary, project-induced sediment could potentially extend 800 meters (0.50 mile) downstream from the construction limits at Post Creek. Terrestrial-based construction-related noise impacts have the potential to extend 1.6 km (1 mile) from the roadway in all directions. Hydroacoustic-noise in Post Creek is expected to extend roughly 92 meters (101 yards) upstream and downstream of the work site. This area is based on the approximate distance that the Service expects to be hydroacoustically ensonified from proposed pile driving 12-inch-diameter steel H-type piles associated with temporary work bridges and sheet piling cofferdams (Oestman et al. 2012, Stadler and Woodbury 2009). The ensonified area was estimated using equations presented in Stadler and Woodbury (2009), and data from Oestman et al. (2012) for 12-inch diameter steel H piles driven on land for a total of approximately 500-1,000 strikes per day. The equations from Stadler and Woodbury (2009) and data from Oestman et al. (2012: p. I-82) indicate a single strike impact hammer strike on a 12-inch-diameter steel H-type pile yields a sound exposure level (SEL) of 149 dB, a peak of 174 dB, and a RMS of 159 dB when measured at a distance of 23 meters. Stadler and Woodbury (2009) indicate that the distance from the pile driver at which a single strike SEL drops to 150 dB is the maximum distance from a pile that fishes can be injured, regardless of how many times the pile is struck. Additionally, the threshold for adverse behavioral effects has been documented at 150 dB RMS (Teachout 2010), which would require approximately 101 yd (92 m) using the above data.

The Ninepipes/Ronan corridor is located within one complex core area (i.e., multiple local populations per core area) of the Columbia Headwaters Recovery Unit and will affect the Post Creek population therein. No federally designated bull trout critical habitat exists within the action area. A more detailed description and discussion of the core area within the action area is presented in Section E. *Environmental Baseline* of this document.

Relationship of the Action Area to the Hierarchy of Bull Trout Analysis Units

The bull trout recovery plan considers a hierarchical order of demographic units ranging from local populations to the range of bull trout within the coterminous United States. This stepdown organization is important for implementing recovery, tracking consultation under section 7 of the Endangered Species 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 bull trout and one or more local bull trout populations (USFWS 2015). Local populations are considered the smallest group of fish that are known to represent an interacting reproductive 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 also exist. As discussed above, the action area includes one bull trout core area. This core area is within the Lower Clark Fork Geographic Region, of the Columbia Headwaters Recovery Unit (Table II-1).

Table II-1. Hierarchy of bull trout demographic units of analysis. Note: (C or S) after each core area indicates if that core area is complex or simple.

Bull Trout Analysis Scale	Hierarchical Relationship
Coterminous United States (DPS)	Range of bull trout
Columbia Headwaters Recovery Unit	One of six Recovery Units in the range of the species within the coterminous United States
Lower Clark Fork Geographic Region	One of five Geographic Regions in the Columbia Headwaters Recovery Unit
Lake Pend Oreille (C)	1 of 2 Core Areas in the Lower Clark Fork Geographic Region
Post Creek	1of 35 local populations within the Core Area presented above

Post Creek within the Action Area is considered incidental Feeding, Migrating, and Overwintering Habitat (FMO) (CSKT, pers. comm.). Post Creek currently crosses US 93 at River Mile (RM) 7.0 and this section of the creek is not designated as either a bull trout occupied stream or bull trout critical habitat by the USFWS. Post Creek is designated as a bull trout occupied stream starting at RM 11.6 and continues upstream to RM 20.4. USFWS designated critical habitat starts at McDonald Lake (RM 14.8) and continues upstream to RM 20.4. No bull trout have been documented in Post Creek within the project area, but occurrence of small numbers within the project reach is assumed (RESPEC 2017). CSKT has recorded three bull trout in Post Creek 4 km upstream of US 93 in the past, two of which appeared to be returning migratory adults exceeding 450 mm in total length, while remaining fish was 188 mm total length (Barfoot 2015).

E. ENVIRONMENTAL BASELINE

This section assesses the effects of past and ongoing human and natural factors that have led to the current status of the species, its habitat and ecosystem in the action area. Environmental baseline is defined as "…the past and present impacts of all Federal, State, or private actions and other human activities in an action area, the anticipated impacts of all proposed Federal projects in an action area that have already undergone formal or early Section 7 consultation, and the impact of State or private actions that are contemporaneous with the consultation in process." (50 CFR 402.02)

1. Status of Bull Trout in the Action Area

The status of bull trout in the action area is described below by core area. Information on status is derived from the BA (RESPEC 2017), the Conservation Strategy for Bull Trout on USFS Lands in Western Montana (USFS 2013), the Columbia Headwaters Recovery Unit Implementation Plan (USFWS 2015b), and the bull trout core area assessments and 5-year reviews (USFWS 2005b, 2005c, 2015g).

Lake Pend Oreille Core Area

The Lake Pend Oreille (LPO) Core Area is one of two complex core areas in the Lower Clark Fork Geographic Region and the largest core area in the Columbia Headwaters Recover Unit, consisting of 35 local populations. In the Columbia Headwaters Recovery Unit Implementation Plan the LPO Core Area is described in three parts (USFWS 2015b). This was done to clarify jurisdictional issues since the LPO Core Area crosses multiple states (Montana, Idaho, Washington), as well as Service Regions (R1 and R6). Below we discuss the three parts of the LPO Core Area separately for the sake of clarity. However, when analyzing the effects of the action we consider those effects on the LPO Core Area as a whole.

LPO-A is upstream of Cabinet Gorge Dam, almost entirely in Montana, and includes the mainstem Clark Fork River upstream to the confluence of the Flathead River as well as the portions of the lower Flathead River (e.g., Jocko River) on the Flathead Indian Reservation. Post Creek is one of the 15 local populations in LPO-A. LPO-B is the Pend Oreille lake basin proper and its tributaries, extending between Albeni Falls Dam downstream from the outlet of Lake Pend Oreille and Cabinet Gorge Dam just upstream of the lake; almost entirely in Idaho. There are 19 local populations in LPO-B. LPO-C is the lower basin (i.e., lower Pend Oreille River), downstream of Albeni Falls Dam to Boundary Dam (1 mile upstream from the Canadian border) and bisected by Box Canyon Dam; including portions of Idaho, eastern Washington, and the Kalispel Reservation (USFWS 2015b). Historically, and for current purposes of bull trout recovery, migratory connectivity among these separate fragments into a single entity remains a primary objective. The LPO core area includes the former Cabinet Gorge Reservoir, Clark Fork River (section 3), Lower Flathead River, Noxon Rapids Reservoir, and Pend Oreille River core areas from the 2002 and 2004 Draft Recovery Plans and 2008 5-year Review (USFWS 2015).

The adult bull trout populations for the LPO-A streams where redd surveys are conducted are considered to be "at least" stable (USFS 2009). Redd counts provide an index of adult abundance of the population (McCubbins et al. 2016). Local populations within the Lower Clark Fork River drainage of LPO-A have been monitored annually since 2000 by Montana Fish Wildlife and Parks (MFWP). Combined total redd counts have ranged from 39-168 during 2000-2015 (MFWP redd count data, pers. comm.). An extensive redd count monitoring program has been in place for LPO-B since 1983 by Idaho Department of Fish and Game (IDFG) and since 2000 by the Avista Native Salmonid Restoration Program. Combined total redd counts have ranged from 553-1256 during 2000-2015 (Bouwens and Jakubowski 2016). Redd counts of local populations within the Flathead Reservation of the Confederated Salish and Kootenai Tribes (CSKT) are not being routinely conducted, and numbers of adult bull trout are thought to be on the order of 100 adult fish or fewer in the migratory population (USFWS 2005b). Actual occurrence of bull trout within Post Creek below the McDonald Lake is estimated to be 1 fish/ km (Barfoot, 2017). It is not known if the bull trout present are a result of outmigration from McDonald Lake, migrants from the Jocko River population that have entered through the Pablo feeder canal, or individuals migrating from the Flathead River. The low numbers found in the stream suggest that bull trout are not successfully spawning below the reservoir (RESPEC 2017). The McDonald Lake population is isolated but stable, with approximately 23 redds per year (Barfoot 2017).

Historic bull trout densities and distribution in LPO-A were likely much higher than they are today. At least two large streams (Pilgrim Creek and Elk Creek) that once likely supported strong adfluvial populations now contain few, if any bull trout. Impacts to bull trout populations in LPO-A began in the early part of the 20th century, and have continued through the present time. These impacts can be largely attributed to dams on the Clark Fork River that presented bull trout with migratory barriers between Lake Pend Oreille and spawning/rearing habitat (USFS 2013). The movement of adult bull trout upstream from Lake Pend Oreille to at least 9 local populations in Montana (97.2 percent of the watershed) was blocked by Thompson Falls Dam in 1913. Construction of Cabinet Gorge Dam in 1952 blocked access to an additional 6 local populations in Montana tributaries. Since 2001, connectivity and successful spawning (DeHaan and Bernall 2013) has been partially achieved by a capture and transport program instituted by Avista, moving an average of 36 adult bull trout (range 19-63) upstream to natal spawning tributaries from which they either originated or were genetically assigned. Additionally, Avista traps and transports downstream-migrating juvenile bull trout to Lake Pend Oreille. Recent advances in juvenile trapping methodology and efficiency are beginning to lead to increased adult return to LPO Core Area spawning tributaries above Cabinet Gorge and Noxon Dams. Further, it is anticipated that bull trout transport will increase with construction of a fish passage facility at Cabinet Gorge Dam. Steps toward construction of this facility have been approved and a fishway is currently nearing final-design, with construction anticipated to begin in 2018 (Avista 2017) (pending section 7 consultation and other permitting); however, a fish passage facility at Cabinet Gorge Dam is not part of the current environmental baseline. A fully functional full-height fish ladder was completed at Thompson Falls Dam in 2010 and commenced operation in 2011. It is currently passing about 5,000 total fish per year upstream (Northwestern Energy 2015). However, because the numbers of bull trout in the system are low, only one or two bull trout use the ladder to move upstream annually.

In addition to dams, numerous smaller scale impacts to bull trout gradually occurred throughout LPO-A in the early part of the 20th century. These included grazing and agricultural development along many of the important low gradient spawning streams, road and energy corridor development in riparian areas, and logging and road development in tributary streams. Changes in fish species composition within LPO-A brought about by stocking programs and some illegal introductions created predation, competition, and hybridization pressures that impacted bull trout populations (USFS 2013).

The bull trout population in LPO-B is relatively robust (approximately 12,000 fish) despite loss of connectivity to large areas of upstream and downstream spawning and rearing habitat. The strong population is largely due to the high quality of the FMO habitat in Lake Pend Oreille and presence of a quality forage fish community, supported by nonnative kokanee (USFWS 2015b). Changes in population attributes of the bull trout population in Lake Pend Oreille between 1998 and 2008 indicate that management actions have benefitted the population. Bull trout size and age structure, mortality, growth, maturity, and abundance in Lake Pend Oreille are consistent with that of a population that is rebuilding and may be able to support limited angler harvest (McCubbins et al. 2016).

Downstream of Lake Pend Oreille in LPO-C, in the Pend Oreille River drainage of northeast Washington, bull trout were largely eliminated through a combination of fragmentation and habitat impacts (Geist et al. 2004, Scholz et al. 2005). One of the 35 local populations in the LPO Core Area occurs in LPO-C. Restoration actions are underway in most tributaries. Historically, prior to Albeni Falls Dam construction in 1955, as many as eight local populations of bull trout existed downstream of the site (USFWS 2002, USFWS 2010a). However, it is likely that all of these local populations are now extirpated (USFWS 2008). Reintroduction of self-sustaining populations is a primary goal of area stakeholders and partners. Once two-way passage is available downstream of Box Canyon and Albeni Falls Dams, recolonization is more likely. However, Dunham et al. (2014) anticipated that even then some level of translocation and reintroduction will be necessary to establish populations at sustainable levels.

Factors Affecting Bull Trout in Lake Pend Oreille Core Area

USFWS 2015b summarized significant threats that were determined to affect bull trout in the 35 core areas of the Columbia Headwaters Recovery Unit. Primary threats are described in detail and are those factors known or likely (i.e., non-speculative) to negatively impact bull trout populations at the core area level, and accordingly require management actions to assure bull trout persistence to a degree necessary that bull trout will not be at risk of extirpation within that core area in the foreseeable future. Table II-2 summarizes the primary threats for the LPO Core Area.

Climate Change

The Climate Shield model by Isaak et al. (2015) was used to evaluate the threat from climate change in the watersheds occupied by bull trout in the Columbia Headwaters Recovery Unit (USFWS 2015b). The model predicts peak summer temperature in watersheds throughout the range of bull trout. The model couples nearly 30,000 crowd-sourced summer water temperature measurements from a diverse array of agencies and institutions across over 10,000 unique stream locations to mathematically assess stream temperatures and forecast future scenarios. By analyzing these data sets, high-resolution networks of cold water refugia can be predicted and evaluated. The Climate Shield model is useful for bull trout recovery planning at a landscape scale. Because it is based on large data sets, the model allows assessment within watersheds at areas where cold water patches of habitat may persist and allows identification of areas that will likely support bull trout spawning and rearing in the future. Conversely, it can also identify watersheds where they are likely to disappear, and where unoccupied patches or patches with unknown bull trout occupancy deserve further assessment and evaluation as potential refugia in the future.

The most useful current application of the Climate Shield model is to examine the presence and potential persistence of cold water patches. Juvenile bull trout are rarely found in streams where mean summer water temperatures exceed 12 degrees C (54 degrees F) (Isaak et al. 2010, Dunham et al. 2014). The model uses a mean August water temperature of 11 degrees C (52 degrees F) to delimit the downstream extent of cold water habitat for modeling purposes (Isaak et al. 2015). Spatially contiguous 1-km (0.6-mile) reaches of streams that are wider than 1 meter (3.3 feet) and have less than 15 percent slope were considered suitable cold water patches for potential bull trout occupancy under the model (Isaak et al. 2015).

Table II-2. Primary Threats to Lake Pend Oreille Core Area in the Columbia Headwaters Recovery Unit, listed by major category (Habitat-Based, Demographic, and Nonnative Species) with subheadings. All threats listed are considered "primary", without rank. LWD = large woody debris; FMO = foraging, migrating, and overwintering habitat, SR = spawning and rearing habitat. (USFWS 2015b).

Geographic Region Core Area	Number of Local Populations	PRIMARY THREATS *HABITAT*	PRIMARY THREATS *DEMOGRAPHIC*	PRIMARY THREATS *NONNATIVES*
Lower Clark Fork Geographic Region				
Lake Pend Oreille A (Portions of Montana upstream of Cabinet Gorge Dam)	**15**	**Upland/Riparian Land Management (1.1)** Sediment from forest roads, logging, and livestock grazing cause riparian and instream degradation, loss of LWD, and pool reduction in FMO habitat and most SR tributaries upstream of Cabinet Gorge Dam (e.g., Thompson River). **Instream Impacts (1.2)** Transportation and utility corridors along riparian areas contribute to degradation through the loss of LWD, pool reduction, and increased sedimentation in some SR tributaries (e.g., Thompson River, Prospect Creek, and Cooper Gulch). Past placer mining, as well as active and proposed mines (e.g., Vermilion River, Rock Creek) affect hydrology, increase sediment, and cause passage issues for bull trout.	**Connectivity Impairment (2.1)** The FMO habitat is fragmented by large mainstem dams leading to low population size and risk of extirpation on now isolated SR habitat. Bull trout are currently trucked and transported upstream at Cabinet Gorge and Noxon Rapids Dams on the Clark Fork River. Improved connectivity) is necessary to fully remediate the effects of this fragmentation and enhance persistence of bull trout in isolated upstream SR habitat in Montana.	**Nonnative fishes (3.1)** Nonnative lake trout, smallmouth and largemouth bass, walleye (recent), northern pike, and brown trout occupy the artificial reservoir habitat (FMO) in Cabinet Gorge, Noxon Rapids, and Thompson Falls Reservoirs. All are highly piscivorous species. They may prey on bull trout to varying degrees (especially migrating juveniles).

		Water Quality (1.3) Water temperatures in mainstem FMO habitat in Cabinet Gorge, Noxon Rapids, and Thompson Falls Reservoirs; and lower reaches of most tributaries are marginally high for bull trout survival in the summer, and conditions are worsening. This concentrates bull trout in isolated pockets of cold water at the mouths of cold water tributaries where they are highly vulnerable to anglers and predators.		
Lake Pend Oreille B (Portions of north Idaho contiguous with the basin of Lake Pend Oreille)	**19**	**Upland/Riparian Land Management (1.1)** Legacy impacts from forest roads, logging, and fires increase sediment and cause riparian and instream degradation, loss of LWD, and pool reduction in FMO habitat and some SR tributaries (e.g., Lightning and Grouse Creeks and Pack River).	None	
Lake Pend Oreille C (Portions of Idaho and Northeast Washington Downstream of Albeni Falls Dam to Boundary Dam)	**1**	**Upland/Riparian Land Management (1.1)** Sediment from forest roads, logging, and livestock grazing cause riparian and instream degradation, loss of LWD, and pool reduction in FMO habitat and most SR tributaries downstream of Albeni Falls Dam (e.g., LeClerc Creek, Calispell Creek, and Tacoma Creek).	**Connectivity Impairment (2.1)** FMO habitat is fragmented by Albeni Falls Dam and Box Canyon Dam leading to low population size and risk of extirpation on now isolated SR habitat. Bull trout are currently, though sporadically, trucked and transported over Albeni Falls Dam. Safe, timely, and effective upstream and downstream passage is necessary to fully remediate effects of	**Nonnative fishes (3.1)** Nonnative northern pike, smallmouth bass, walleye (recent), and to a lesser extent brown trout and occasional lake trout occupy the artificially created habitat (FMO) downstream of Albeni Falls Dam. All are and highly piscivorous species. Situationally (temporally and spatially) these species may prey on bull trout to varying degrees (especially migrating

		Instream Impacts (1.2) Transportation, flood control, and utility corridors along riparian areas contribute to degradation through the loss of LWD, pool reduction, and increased sedimentation in some SR tributaries (e.g., Sullivan Creek, Indian Creek, Calispell Creek and Tacoma Creek). Historic placer mining significantly changed the hydrology, created sediment sources and caused passage issues (e.g., Sullivan Creek) and the effects are still felt today. **Water Quality (1.3)** Water temperatures in mainstem FMO habitat (lower Pend Oreille River and run-of-the river reservoirs), and lower reaches of most tributaries are marginally high for bull trout survival in the summer, and conditions are worsening. Artificial pools created by	fragmentation and to enhance persistence of bull trout in isolated downstream SR habitat in Idaho and Northeast Washington. Lack of upstream and downstream passage at Box Canyon Dam increases the risk to the persistence of bull trout in isolated systems downstream. **Small Population Size (2.3)** Small population size and fragmentation is severely limiting bull trout survival and recovery in key SR tributaries in the lower drainage (e.g., LeClerc and Sullivan Creeks). Survival of bull trout in this portion of the lower Clark Fork is at risk.	juveniles). Given the low abundance in this area, any loss is significant. In SR habitat, brook trout occur in high numbers in some streams, especially in lower elevations. Hybridization is observed frequently due to low bull trout population (e.g., LeClerc Creek).

The Climate Shield model results indicated the ratio of currently occupied habitat (based on 2010) in the LPO Core Area compared to habitat potentially suitable for occupancy during 2040 and 2080 to be 0.74 and 0.24, respectively. The model indicated that the overlap between current bull trout spawning and rearing habitat occupancy (based on 2010) to the habitat modeled as potentially suitable for future spawning and rearing occupancy during 2040 and 2080 to be 14.5% and 16.5%, respectively (USFWS 2015b). While these metrics are useful in comparing projected changes over time, caution should be used when applying them at the core area level because each core area has dynamics and attributes that make it unique. In the LPO Core Area, the low percentage of occupied spawning and rearing habitat estimated by the model may be due, in part, to an over-estimation of "occupiable" habitat in lower stream reaches due to temperature, but also for upper stream reaches due to barriers and stream intermittency. Despite this uncertainty, the Climate Shield model does reveal that the LPO Core Area is vulnerable to reduced snowpack and increased rain-on-snow events. This shift would likely affect bull trout spawning and rearing habitat and migratory FMO habitat through reduced stream flow and warmer water (USFWS 2015b).

F. EFFECTS OF THE ACTION

Effects of the action are "…the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action that will be added to the environmental baseline." [50 CFR §402.02] These effects are considered along with the predicted cumulative effects to determine the overall effects to the species for purposes of preparing a BO on the proposed action. Direct effects are defined as those that result from the proposed action and directly or immediately impact the species or its habitat. Indirect effects are those that are caused by, or will result from, the proposed action and are later in time, but still reasonably certain to occur.

1. Factors to be Considered Analyses for Effects of the Action

This biological opinion evaluates the impacts of: (1) replacing the existing 15.5-meter long, 9.5-meter wide, two-span bridge with a multiple-span structure 152 meters long (2) removal of the existing bridge and piers, (3) construction and removal of at least one temporary work bridge, and associated coffer dams on bull trout. The proposed action will result in minor short-term degrades to several of the pathways and indicators (Table II-3). Indicators affected by the proposed action include sediment, substrate embeddedness, and streambank condition. Bull trout have the potential to be adversely affected by the proposed action through the potential for temporary barriers, via elevated underwater sound pressure waves should impact pile-driving occur or physical barriers should portions of the existing bridge drop into the existing channel during demolition. In order to minimize the likelihood of this occurring, the Administration and the Department will implement the conservation measures for protecting bull trout in Post Creek listed in this chapter.

To define the habitat conditions for the species and its critical habitat and assess impacts from proposed actions, the Service uses the "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; USFWS 1998). The framework/matrix defines the biological requirements for bull trout and facilitates the evaluation and relevance of the environmental baseline to the current status of the species to determine the effect of the action and whether the species can be expected to survive with an adequate potential for recovery. The evaluation of the population and habitat indicators were conducted at the 5th or 6th field Hydrologic Unit Code (HUC or sub-watersheds) scales to establish the environmental baseline. Definitions for the baseline determinations Functioning Appropriately (FA), Functioning at Risk (FAR), and Functioning at Unacceptable Risk (FUR) for each of the habitat indicators are discussed in USFWS 1998 and Appendix A.

Habitat indicators in a sub-watershed that are 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 suggests 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 (i.e., PCEs are not providing their intended recovery function) active restoration is needed to begin recovery of the species.

Table II-3 includes the functional level of habitat indicators for the sub-watershed in the action area as assessed in the project biological assessment (RESPEC 2017). Major effects to a habitat indicator results in a change in one level of baseline condition (e.g. FA to FAR). Minor effects indicate the action may result in an incremental or cumulative effect but does not result in a functional change to the system. For the purposes of this checklist, restore (R) means to change the function of an indicator one condition class (e.g. FUR to FAR). Maintain (M) means that the function of an indicator does not change, and degrade (D) means to change the function of an indicator for the worse. In some cases, a FUR indicator may be further degraded, and this should be noted.

Characteristics Subpopulation: This pathway is made up of subpopulation size, growth and survival, life history diversity and isolation, and persistence and genetic integrity indicators. The action will not affect the life history diversity and isolation, and persistence and genetic integrity indicators. Direct mortality of bull trout could occur during construction project activities by: equipment or materials crushing an adult or juvenile bull trout, from elevated sediment levels, and barotrauma.

Water Quality: Water temperature, sedimentation, and chemical contamination/nutrients make up the indicators for water quality. The proposed action will not affect water temperature or spawning and rearing habitat. Increases in sedimentation from the action could temporarily clog fish gills, cause bull trout to avoid the project area while temporary work piers or cofferdams are being removed, reduce stream productivity, and reduce feeding opportunities for fish.

The proposed action may result in short-term increases in sediment due to general construction activities. High levels of suspended sediment and turbidity can result in direct mortality of fish by damaging and clogging gills (Curry and MacNeill 2004). Fish gills are delicate and easily damaged by abrasive silt particles (Bash et al. 2001a). Fish are more susceptible to increased

Table II-3. Effects Matrix Checklist for the Montana Department of Transportation Proposed Post Creek Bridge Replacement (RESPEC 2017)

Diagnostic/Pathways: Indicators	Population and Environmental Baseline (FA,FAR,FUR)[a]	Major Effects[b] of the Action(s) (Restore, Maintain, Degrade)	Minor Effects[c] of the Action(s) (Restore, Maintain, Degrade)	Comments
Subpopulation Characteristics				
Subpopulation Size	FUR	Maintain	Maintain	
Growth and Survival	FUR	Maintain	Maintain	
Life History Diversity and Isolation	FUR	Maintain	Maintain	
Persistence and Genetic Integrity	FUR	Maintain	Maintain	
Water Quality				
Temperature	FAR	Maintain	Maintain	
Sediment	FUR	Maintain	Degrade	Temporary Impact
Chemical Contamination/ Nutrients	FAR	Maintain	Maintain	
Habitat Access				
Physical Barriers	FUR	Maintain	Maintain	Temporary Impact
Habitat Elements				
Substrate Embeddedness	FAR	Maintain	Degrade	Temporary Impact
Large Woody Debris	FAR	Maintain	Maintain	
Pool Frequency and Quality	FUR	Maintain	Maintain	
Large Pools	FAR	Maintain	Maintain	
Off-Channel Habitat	FAR	Maintain	Maintain	
Refugia	FUR	Maintain	Maintain	
Channel Condition and Dynamics				
Wetted Width/ Max Depth Ratio	FA	Maintain	Maintain	
Streambank Condition	FAR	Maintain	Degrade	Temporary Impact
Floodplain Connectivity	FAR	Maintain	Restore	
Flow and Hydrology				
Change in Peak/Base Flows	FUR	Maintain	Maintain	
Drainage Network Increase	FUR	Maintain	Maintain	
Watershed Conditions				
Road Density and Location	FAR	Maintain	Maintain	
Disturbance History	FAR	Maintain	Maintain	
Riparian Conservation Area	FAR	Maintain	Maintain	
Disturbance Regime	FAR	Maintain	Maintain	
Integration of Species and Habitat Condition	FUR	Maintain	Maintain	

(a) FA = Functioning Acceptable, FAR = Functioning at Risk, FUR = Functioning at Unacceptable Risk
(b) Major effects - change one level from baseline condition (e.g., FA to FAR).
(c) Minor effects - indicates action may result in an incremental or cumulative effect but does not result in a functional change to the system (no change in functional level).

suspended sediment concentrations at different times of the year or in watersheds with naturally high sediment such as glaciated streams. Fish secrete protective mucous to clean the gills (Erman and Ligon 1985). In glaciated systems or during winter and spring high flow conditions when sediment concentrations are naturally high, the secretion of mucous can keep gills clean of sediment. Protective mucous secretions are inadequate during the summer months, when natural sediment levels are low in a stream system. Consequently, sediment introduction at this time may increase the vulnerability of fish to stress and disease (Bash et al. 2001b).

Newcombe and Jensen (1996) have shown that construction effects upon fish are based on suspended sediment mg/L over time expressed as duration in hours or days. Past monitoring efforts indicate that total suspended sediment levels, elevated during the construction activity can quickly (within 1 to 3 hours post construction) return to pre activity levels. The duration and magnitude of sediment load increases during instream construction reflect watercourse size, volume of flow, construction activity, effectiveness of Best Management Practices and sediment particle sizes. The dispersion of suspended sediment concentrations within the plume will reflect the flow conditions of the receiving waterbody (Julien, 1995). Very low flow conditions can result in minimal dilution and high suspended solid concentrations. However, the distance of downstream transport may be minimized. At the other extreme, high flows associated with storm events can increase background levels and entrain exposed sediment at the crossing location.

Additionally, the downstream extent and concentrations of the sediment plume will reflect the particle sizes of the material excavated. Physical structures (BMP’s) such as silt curtains or debris dams and boulders that trap particles promote the settling of suspended sediment.

The proposed action has some potential for additions of toxic substances to the stream that could have long-term effects on macroinvertebrates production in the stream substrate and could decrease available foraging habitat for bull trout. All construction equipment will be inspected daily (during work days) to ensure hydraulic, fuel and lubrication systems are in good condition and free of leaks to prevent these materials from entering any stream. Vehicle servicing and refueling areas, fuel storage areas, and construction staging and materials storage areas should be located a minimum of 50 feet from ordinary high water, and contained properly to ensure that spilled fluids or stored materials did not enter any waterbody.

Based upon the potential presence of bull trout in Post Creek, the potential for localized short-term sediment effects and chemical contaminations to adult and juvenile bull trout may occur. These impacts will be minimized through implementation of best management practices (RESPEC 2017).

Habitat Access: Scientific research by the Washington State Fish and Wildlife Office in conjunction with the Washington Department of Transportation in April 2010, indicate that impact pile-driving for the underwater installation of piers, pilings, etc., may result in elevated underwater sound pressure waves that are physically detrimental to fish and other animal species. The primary concern is that the sound pressure waves generated by impact pile driving and other sources, such as explosives, can have negative physiological and neurological effects on fish (Yelverton et al. 1973, Yelverton and Richmond 1981, Steevens et al. 1999, Fothergill et al. 2001, U.S. Department of Defense 2002). Injury and mortality to fish species has been directly attributed to impact pile-driving (Stotz and Colby 2001, Stadler 2002, Fordjour 2003, Abbott et al. 2005, Hastings and Popper 2005). In some instances, these high sound pressure waves resulted in physical damage to the gas-filled internal organs of fish, such as kidneys, eyes, and swim bladders (Turnpenny and Nedwell 1994, Turnpenny et al. 1994, Popper 2003, Hastings and Popper 2005). These injuries can occur as the result of barotraumas, pathologies associated with high sound levels, including hemorrhage and rupture of internal organs (Turnpenny and Nedwell 1994, Turnpenny et al. 1994, Popper 2003, Hastings and Popper 2005).

Essentially, the sound waves enter the fish tissue as the tissues nearly match the surrounding water's acoustical behavior (Hastings 2002). When the sound waves pass through the fish, they cause the swim bladder to rapidly contract and expand repeatedly with the high sound pressure waves of the impact pile driving. This rapid expansion and contraction of the swim bladder causes it to repeatedly batter the surrounding internal tissues and organs, such as the kidneys, heart, liver, etc. (Gaspin 1975). Yelverton and others have found that body mass factors into the effect of sound pressure waves on fish, whereby fish greater in mass and size would require a greater impulse level of sound to cause an injury, while fish with a smaller mass and size would sustain injuries from smaller impulses. For the purpose of endangered species consultations, and until new information becomes available to refine the criteria, NOAA Fisheries expects the onset of physical injury would occur if either the peak sound pressure level (SPL) exceeds 206 dB (re: 1μPa) or the SEL, accumulated of all pile strikes generally occurring within a single day, exceeds 187 dB (re: 1 μPa2·sec) for fishes 2 grams or larger, or 183 dB for smaller fishes (Stadler and Woodbury 2009). Additionally, the threshold for adverse behavioral effects has been documented at 150 dB_{RMS} (root mean square; Teachout 2010).

The most noticeable and documented effects resulting from impact pile-driving is fish kills, but it is reported that not all fish killed by pile driving float to the surface, and thus remain undetected (Telecki and Chamberlain 1978, WSDOT 2003). Death resulting from barotraumas did not necessarily result in immediate death, as it occurred within minutes to days after exposure to these sound pressure waves (Abbott et al. 2002). Dependent on the source of such underwater sound pressure levels, they can also result in temporary stunning of fish, and alterations in behavior that could potentially affect fish feeding and predator evasion within the vicinity of the pile driving activity (Turnpenny and Nedwell 1994, Turnpenny et al. 1994, Popper 2003, Hastings and Popper 2005).

To determine the area potentially affected by pile driving, the NOAA Fisheries calculation spreadsheet was used, along with noise data for 12-inch-diameter steel H-piles from (Oestman et al. 2012). In practice, the size of the piles used for construction of the temporary facilities is determined by the contractor, but they are typically the aforementioned materials. The calculations assume that the piles would be installed on land for a total of approximately 500-1,000 strikes per day.

Using the measured strike levels provided in Table I.4-1 in Oestman et al. (2012) for dB_{PEAK}, and dB_{RMS} of 174 and 159, respectively, the cumulative SEL was calculated to be 149 dB for 12-

inch H piles using the NOAA Fisheries suggested method of dB_{PEAK} minus 25. The NOAA Fisheries calculator tool estimates that the dB_{PEAK} threshold of 206 dB would not be exceeded with 12-inch diameter steel H-piles installed on land. However, estimates of distances from the noise source where the cumulative SEL thresholds will be met and/or exceeded for 150 dB for behavioral effects, 183 dB for injury to fishes less than 2 grams, and 187 dB for injury to fishes greater than 2 grams from impact pile driving 12-inch diameter steel H-piles are presented in Table II-4.

Table II-4. Thresholds for barotrauma to fish as a result of pile driving.

		Effect			
		Onset of Physical Injury			Adverse Behavioral Effects
Pile Type	Transmission Loss constant	$dB_{Peak} \geq 206$ dB	Cumulative SEL ≥ 187 dB	Cumulative SEL ≥ 183 dB	
			Fish ≥ 2 grams	Fish < 2 grams	$dB_{RMS} \geq 150$ dB
12-inch steel H	15	0 ft (0 m)	13-23 ft (4-7 m)	26-39 ft (8-12 m)	302 ft (92 m)

During the proposed project, contractors may construct temporary work bridges through pounding temporary pilings and construct coffer dams through sheet piling during bridge pier and abutment removal. The installation of the temporary piers and coffer dams using pile-driving technology could have detrimental impact on bull trout within the immediate project area, if it occurs when the potential for bull trout presence is highest. Hence, the proposed project may cause a temporary physical and behavioral barrier to adult or juvenile bull trout in the stream due to construction activities, such as work bridge installation, existing bridge demolition, and installation and removal of coffer dams. These temporary barrier effects would occur intermittently during construction, primarily during construction of temporary facilities. Driving of pile, if necessary for detour or work bridge construction, will be limited to between July 1 and August 31, when already rare migratory bull trout are even less likely to be present. No pile will be driven within the wetted channel (RESPEC 2017). Additional conservation measures and best management practices that will be implemented during removal of the existing bridge and construction of the new bridge are discussed earlier in this chapter. Construction of the new bridge is expected to have negligible hydroacoustic effects because the piers would be constructed using drilled shaft technology which does not create the pressure waves that are typically generated from impact pile driving.

Habitat Elements and Channel Condition and Dynamics: The habitat elements pathway consists of the following six indicators: substrate embeddedness, large woody debris, pool frequency and quality, large pools, off-channel habitat, and refugia. Habitat indicators wetted width/max depth ratio, streambank condition, and floodplain connectivity are the three indicators that make up the channel condition and dynamics pathway. Of these, streambank condition would have a minor temporary degrade in the immediate vicinity of the project area due to disturbance associated with construction activities. Conservation measures to minimize the duration of these effects include installing and maintaining appropriate structural BMPs to prevent erosion and sediment transport, reseeding and revegetating the disturbed areas with appropriate vegetation, and implementing bank stabilization measures for disturbed channel banks (RESPEC 2017).

2. Species Response to the Proposed Action

The project has potential to directly affect adult and sub-adult bull trout from increased turbidity due to removal of the existing pier in the channel and from removal of the existing bridge end bents, through behavioral effects, abandonment of cover, short-term reductions in feeding rates and success, and minor physiological stress (U.S. Fish and Wildlife Service 2010). While bull trout are uncommon within the action area, there is the chance that an individual fish may be affected and temporarily avoid migrating up or downstream.

Intermittent, temporary barriers due to sound pressure waves from pile-driving, and potential temporary physical barriers from demolition of the existing bridge, have limited potential to harm and harass juvenile and adult bull trout that may be in Post Creek, due to low population numbers in the action area. The potential short-term effect to bull trout and other fish in the action area from pile driving would be barotrauma, i.e., the physical damage to body tissues changed by a cause in pressure (RESPEC 2017). Despite the low population numbers in the action area, there is the chance that an individual fish may be affected and temporarily avoid, or be physically prevented from, migrating up or downstream until construction activities: (1) cease for the day, (2) the temporary construction impacts associated with the temporary facilities are removed and the project is complete, or (3) debris from the demolished bridge is removed from the channel.

For indirect effects, the new bridge is being designed such that all surface runoff is directed to the south bridge end where it will be discharged into the roadside ditches. The point of discharge into the roadside ditch is approximately 106 meters (350 ft) from Post Creek. Because bull trout are considered uncommon in the action area, this indirect effect is considered discountable for its effects on bull trout. Riparian shrub and wetland habitat will be temporarily disturbed by construction of the detour road and construction of the new bridge and roadway. Riparian vegetation removal could cause minor, indirect negative impacts to fish by removing shade and potentially increasing local water temperatures. High water temperatures can delay or stop salmonid migration, spawning, egg development, and rearing. Because of the small amount of vegetation to be cleared immediately adjacent to the stream, this potential impact is expected to be minor. Rehabilitation and revegetation of disturbed areas following construction would help to minimize adverse impacts. The proposed highway reconstruction is not expected to precipitate or induce human growth in the action area nor result in habitat alternations that could result in indirect effects (RESPEC 2017).

3. Interrelated and Interdependent Effects

An interrelated action is an action that is part of a larger action and depends on the larger action for its justification. An interdependent action is defined as an action having no independent utility apart from the proposed action. The proposed project will require a borrow material site and staging areas for equipment, gravel stockpiles, and a temporary asphalt plant. The locations of these features are currently unknown and fall under the responsibility of the contractor, but these interrelated actions will need to be reviewed for their potential impact to T&E species in the project area before construction. No interdependent project effects have been identified in association with the proposed action (RESPEC 2017).

4. Cumulative Effects

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

Primary threats to bull trout in the Lake Pend Oreille Core Area include: upland/riparian land management, instream impacts, water quality, connectivity impairment, and nonnative fishes (USFWS 2015b).

Increased development on tribal and private parcels in the action area could occur along stream corridors, which could lead to stream channel alterations exacerbating water temperature, nutrient, and bank stability problems. The proposed action along the US 93 Evaro to Polson corridor would rectify some impacts on streams from other actions by replacing or adding culverts where they are currently undersized or lacking, by replacing some culverts with bridges or larger culverts to improve hydrologic connectivity in the system, and by restoring streams in the highway ROW. With implementation of the improved structures, the cumulative effect of other actions on fisheries resources may be reduced (RESPEC 2017).

Angler harvest and poaching has been identified as one reason for bull trout decline (U.S. Fish and Wildlife Service 2002b). Illegal poaching is difficult to quantify, but generally increases in likelihood as the human population in the vicinity grows (Ross 1997). In addition, misidentification of bull trout has been a concern because of the similarity of appearance with brook trout. Although harvest of bull trout is illegal, incidental catch does occur and the fate of the released bull trout is unknown, but some level of hooking mortality is likely due to the associated stress and handling of the release (Long 1997).

The CSKT Kerr Dam Fish and Wildlife Mitigation settlement with Pacific Power and Light (PPL) Montana is a mitigation plan and monetary settlement with the goal of mitigating the impacts of Seli'š Ksanka Qlispe' (Kerr Dam) during the period from 1985 to 2035 (however, PPL no longer owns the dam; it is now owned and operated by a tribal corporation). The settlement includes acquiring approximately 1,375 hectares (3,398 acres) of wildlife habitat, much of it surrounding the Ninepipe National Wildlife Refuge and Kicking Horse Reservoir. These lands would then be restored and enhanced for wildlife production. A key component of the mitigation work would be to acquire habitats that are adjacent to or complement those owned by the Montana Fish, Wildlife, and Parks (MFWP) and the USFWS. The greatest benefit from this habitat protection project for bull trout would occur if lands in the Post Creek riparian corridor were preserved (RESPEC 2017).

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. Potential increases in water temperature due to climate change are likely to occur in the future.

The impact of increased water temperature on bull trout is difficult to predict, but we anticipate that higher temperatures will reduce the distribution of bull trout within the action area as some streams become unsuitable. Further, we anticipate that increased water temperature will also affect bull trout by creating more favorable conditions for non-native fish species such as brook trout and potentially brown trout.

Cumulative effects within the core area are reflected in bull trout population numbers and life history forms and the habitat conditions described herein. All core areas are at risk of the continued increase of non-native fish species and fisheries management; and concern for the viability and effects to bull trout populations are well documented (USFWS 2015). Clearly, activities occurring instream within channels on private lands at the same time the proposed federal activities are occurring on the same stream will result in additive adverse effects to bull trout, at least in the short-term. However, some non-federal activities will likely also be targeted for improving conditions for bull trout from existing levels over the long-term and will work in concert with federal actions toward recovery of bull trout in some instances.

G. CONCLUSION

1. Jeopardy Determination

After reviewing the current status of bull trout, the environmental baseline (including effects of federal actions covered by previous consultations) for the action area, the effects of the proposed road management actions, and 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." Our conclusion is based on, but not limited to, the information presented in the biological assessment for the proposed action (RESPEC 2017) and the information and analyses in this biological opinion.

Jeopardy determinations for bull trout are made at the scale of the listed entity, which is the coterminous United States population (64 FR 58910). This follows the April 20, 2006, analytical framework guidance described in the Service's memorandum to Ecological Services Project Leaders in Idaho, Oregon and Washington from the Assistant Regional Director – Ecological Services, Region 1 (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 detailed earlier in this BO (see Section C.1 and Table II-1), the approach to the jeopardy analysis in relation to the proposed action follows a hierarchical relationship between units of analysis (i.e., geographical subdivisions) that characterize effects at the lowest unit or scale of analysis (the local population) toward the highest unit or scale of analysis (the Columbia Headwaters Recovery Unit). The hierarchical relationship between units of analysis (local population, core areas) is used to determine whether the proposed action is likely to jeopardize the survival and recovery of bull trout. As mentioned previously, 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 population or core area) then the proposed action could not jeopardize bull trout in the coterminous United States (i.e., range wide). 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 or core area), then further analysis is warranted at the next higher scale.

The information and analysis presented in this biological opinion indicates that adverse effects to the Post Creek local population of bull trout are likely, but these effects on the larger LPO Core Area are relatively minor. As a result, the Service concludes that implementation of this project is not likely to jeopardize the continued existence of bull trout at the scale of the LPO Core Area, and by extension is not likely to jeopardize bull trout at higher organizational levels (i.e., Lower Clark Fork River Geographic Region, Columbia Headwaters Recovery Unit, Coterminous United States; see Table II-1). Therefore, the Service concludes that this project would not appreciably reduce both the survival and recovery and would not jeopardize bull trout at the range-wide scale of the listed entity, the coterminous population of the United States.

This conclusion is further supported by the following:

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

- Post Creek currently crosses US 93 at River Mile (RM) 7.0 and this section of the creek is not designated as either a bull trout occupied stream or bull trout critical habitat and is considered to be nodal migratory habitat for adults and juveniles. Post Creek is designated as a bull trout occupied stream starting at RM 11.6 and continues upstream to RM 20.4.

- The probability of persistence of bull trout in the Columbia River basin would not be significantly reduced even if the US 93 Ninepipe/Ronan Project affects the Post Creek local population to the extent discussed in this BO. This is because Post Creek is one of 35 local populations within the LPO Core Area.

- The proposed action will include conservation measures and Best Management Practices to reduce impacts to bull trout in the Post Creek local population.

As a result, the Service concludes that implementation of the proposed action is not likely to appreciably reduce the reproduction, numbers, or distribution of bull trout at the scale of the LPO Core Area, and by extension in the Lower Clark Fork River Geographic Region and the Columbia Headwaters Recovery Unit. Therefore, the Service concludes that proposed action will not appreciably reduce both the survival and recovery and would not jeopardize bull trout at the range-wide scale of the listed entity, the coterminous population of the United States.

H. INCIDENTAL TAKE STATEMENT

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

The measures described below are not discretionary and must be undertaken by the Administration and the Department so that they become binding conditions of any contract issued to a road contractor, as appropriate, for the exemption in section 7(o)(2) to apply. The Administration has a continuing duty to regulate and oversee the activity covered by this Incidental Take Statement. If the Administration and Department fail to assume and implement the terms and conditions of the Incidental Take Statement, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Administration and Department must report the progress of the action and its impact on the species to the Service as specified in the Incidental Take Statement [50 CFR 402.14(i)(3)].

a. Amount or Extent of Take Anticipated

The Service anticipates that project activities will result in incidental take of bull trout in the form of harm, harassment or mortality related to the short-term degradation of aquatic habitat parameters related to increased levels of activity-created sediment, physical barriers, and the related risk to bull trout life history stages. Activity-created sediment, when additively combined with increased background sediment, may impact the bull trout habitat indicator sediment. Sedimentation from the proposed activity will have short-term adverse effects (sub-lethal) by impairing feeding and sheltering patterns of juvenile and adult bull trout to the extent of injury (harm and/or harassment). The Service expects a low level of take from the temporary reduction of habitat function (i.e. minor degrade FAR habitat indicator) during the period of project implementation and possibly for a short period of time (< week) following project completion.

Reductions in these habitat pathways will likely impair feeding and sheltering patterns of juvenile and adult bull trout to the extent that injury (harm and/or harassment) may occur.

Sound pressure waves resulting from pile driving would be expected to create a temporary physical barrier preventing the movement of bull trout through the project area for the duration of the pile driving or blasting activity. Furthermore, pile driving activities may harass individual bull trout from the project area, disrupting normal behavior patterns which include, but are not limited to feeding or sheltering. Finally, depending upon bull trout proximity to the pile driving, the sound pressure waves may induce barotraumas to individuals, possibly resulting in physical harm or mortality. Because of the low population levels of bull trout within the action area, the Service anticipates a low level of take from the proposed action. Additionally, during the demolition of the existing structure, portions of the structure may fall into the active channel and present partial or complete barriers to fish passage for up to 3 to 5 days. The temporary obstructions may harass individual bull trout from the project area, disrupting normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering.

Because of the low population levels of bull trout within the action area, the Service anticipates a low level of take from the proposed action over the period of project implementation. The amount of take that may result from implementation of the action is difficult to quantify for the following reasons:

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

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

- Losses may be masked by seasonal fluctuations in numbers, and aquatic habitat modifications are difficult to ascribe to particular sources, especially in already degraded watersheds.

- Because of the wide ranging distribution of bull trout, identification and detection of dead or impaired species, and not all barotrauma-induced mortalities float to the surface, detection of injured or dead individuals may be difficult.

For these reasons, the Service has determined that the actual amount or extent of the anticipated 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. In this biological opinion we use length of occupied stream affected (approximately 893 yards/0.51 miles), and the duration of pile driving (2 months) as surrogates for incidental take. It is possible that take may be exceeded if:

- Steel pipe piles driven with an impact hammer exceed 12 inches in diameter, because the area that is expected to be ensonified from the pile driving would exceed the calculations provided in this BO.
- The rest period between consecutive days of impact pile driving is less than 9 hours
- Sediment effects extend more than 0.5 mile downstream
- The project duration exceeds 2 months.

The Service anticipates that incidental take of bull trout will occur intermittently in Post Creek from the bridge replacement activities approximately 13 yards upstream and 880 yards downstream. Take would be expected to occur when pile-driving and bridge demolition activities occur. This portion of Post Creek is used primarily as nodal migratory habitat for bull trout (RESPEC 2017), however, it also supports adult and juvenile bull trout foraging and overwintering. Thus, the take would apply to juvenile and adult bull trout within the action area. If at any time during implementation of the project, the Administration and Department conducts pile driving or blasting activities in addition to those described in the proposed action, or conducts proposed activities in a manner that differs from that described in the proposed action, then the amount of take we anticipate could be exceeded. Should the Administration and Department anticipate that permitted take will be exceeded, the Service should be consulted prior to those activities' occurrence.

Effect of the Take

In the accompanying biological opinion, the Service concludes that implementation of this project is not likely to appreciably reduce both the survival and recovery of bull trout at the LPO core area, and by extension, the Clark Fork River Management Unit. Therefore the Service concludes the action will not jeopardize the continued existence of bull trout within the coterminous United States population of the bull trout.

Reasonable and Prudent Measures

Incidental take statements typically provide reasonable and prudent measures which are expected to reduce the amount of incidental take. Reasonable and prudent measures are those measures necessary and appropriate to minimize the incidental take resulting from the proposed action. These reasonable and prudent measures are non-discretionary and must be implemented by the Administration in order for the exemption in section 7(0)(2) to apply. The Service believes the following reasonable and prudent measure(s) are necessary and appropriate to minimize impacts of incidental take of bull trout.

1. The Administration and the Department shall identify and implement means to reduce the potential for incidental take of bull trout from harassment, harm, and direct mortality in Post Creek as a result of construction related activities associated with this project.

2. The Administration and the Department shall monitor approach construction and bridge replacement activities (including bridge demolition and removal, and revegetation activities) to ensure that these activities comply with the biological assessment, supporting documentation, and biological opinion for this project. The Administration and the Department shall also implement the reporting requirement as described in the terms and conditions below.

Terms and Conditions

The following terms and conditions implement the reasonable and prudent measures as described above.

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

a) To minimize impacts to overwintering and migrating bull trout, impact pile driving for the construction of temporary and permanent facilities may occur between July 1 and August 31. This work includes dry land and in-water impact pile driving.

b) Measures from the proposed action, listed on pages II-2 through II-5. These measures include: avoiding or minimizing grading and construction practices that unnecessarily disturb natural features, promote erosion, and require extensive revegetation; locating the new Post Creek bridge piers outside the ordinary high-water mark for Post Creek, with the nearest piers located approximately 12 meters (40 feet) north and south of the creek banks; limiting instream work required to remove the bridge abutments and pier to the time period identified by the tribal fisheries program permitting process (preliminarily, July 1 through August 31); use of coffer dams, or similar structures, around areas of abutment removal; and cutting off or removing substructures to a depth of 305 millimeters (1 foot) below the stream bed and shaping and contouring removal areas to blend with the surrounding terrain.

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

a) Structures designed to minimize sediment and pollutant runoff from sensitive areas such as settling ponds, vehicle and fuel storage areas, hazardous materials storage sites, erosion control structures, and coffer dams shall be visually monitored daily, especially following precipitation events, to ensure these structures are functioning properly.

b) Monitor all dewatering activities visually to ensure bull trout are not trapped. In the unlikely event a live bull trout is found within a dewatering area, immediately return it to the stream.

c) Inspect construction equipment daily to ensure hydraulic, fuel and lubrication systems are in good condition and free of leaks to prevent these materials from entering any stream.

d) Provide a report from any hydroacoustic monitoring for impact pile driving ***prior to*** the beginning of production pile driving that would occur between September 1 and July 14. Pile driving would proceed once the Service has approved the report. The report shall include:
   a. Impact hammer energy rating, model and size
   b. A description of the sound monitoring equipment
   c. Pile type and size
   d. Depth of the hydrophone(s) and water depth at hydrophone locations
   e. Total number of strikes to drive each pile that is monitored
   f. Distance from the pile where the data were collected
   g. Depth into the substrate that the pile was driven
   h. The total number of strikes to drive each pile and for all piles driven during a 24-hour period.
   i. The results of the hydroacoustic monitoring. An example is listed in Appendix A.
   j. The distance at which peak, cumulative SEL, and RMS values exceed the respective threshold values.
   k. A description of any observable fish behavior in the immediate area, and if possible, correlation to underwater sound levels occurring at that time.
   l. Recommended number of strikes per day, based on the National Marine Fisheries Service calculator tool to stay below the physical harm thresholds of the peak sound pressure level (SPL) of 206 dB (re: 1 µPa) or the cumulative sound exposure level (SEL) of 187 dB (re: 1 µPa) for production pile driving.

e) Upon locating dead, injured or sick bull trout, notification must be made within 24 hours to the Service's Montana Ecological Services Office at (406) 449-5225. Record information relative to the date, time and location of dead or injured bull trout when found, and possible cause of injury or death of each fish and provide this information to the Service.

f) The Administration and Department shall provide an annual report by December 31 each year detailing project progress, deviations from design, extent of revegetation efforts, and survival rates of plantings. Monitoring and reporting of revegetation efforts within the riparian zone will continue for three years post-construction, with a target of 80% survival of plantings three years after planting.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. With implementation of these measures, the Service expects that take of bull trout will be limited to harm or harassment and the resulting impacts to instream habitat associated with bridge construction and removal activities. If, during the course of the action, term and condition #1 outlined above is not adhered to, the level of incidental take anticipated in this biological opinion may be exceeded. Such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures. Additionally, the terms and conditions implementing reasonable and prudent measure #2 outlined above are to be adhered to in order to determine if take has occurred. If it is anticipated that these conditions cannot be met during implementation and construction, the Service must be consulted.

I. CONSERVATION RECOMENDATIONS

Sections 7(a)(1) of the Act directs federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans or to develop information. The recommendations provided here relate only to the proposed action and do not necessarily represent complete fulfillment of the agency's section 7(a)(1) responsibilities.

1. To assist in meeting the Department's responsibilities under Section 7(a)(1) of the Act, and to utilize authorities granted within the Fixing America's Surface Transportation (FAST) Act, which provide opportunities to increase partnerships between transportation and environmental sectors, the Service strongly recommends that the Department work proactively with the Service, CSKT, Montana Department of Fish, Wildlife and Parks, and others to identify and remedy any impacts to salmonids, including bull trout, within the Lake Pend Oreille core area that are the result of transportation systems.

2. With recent changes in conservation measures to minimize effects to bull trout and bull trout designated critical habitat from impact pile driving, and possibly increase use of construction techniques that may not have previously been used as frequently, the Service recommends that the Department monitor the effectiveness of the conservation measures that are designed to protect water quality, reduce sedimentation and erosion. Specifically, that current best management practices are sufficient for the tasks and resources requiring containment are properly estimated.

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

J. REINITIATION NOTICE

This concludes formal consultation for bull trout on the effects of the US 93 Ninepipe/Ronan Project. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if:

(1) the amount or extent of incidental take is exceeded;

(2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion;

(3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or

(4) a new species is listed or critical habitat designated that may be affected by the action.

In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation. The Service retains the discretion to determine whether the conditions listed in (1) through (4) have been met and reinitiation of formal consultation in required.

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APPENDIX A. Framework/matrix indicators for species and values describing each functional level.

DIAGNOSTIC OR PATHWAY	INDICATORS	FUNCTIONING APPROPORIATELY	FUNCTIONING AT RISK	FUNCTIONING AT UNACCEPTABLE RISK
SPECIES:				
Subpopulation Characteristics within subpopulation watersheds	***Subpopulation Size***	Mean total subpopulation size or local habitat capacity more than several thousand individuals. All life stages evenly represented in the subpopulation.[1]	Adults in subpopulation are less than 500 but >50.[1]	Adults in subpopulation has less than 50. [1]
	Growth and Survival	Subpopulation has the resilience to recover from short-term disturbances (e.g. catastrophic events, etc.) or subpopulation declines within one to two generations (5 to 10 years).1 The subpopulation is characterized as increasing or stable. At least 10+ years of data support this estimate.[2]	When disturbed, the subpopulation will not recover to predisturbance conditions within one generation (5 years). Survival or growth rates have been reduced from those in the best habitats. The subpopulation is reduced in size, but the reduction does not represent a long-term trend. [1] . At least 10+ years of data support this characterization.[2] If less data is available and a trend can not be confirmed, a subpopulation will be considered at risk until enough data is available to accurately determine its trend.	The subpopulation is characterized as in rapid decline or is maintaining at alarmingly low numbers. Under current management, the subpopulation condition will not improve within two generations (5 to 10 years). [1] This is supported by a minimum of 5+ years of data.
	Life History Diversity and Isolation	The migratory form is present and the subpopulation exists in close proximity to other spawning and rearing groups. Migratory corridors and rearing habitat (lake or larger	The migratory form is present but the subpopulation is not close to other subpopulations or habitat disruption has produced a	The migratory form is absent and the subpopulation is isolated to the local stream or a small watershed not likely to support more than 2,000 fish.[1]

		river) are in good to excellent condition for the species. Neighboring subpopulations are large with high likelihood of producing surplus individuals or straying adults that will mix with other subpopulation groups. [1]	strong correlation among subpopulations that do exist in proximity to each other. [1]	
	Persistence and Genetic Integrity	Connectivity is high among multiple (5 or more) subpopulations with at least several thousand fish each. Each of the relevant subpopulations has a low risk of extinction. [1] The probability of hybridization or displacement by competitive species is low to nonexistent.	Connectivity among multiple subpopulations does occur, but habitats are more fragmented. Only one or two of the subpopulations represent most of the fish production. [1] The probability of hybridization or displacement by competitive species is imminent, although few documented cases have occurred.	Little or no connectivity remains for refounding subpopulations in low numbers, in decline, or nearing extinction. Only a single subpopulation or several local populations that are very small or that otherwise are at high risk remain.[1] Competitive species readily displace bull trout. The probability of hybridization is high and documented cases have occurred.
HABITAT:				
Water Quality:	***Temperature***	7 day average maximum temperature in a reach during the following life history stages: [1, 3] incubation 2 - 5°C rearing 4 - 12 °C spawning 4 - 9°C also temperatures do not exceed 15 °C in areas used by adults during migration (no thermal barriers)	7 day average maximum temperature in a reach during the following life history stages: [1, 3] incubation <2°C or 6°C rearing <4°C or 13 - 15 °C spawning <4°C or 10°C also temperatures in areas used by adults during migration sometimes exceeds 15°C	7 day average maximum temperature in a reach during the following life history stages: [1, 3] incubation <1°C or >6°C rearing >15 °C spawning <4 °C or > 10°C also temperatures in areas used by adults during migration regularly exceed 15°C (thermal barriers present)
	Sediment (in areas of spawning and incubation; rearing areas will be addressed under substrate embeddedness)	Similar to chinook salmon [1]: for example (e.g.): < 12% fines (<0.85mm) in gravel[4]; e.g. <20% surface fines of <6mm[5, 6]	Similar to chinook salmon [1]: e.g. 12-17% fines (<0.85mm) in gravel[4]; e.g. 12-20% surface fines [7]	Similar to chinook salmon [1]: e.g. >17% fines (<0.85mm) in gravel[4]; e.g. >20% fines at surface or depth in spawning habitat[7]

	Chemical Contamination/ Nutrients	low levels of chemical contamination from agricultural, industrial and other sources, no excess nutrients, no CWA 303d designated reaches[8]	moderate levels of chemical contamination from agricultural, industrial and other sources, some excess nutrients, one CWA 303d designated reach[8]	high levels of chemical contamination from agricultural, industrial and other sources, high levels of excess nutrients, more than one CWA 303d designated reach[8]
Habitat Access:	***Physical Barriers*** (address subsurface flows impeding fish passage under the pathway flow/hydrology)	man-made barriers present in watershed allow upstream and downstream fish passage at all flows	man-made barriers present in watershed do not allow upstream and/or downstream fish passage at base/low flows	man-made barriers present in watershed do not allow upstream and/or downstream fish passage at a range of flows
Habitat Elements:	***Substrate Embeddedness*** in rearing areas (spawning an1d incubation areas were addressed under the indicator sediment)	reach embeddedness <20%[9, 10]	reach embeddedness 20-30% [9,10]	reach embeddedness >30%[4,10]
	Large Woody Debris	current values are being maintained at greater than 80 pieces/mile that are >24"diameter and >50 ft. length on the Coast [9], or >20 pieces/ mile >12"diameter >35 ft. length on the Eastside[11] ; also adequate sources of woody debris are available for both long and short-term recruitment	current levels are being maintained at minimum levels desired for "functioning appropriately", but potential sources for long term woody debris recruitment are lacking to maintain these minimum values	current levels are not at those desired values for "functioning appropriately", and potential sources of woody debris for short and/or long term recruitment are lacking
	Pool Frequency and Quality	pool frequency in a reach closely approximates [5]: Wetted width (ft.) #pools/mile 0-5 39 5-10 60 10-15 48 15-20 39 20-30 23 30-35 18 35-40 10 40-65 9 65-100 4 (can use formula: pools/mi = 5,280/wetted channel width	pool frequency is similar to values in "functioning appropriately", but pools have inadequate cover/temperature[4], and/or there has been a moderate reduction of pool volume by fine sediment	pool frequency is considerably lower than values desired for "functioning appropriately"; also cover/temperature is inadequate[4], and there has been a major reduction of pool volume by fine sediment

		#channel widths per pool); also, pools have good cover and cool water[4], and only minor reduction of pool volume by fine sediment		
	Large Pools (in adult holding, juvenile rearing, and overwintering reaches where streams are >3m in wetted width at baseflow)	each reach has many large pools >1 meter deep[4]	reaches have few large pools (>1 meter) present[4]	reaches have no deep pools (>1 meter)[4]
	Off-channel Habitat	watershed has many ponds, oxbows, backwaters, and other off-channel areas with cover; and side-channels are low energy areas[4]	watershed has some ponds, oxbows, backwaters, and other off-channel areas with cover; but side-channels are generally high energy areas[4]	watershed has few or no ponds, oxbows, backwaters, or other off-channel areas[4]
	Refugia	habitats capable of supporting strong and significant populations are protected and are well distributed and connected for all life stages and forms of the species [12, 13]	habitats capable of supporting strong and significant populations are insufficient in size, number and connectivity to maintain all life stages and forms of the species[12, 13]	adequate habitat refugia do not exist[12]
Channel Condition & Dynamics	***Average Wetted Width/ Maximum Depth*** Ratio in scour pools in a reach	<10[7, 5]	11-20[5]	>20[5]
	Streambank Condition	>80% of any stream reach has >90% stability[5]	50 - 80% of any stream reach has >90% stability[5]	<50% of any stream reach has >90% stability[5]
	Floodplain Connectivity	off-channel areas are frequently hydrologically linked to main channel; overbank flows occur and maintain wetland functions, riparian vegetation and succession	reduced linkage of wetland, floodplains and riparian areas to main channel; overbank flows are reduced relative to historic frequency, as evidenced by moderate degradation of wetland function, riparian vegetation/succession	severe reduction in hydrologic connectivity between off-channel, wetland, floodplain and riparian areas; wetland extent drastically reduced and riparian vegetation/succession altered significantly
Flow/Hydrology:	***Change in Peak/Base Flows***	watershed hydrograph indicates peak flow, base flow and flow timing	some evidence of altered peak flow, baseflow and/or	pronounced changes in peak flow, baseflow and/or flow

		characteristics comparable to an undisturbed watershed of similar size, geology and geography	flow timing relative to an undisturbed watershed of similar size, geology and geography	timing relative to an undisturbed watershed of similar size, geology and geography
	Increase in Drainage Network	zero or minimum increases in active channel length correlated with human caused disturbance	low to moderate increase in active channel length correlated with human caused disturbance	greater than moderate increase in active channel length correlated with human caused disturbance
Watershed Conditions:	***Road Density & Location***	<1mi/mi [13]; no valley bottom roads	1 - 2.4 mi/mi [13]; some valley bottom roads	>2.4 mi/mi [13]; many valley bottom roads
	Disturbance History	<15% ECA of entire watershed with no concentration of disturbance in unstable or potentially unstable areas, and/or refugia, and/or riparian area; and for NWFP area there is an additional criteria of <15% LSOG in watersheds[14]	<15% ECA of entire watershed but disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian area; and for NWFP area there is an additional criteria of <15% LSOG in watersheds[14]	>15% ECA of entire watershed and disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian area; does not meet NWFP standard for LSOG
	Riparian Conservation Areas (RHCA - PACFISH and INFISH) (Riparian Reserves - Northwest Forest Plan)	the riparian conservation areas provide adequate shade, large woody debris recruitment, and habitat protection and connectivity in subwatersheds, and buffers or includes known refugia for sensitive aquatic species (>80% intact), and adequately buffer impacts on rangelands: percent similarity of riparian vegetation to the potential natural community/ composition >50%[15]	moderate loss of connectivity or function (shade, LWD recruitment, etc.) of riparian conservation areas, or incomplete protection of habitats and refugia for sensitive aquatic species (>70-80% intact), and adequately buffer impacts on rangelands : percent similarity of riparian vegetation to the potential natural community/composition 25-50% or better[15]	riparian conservation areas are fragmented, poorly connected, or provides inadequate protection of habitats for sensitive aquatic species (<70% intact, refugia does not occur), and adequately buffer impacts on rangelands : percent similarity of riparian vegetation to the potential natural community/composition <25%[15]
	Disturbance Regime	Environmental disturbance is short-lived; predictable hydrograph, high quality habitat and watershed complexity providing refuge and rearing space for all life stages or multiple life-history forms. [1] Natural	Scour events, debris torrents, or catastrophic fire are localized events that occur in several minor parts of the watershed. Resiliency of habitat to recover from	Frequent flood or drought producing highly variable and unpredictable flows, scour events, debris torrents, or high probability of catastrophic fire exists throughout a major part of

		processes are stable.	environmental disturbances is moderate.	the watershed. The channel is simplified, providing little hydraulic complexity in the form of pools or side channels. [1] Natural processes are unstable.
SPECIES AND HABITAT:				
Integration of Species and Habitat Conditions		Habitat quality and connectivity among subpopulations is high. The migratory form is present. Disturbance has not altered channel equilibrium. Fine sediments and other habitat characteristics influencing survival or growth are consistent with pristine habitat. The subpopulation has the Fine sediments, stream temperatures, or the availability of suitable habitats have been altered and will not recover to predisturbance conditions within one generation (5 years). Survival or growth rates have been reduced from those in the best habitats. The Cumulative disruption of habitat has resulted in a clear declining trend in the subpopulation size. Under current management, habitat conditions will not improve within two generations (5 to 10 years). Little or no connectivity remains among subpopulations. The resilience to recover from short-term disturbance within one to two generations (5 to 10 years). The subpopulation is fluctuating around an equilibrium or is growing.[1]	Fine sediments, stream temperatures, or the availability of suitable habitats have been altered and will not recover to predisturbance conditions within one generation (5 years). Survival or growth rates have been reduced from those in the best habitats. The subpopulation is reduced in size, but the reduction does not represent a long-term trend. The subpopulation is stable or fluctuating in a downward trend. Connectivity among subpopulations occurs but habitats are more fragmented.[1]	Cumulative disruption of habitat has resulted in a clear declining trend in the subpopulation size. Under current management, habitat conditions will not improve within two generations (5 to 10 years). Little or no connectivity remains among subpopulations. The subpopulation survival and recruitment responds sharply to normal environmental events. [1]

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Chapter III. Biological Opinion for Grizzly Bears

Table of Contents

A. CONTEXT OF THE PROPOSED ACTION FOR GRIZZLY BEAR

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).

The Montana Department of Transportation (Department) and the Federal Highway Administration (Administration), in cooperation with the Confederated Salish and Kootenai Tribes (CSKT), determined in their revised biological assessment that activities conducted under the proposed action would be likely to adversely affect grizzly bears (RESPEC 2017).

This section describes the spatial context in which the Service conducts its Section 7 consultation and jeopardy analysis under the Act; describes the relationship of the project area to grizzly bear occurrence; and describes the desired condition for grizzly bears under the revised biological assessment, as well as the guidelines and standards applied at the project level to achieve desired conditions.

This biological opinion (BO) will consider the effects of implementation of the proposed framework of the US 93 Ninepipe/Ronan Improvement Project. This BO provides a detailed analysis for effects of specific projects within the Ninepipe/Ronan segment of US 93.

This BO addresses only the impacts to the federally listed grizzly bear within the action area and does not address the overall environmental acceptability of the proposed action.

1. 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 CFR 402.02). In delineating the action area, we evaluated the farthest reaching physical, chemical, and biotic effects of the action on the environment. For the purposes of this BO, we have defined the action area to be two 5th-order Hydrologic Units (HUCs; also known as sub-watersheds), as each sub-watershed approximates the size of Bear Management Unit subunits within the NCDE recovery zone, and the project area affects both HUCs. For grizzly bears located within a recovery zone, action areas corresponded to bear management units (BMUs), because while BMUs are not actual female home ranges, they are of sufficient size that provided proper perspective of the effects of a proposed action relative to a scale at which a grizzly bear might use a landscape. Because this proposed action occurs outside of a recovery zone, 5th-order HUCs were selected because they are relatively equivalent in size to BMUs inside a recovery zone. The action area encompasses the Mission Creek (1701021205), and Flathead River-Pablo Reservoir

(1701021206) sub-watersheds. This includes portions of the Flathead Indian Reservation, National Bison Range, State, and private lands within the sub-watersheds' boundaries.

The Grizzly Bear Recovery Plan (Recovery Plan) prompted the identification of six grizzly bear recovery zones, defined as areas within which the criteria for achievement of recovery would be measured (USFWS 1993). The action area encompasses a portion of the Northern Continental Divide Ecosystem (NCDE), with the project area located approximately two miles west of the NCDE recovery zone boundary. The remaining recovery zones are discussed in *Status of the Species* Section.

2. Description of the Proposed Action

As described in detail in Chapter I, the US 93 Ninepipe/Ronan Improvement Project will improve the level of service (LOS), mobility, traffic flow, system linkage and safety through reconstruction of approximately 11.2 miles of US 93 in Lake County, Montana, beginning at Red Horn Road/Dublin Gulch Road (reference post [RP] 37.1) and extending north to Baptiste Road/Spring Creek Road (RP 48.3). The proposed action has been divided into rural and urban portions, consisting of two segments each.

With the detailed description of the proposed action in Chapter I, described below are those portions of the project that are most relevant to grizzly bears. The proposed action would produce a corridor with varying road widths. In rural segments (approximately 7.5 miles), there will be two-lane roadway with intermittent segments that include a third, 0.5-mile long, 14-ft wide turning lane; and another variation includes two segments that are 1.8-mile and 1.2-mile long of 12-ft wide passing lane. In the segments that are just a two-lane roadway, the typical pavement width would be approximately 40 ft. Where turning lanes would be provided, pavement width would be approximately 54 ft, with a preferred right-of-way width of 160 ft. Where a passing lane would be provided, typical pavement width would be approximately 52 ft, with a preferred right-of-way width of 180 ft. There would also be a 0.9-mile long segment of four-lane divided roadway, with two travel lanes in each direction, a depressed center median, and periodic turning lanes. For the four-lane divided highway segment, typical pavement width would be approximately 110 ft, with a minimum right-of-way width of 220 ft (RESPEC 2017:8). The right-of-way, in this case, is a strip of land acquired for or devoted to a highway use. The actual roadway occupies a significant portion, but not all, of the right-of-way. Currently, the existing road widths in the rural segments are approximately 30 to 40 ft. The 2.9-mile long Post Creek Hill project segment will also include a 10-ft wide pedestrian path on the east side of the highway. The pedestrian path crossing the new Post Creek bridge will be adjacent to the northbound travel lane, and separated from traffic by a jersey barrier. Away from the new bridge, the path will be separated from the travel lanes and located on the fill slopes of the new roadway.

From Chapter I (Table I-4, p. I-12), there are four road segments that will include several road reconstruction projects: US 93 N-Post Creek Hill, Remainder of Ninepipe/Ronan Corridor, Ronan-Urban, and Ronan-North. The latter two segments are considered urban segments, and the former two segments are the rural segments. US 93 N-Post Creek Hill and the two urban segments are each anticipated to contain one road reconstruction project each, while the

Remainder of Ninepipe/Ronan Corridor segment is anticipated to contain up to three road reconstruction projects (M. Lloyd, MDT Consultant Project Engineer, pers. comm., November 4, 2020).

Included in the two rural segments are wildlife crossing structures at five locations: Post Creek, Ninepipe Reservoir, two separate kettle ponds, and Crow Creek. Wing fencing is proposed at all wildlife crossing structures and would vary in length depending on terrain, proximity to major county road and private road intersections, and other logical termination points. Crossings designed for large mammals include a minimum of 150 yards of wing fencing (RESPEC 2017:8). The following structures for large mammals are proposed at the above locations:

- **Post Creek** (approximately RP 37.7)
    - One 500-ft multiple-span bridge. The bridge will have a maximum clearance of 14 ft where it crosses Post Creek and a minimum clearance of 8 ft at the south end of the bridge.
- **Ninepipe Reservoir** (approximately RP 40.8)
    - One 12-ft x 22-ft culvert
    - Two 10-ft x 12-ft culverts
    - One 660-ft multiple-span bridge with minimum clearance of 10 – 13 ft.
- **Kettle Pond 1** (approximately RP 41.7)
    - Two 59-ft single-span bridges with minimum clearance of 10 – 13 ft.
- **Kettle Pond 2** (approximately RP 42.5)
    - Two 59-ft single-span bridges with minimum clearance of 10 – 13 ft.
- **Crow Creek** (approximately RP 44.2)
    - One 121-ft multiple-span bridge with minimum clearance of 10 – 13 ft.
    - One 150-ft multiple-span bridge with minimum clearance of 10 – 13 ft.

To address exceedance of take of grizzly bears that occurred under the 2005 BO, the Department and Administration are proposing additional mitigation measures outside of the project area corridor (Biological assessment amendment July 30, 2020). Specifically, due to ongoing issues related to grizzly bear mortalities resulting from vehicle collisions on US 93 north of St. Ignatius, Montana, in a previously constructed segment, the Department and Administration have programmed and initiated the US 93 North-Wildlife Fencing (NH 5-2(185)30; UPN 9828000) project. This project would construct fence to help guide grizzly bear and other wildlife to existing crossing structures, while "*Each section of fence would end at points that did not encompass an un-fundable number of road approaches, would offer optimal driver site distance, and would utilize county road intersections where entering or exiting traffic would increase driver attention to the road ahead.*" The expectation of the project is that the fence would guide grizzly bears to the existing wildlife crossings in the vicinity of St. Ignatius. The BA amendment states that "*Adaptive management will be pursued if additional needs or specific changes are identified and deemed necessary and feasible*" (BA amendment 2020:2). The approximate wildlife fence proposed start and end points are:

- Pistol Creek from RP 30.40 to RP 30.93. No wildlife fencing currently exists between the two crossing structures at this location.
- Sabine Creek from RP 31.60 to RP 32.06. Short wing-fence is currently in place with the existing crossing structure.

- Mission Creek from RP 32.30 to 32.50. Short wing-fence is currently in place with the existing crossing structure.
- Lower Mission/Lee from RP 33.60 to RP 34.84. Short wing-fence was originally built with three of the five structures. Two structures do not have wing-fence.

Wildlife jumpouts (i.e., escape ramps) will be incorporated into the longer sections of fence, as appropriate. To address fence openings at “approaches” (an “approach” provides access from a public way to a highway, street, road, or to an abutting property, including farm access and private driveways), the Department will work with landowners to identify the best option, taking into account grizzly bear access. Fence openings at approaches must be fundable within the current project budget (BA amendment 2020:2).

The Department is currently funding research on fence end treatments along US Highway 93 North and MT 200. This research may identify new treatment options for projects along the US Highway 93 North corridor. Fence end treatments that may prove effective from this research may be incorporated into this project (BA amendment 2020:2).

Conservation Measures for Grizzly Bears

Conservation measures and Best Management Practices (BMPs) to be implemented during the four projects that comprise the US 93 Ninepipe/Ronan Improvement Project include:

- To provide safe passage for grizzly bears and other wildlife between suitable habitats on either side of the highway, wildlife crossing structures are proposed at Post Creek, Crow Creek, and on the Ninepipe National Wildlife Refuge. Guide fencing to route bears toward wildlife crossings is proposed at each crossing, and where practical, will extend a minimum of 150 yards on each side of the proposed crossings.
- The proposed project would reduce effects on fisheries resources and grizzly bear habitats by steepening fill slopes from 6:1 (H:V) to 4:1; this would be incorporated into all rural alternatives where it is justified to do so. Fill slopes for the approaches to bridge structures have also been steepened to 2:1. These steeper slopes reduce the width of the roadway footprint and, consequently, reduce impacts to floodplains and wetlands.
- To the greatest extent possible, the Department has elected to maintain US 93 on its current alignment to minimize impacts to wetlands, riparian areas, and other important wildlife habitat. At Post Creek, the original proposal to construct the new bridge and roadway to the west of the current alignment has been changed to avoid impacts to important forested wetlands and grizzly bear habitat in the Post Creek riparian corridor. The new roadway and bridge is now proposed on the existing alignment. Improved wetland delineation accuracy in combination with staying on the current alignment has reduced wetland impacts by 4.15 acres.
- During construction, the following conservation measures would be implemented to minimize project effects on grizzly bears:
    - Promptly clean up any project-related spills, litter, garbage, and debris.
    - Store all food, food related items, petroleum products, antifreeze, garbage, and personal hygiene items inside a closed, hard-sided vehicle or commercially manufactured bear resistant containers.

- Remove garbage from the project site daily and dispose of it in accordance with all applicable regulations.
- Notify the Project Manager of any animal carcasses found in the area.
- Notify the Project Manager of any bears observed in the vicinity of the project.
- Specific to the Post Creek project (UPN 8008000), within 400 meters (0.25 mile) of the Post Creek bridge, no work will occur between 9:00 PM and 6:00 AM from April 1 to June 30. This is to allow post-denning bears the opportunity to move east and west along the Post Creek riparian zone.
- In the vicinity of Post Creek, locate construction staging areas, field offices, and sleeping quarters according to the following restrictions:
  - On the west side of the corridor, locate these facilities south of Dublin Gulch Road/Red Horn Road or north of West Post Creek Road/East Post Creek Road.
  - On the East side of the corridor, locate these facilities south of Dublin Gulch Road/Red Horn Road (RESPEC 2017:14-15).

B. STATUS OF THE SPECIES

This section presents information about the regulatory, biological, conservation, and recovery status of grizzly bears that provides context for evaluating the significance of probable effects caused by the proposed action. Detailed information is provided for the Northern Continental Divide Ecosystem (NCDE) because part of the NCDE may be affected by the proposed action.

No critical habitat has been designated for grizzly bears. For information on the status of grizzly bears, including species description, life history, and status and distribution, refer to the Grizzly Bear Recovery Plan (U.S. Fish and Wildlife Service 1993), the Grizzly Bear 5-Year Review (U.S. Fish and Wildlife Service 2011), the grizzly bear recovery program 2019 annual report (U.S. Fish and Wildlife Service 2020), the conservation strategy for the grizzly bear in the Northern Continental Divide Ecosystem (NCDE subcommittee 2020), Grizzly bear demographics in the NCDE (Costello et al. 2016), NCDE grizzly bear population monitoring team 2018 annual report (Costello and Roberts 2019), the Greater Yellowstone Ecosystem conservation strategy (U.S. Fish and Wildlife Service 2016), the Yellowstone Grizzly Bear Investigations 2018 (van Manen et al. 2019), the interagency grizzly bear study team 2019 annual report summary (IGBST 2020), the Cabinet-Yaak Grizzly Bear Recovery Area 2018 Research and Monitoring Progress Report (Kasworm et al. 2019a), Density, distribution, and genetic structure of grizzly bears in the Cabinet-Yaak Ecosystem (Kendall et al. 2016), and the Selkirk Mountains Grizzly Bear Recovery Area 2018 Research and Monitoring Progress Report (Kasworm et al. 2019b). These documents (referenced here), include the best available science regarding the status and distribution of grizzly bears and are incorporated by reference.

Detailed Status of grizzly bears in the NCDE

The NCDE extends from the Rocky Mountains of northern Montana into contiguous areas in Alberta and British Columbia, Canada. The U. S. portion of the NCDE includes parts of four National Forests (Flathead, Kootenai, Helena-Lewis and Clark, and Lolo), four wilderness areas (Bob Marshall, Mission Mountains, Great Bear, and Scapegoat), and one wilderness study area

(Deep Creek North). National Forest System lands encompass 61 percent of the NCDE. Additionally, the NCDE recovery zone includes Glacier National Park, the Flathead Indian Reservation (Salish-Kootenai tribal land), the Blackfeet Indian Reservation, adjacent private and state lands, and lands managed by the U.S. Bureau of Land Management. Grizzly bears from this population also occupy areas outside the defined NCDE recovery zone.

Grizzly bear recovery zones are subdivided into smaller units to facilitate both the assessment of projects and recovery objectives. Twenty-three bear management units (BMU) were formally delineated throughout the NCDE. BMUs were designed to:

- Assess the effects of existing and proposed activities on grizzly bear habitat without having the effects diluted by consideration of too large an area;
- Address unique habitat characteristics and grizzly bear activity and use patterns;
- Identify contiguous complexes of habitat which meet year-long needs of the grizzly bear; and
- Establish priorities for areas where land use management needs would require cumulative effects assessments.

The Recovery Plan defines a recovered grizzly bear population as one that can sustain the existing level of known and unknown human-caused mortality that exists in the ecosystem and that is well distributed throughout the recovery zone. Demographic recovery criteria outlined for the NCDE recovery zone include:

- Observation of 22 females with cubs of the year (unduplicated sightings), 10 in Glacier National Park and 12 outside the park, over a 6-year average both inside the recovery area and within a 10 mile area immediately surrounding the recovery zone, excluding Canada;
- Twenty-one of the 23 BMUs occupied by females with young from a running 6-year sum of verified observations, and with no two adjacent BMUs unoccupied;
- Known, human-caused mortality not to exceed 4 percent of the current population estimate;
- No more than 30 percent of the known, human-caused mortality shall be females;
- The mortality limits cannot be exceeded in more than 2 consecutive years for recovery to be achieved; and
- Recovery in the NCDE cannot be achieved without occupancy of the Mission Mountains portion of the NCDE.

Mortality of grizzly bears within a 10-mile area outside the recovery zone boundary is counted towards recovery zone statistics. This is a conservative accounting for grizzly bears making their range primarily in the recovery zone, but it includes bears whose range overlaps the recovery zone line.

Two population studies were designed with the objective to more reliably estimate the number of grizzly bears inhabiting the NCDE. In 1998, the U.S. Geological Survey (USGS) DNA-based mark-recapture study in the greater Glacier area collected information from 1998 through 2000. In 2004, the USGS initiated a more extensive DNA-based study to estimate the grizzly bear population size in 7.8 million acres of occupied grizzly bear range in and around the NCDE recovery zone. The Northern Divide Grizzly Bear Project identified 563 individual grizzly bears alive in the greater NCDE during the summer of 2004 through genetic analysis of noninvasive hair sampling at baited and unbaited barbed wired hair collection sites (Kendall et al. 2009). A final total grizzly bear population estimate of 765 grizzly bears was reported based on the 563 grizzly bears detected in 2004 (Ibid.). Both the raw count of 563 grizzly bears and a total population estimate of 765 for 2004 illustrate the conservative nature of the recovery plan minimum population estimate of 304 grizzly bears in 2004. The DNA-based estimate is scientifically robust, and is more than two times the recovery plan estimate.

Also in 2004, Montana Fish, Wildlife and Parks initiated a NCDE grizzly bear trend monitoring project (Mace and Roberts 2012). The purpose of this program is to estimate population trend by monitoring the survival and reproductive rates of radio-instrumented female grizzly bears. Results indicate a positive population trend of 2.3 percent annually, indicative of an increasing grizzly bear population in the NCDE (Costello et al. 2016).

With the recent DNA-based population estimate, the methodology to estimate minimum population size outlined in the 1993 recovery plan became outdated (Servheen in litt. 2008). In an effort to apply the DNA-based population estimate for the year 2004 to the existing recovery plan criteria (U.S. Fish and Wildlife Service 1993), the Service has outlined an interim process (Servheen in litt. 2008). This interim process would remain in effect until such time as the five-year status review and the ongoing, formal recovery plan revision are complete.

Because the DNA-based population estimate is for the year 2004, the interim process makes some assumptions in order to be applicable to post-2004 grizzly bear populations, with the primary assumption being that grizzly bear populations do not increase or decrease rapidly. Costello et al. (2016) indicates an annual population growth of 2.3 percent since 2004. Using the same data, Costello et al. (2016) calculated dependent cub survival to be 0.553 (95% CI = 0.432–0.708); yearling survival to be 0.639 (95% CI = 0.502–0.816); and independent females (age $\geq$2 years old) survival was calculated to be 0.947 (CI = 0.913 – 0.969). These survival rates and estimates of trend indicate mortality were not only within sustainable limits between 2004 and 2014, but were outpaced by survival and recruitment to account for an increasing population. Therefore, the best available science indicates the population has not declined since 2004.

We continue to use the 1993 Recovery Plan criteria for estimating sustainable mortality limits, applying the conservative 4 percent total mortality limit and the 30 percent female mortality limit. However, we now apply the criteria to the current lower 95 percent confidence interval of the 2018 population estimate of 892 grizzly bears (USFWS 2018). As of 2018, the 6-year average of known human-caused total mortalities in the NCDE was 23.8. Using our criteria limits applied to the population estimate, we find that total known human-caused mortality is below the sustainable mortality level of no more than 35.7 per year. The 6-year average of known human-caused female mortalities in the NCDE is 9.7, also below the sustainable mortality level of no more than 10.7 per year (USFWS 2018:5).

Other information regarding the overall status of the NCDE grizzly bear population is also available (USFWS 2018, Costello et al. 2016, Kendall et al. 2009):

1. During the most recent 6-year period (2013-2018), all 23 BMUs were occupied by females with young during at least 1 of the 6 years; using a 6-year running tally, the demographic standard of 21 or 23 BMUs occupied was met each year beginning in 2006; no two adjacent BMUs were unoccupied each year beginning in 2009, concurrent with the year when the full 6 years of monitoring was realized.
2. The total current distribution of NCDE grizzly bears is estimated to be 63,924 square kilometers, which includes 41,051 square kilometers inside the demographic monitoring area (DMA; 96 percent of the DMA).
3. The genetic health of NCDE grizzly bears is good, with diversity approaching levels seen in undisturbed populations in Canada and Alaska.

Other research informs our assessment of the status of the NCDE grizzly bear population. During 1987 to 1996, research in the Swan Mountains indicated a tenuous finite rate of increase of 0.977 for grizzly bears in the study area related to high female mortality (Mace and Waller 1998). The authors concluded the population was probably stable based on multiple lines of evidence, including vital rates, density and occupancy of grizzly bears in the multiple-use zone (Forest Service lands). Density estimates were high, exceeding those of several density estimates published for grizzly bear populations in Canada. Of note is that annual mortality rates for bears utilizing roaded rural (private lands and adjacent roaded areas) and wilderness areas was 21 and 15 times higher, respectively, than for bears using only multiple-use lands (Forest Service lands; Ibid.). Mortalities in the wilderness areas resulted from “mistaken identity” during the big game hunting season and human defense of life. In rural areas, mortalities resulted from malicious killing and the management removal of habituated or food-conditioned bears (Ibid.).

Recent data (U.S. Fish and Wildlife Service 2010, U.S. Fish and Wildlife Service 2013, Costello et al. 2016) also indicate that the majority of human-caused mortalities in the NCDE since 1999 were management removals of nuisance or habituated grizzly bears and illegal killings. The majority of these mortalities occurred on private lands, demonstrating a higher incidence of grizzly bear mortality associated with areas on and in proximity to private lands and associated development than on multiple-use Forest lands.

Grizzly bear location and distribution information are also valuable in assessing the status of grizzly bears. A mapping effort in 2002 (U.S. Forest Service et al. 2002) used five years of location data to map the area outside the recovery zone where grizzly bears may occur. The resulting distribution of known grizzly bear presence extends to the west, south, and east of the recovery zone. Although information is limited and not statistically analyzed, grizzly bear occurrences are being increasingly documented outside the recovery zone line suggesting that the grizzly bear population in the NCDE is expanding. For example, in 2008 occurrences of grizzly bears were further from the recovery zone boundaries than in past years, and outside the 2002 distribution line. Grizzly bears have recently been documented in areas of Montana south and west of the 2002 distribution line including areas near Avon, Elliston, Drummond, Bearmouth, Butte, Anaconda, Phillipsburg, Rattlesnake Wilderness, Ninemile Valley, Lolo Pass, Rock Creek Drainage, Noxon, Heron, and Trout Creek (Jamie Jonkel, Montana Fish, Wildlife and Parks, pers. comm., 2011). They have also been documented as far east as the Little Belt Mountains, and southeast as far as the Elkhorn Mountains (Mike Madel, Montana Fish, Wildlife and Parks, pers. comm., 2017). Most of these documented grizzly bears have been occurrences by males. Due to the broad distribution of grizzly bear locations and known grizzly bear distribution within the recovery zone, this expansion is likely due to increased grizzly bear numbers in some portions of the recovery zone.

The NCDE-wide grizzly bear population estimate is valuable in assessing the status of the population, gauging the use of Recovery Plan minimum population estimates, and assessing the impacts of current levels of human-caused mortality. The total population estimate of 1,044 grizzly bears in 2018, gives us insight into the conservative nature of the 1993 Recovery Plan criteria. Trend information from the Montana Fish, Wildlife and Parks efforts indicates a 2.3 percent annual increase in population since 2004 (Costello et al. 2016). Future data will continue to be used to assess population growth or decline.

All status evidence indicates the strength of this population, including current distribution of grizzly bears within and outside the recovery zone, a total population estimate of 765 grizzly bears in the NCDE for the year 2004, the 2.3 percent positive rate of growth, and the 2018 population estimate of 1,044 grizzly bears. Kendall et al. (2009) found that the recent decrease in genetic differentiation and the expanded distribution of grizzly bears in the NCDE are consistent with population growth. The results of the study suggest that the NCDE grizzly bear population is doing better than previously thought (*Ibid*.). The number and wide distribution of female grizzly bears detected during the study (Kendall et al. 2009), along with reported numbers and locations of recent sightings and conflicts, (Costello et al. 2016), also suggest an increasing number of grizzly bears in the NCDE. In addition, the NCDE grizzly bear population is contiguous with grizzly bears in Canada, which results in high genetic diversity (Proctor et al. 2012). Based on the best available information, the Service concludes that the status of the NCDE grizzly bear population has recovered (USFWS 2018:6).

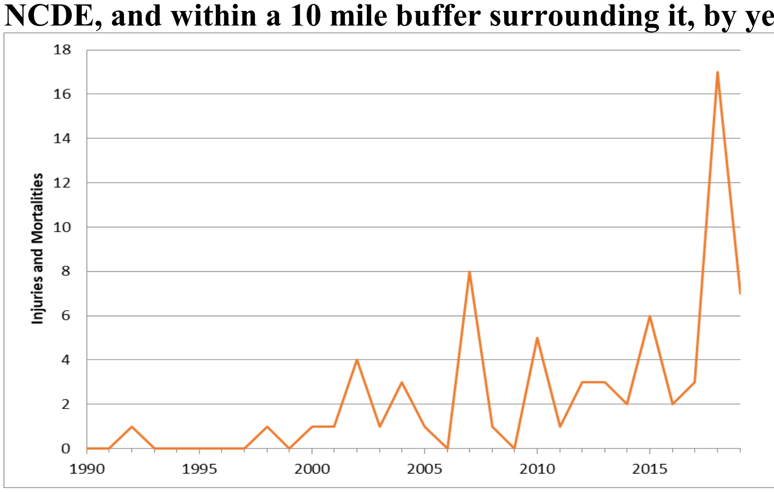
Humans kill grizzly bears unintentionally with vehicles or by mistaking them for black bears when hunting. From 2004 to 2019, 27% (109 of 402) of all human-caused grizzly bear mortalities in the NCDE and a 10 mile buffer surrounding it were accidental or unintentional. This includes 61 mortalities due to collisions with vehicles. Direct mortality of grizzly bears as a result of crossing highways with various traffic volumes has not been a significant problem for the overall grizzly bear population in the NCDE. However, grizzly bears are hit and killed on roads throughout their range in the conterminous U.S. almost every year. From 1983 through 2019, 74 grizzly bears have been killed on highways in the NCDE and a 10 mile buffer surrounding it, with 54 of those collisions occurring on four roads (Table III-1; Montana Fish, Wildlife and Parks unpublished data, CSKT Wildlife Management Program, unpublished data, Appendix B: Costello et al. 2020). Within the NCDE, grizzly bear mortalities from vehicle collisions have increased significantly since 2000 (Figure III-1; Montana Fish, Wildlife and Parks unpublished data). Measures to reduce vehicle and train collisions with grizzly bears include removing wildlife carcasses from the road or tracks so that grizzly bears are not attracted to these areas (Servheen et al. 2004), keeping the tracks clean of spilled grain, constructing wildlife crossing structures over or under highways, and reducing human-caused mortality in nearby residential areas by providing bear resistant garbage containers where needed. All of these measures are already being implemented to varying degrees in different parts of the ecosystem (NCDE Subcommittee 2018).

Table III-1. Number of grizzly bear vehicle collisions, by highway in the NCDE, and within a 10 mile buffer surrounding it, from 1983 through 2019. Data represent collisions only, not necessarily mortalities.

Highway	No. Grizzly Bear/Vehicle Collisions	Date Range[1]
U.S. Highway 2	13	1985 – 2019
Montana Highway 83	11	2002 – 2018
Montana Highway 200	10	2004 – 2019
U.S. Highway 93	20	1998 - 2019

[1]Time period during which vehicle collisions have occurred. Only complete years are presented (i.e., 2020 has not yet concluded).

Figure III-1. Number of grizzly bears injured or killed due to vehicle collisions in the NCDE, and within a 10 mile buffer surrounding it, by year (1990 – 2019).



As discussed in Chapter I, the Service previously consulted with the Administration on the US 93 Evaro to Polson corridor in 2001, 2004, 2005, and 2006. Between 2006 and 2010, as part of the overall reconstruction of US 93 between Evaro and Polson, a total of 42 wildlife crossings of various types and dimensions have been constructed. The goal of these crossings was to help all wildlife, not just grizzly bears, safely move between cross-highway habitats while at the same time improve habitat connectivity and improve public safety by minimizing animal/vehicle collisions. Additionally, approximately 18 miles of wildlife guide fencing was installed to help route animals to the wildlife crossing structures. Approximately 60 wildlife jumpouts were installed to provide escape routes for animals within the right-of-way between sections of fencing (RESPEC 2017:20). These constructed crossings and associated features represent a significant change to the conditions within the corridor since the last BO for grizzly bears was issued on August 29, 2005. A summary of all 42 crossing structures is provided in Appendix A, and provides the locations by milepost, type of crossing, size of structure, and other details.

The existing crossing structures within the corridor can broadly be characterized as: a vegetated overpass, a very large bridge, short bridges, large corrugated metal culverts, small box culverts, and small round culverts. Twenty-nine crossing structures were monitored for wildlife use from 2008 through 2015, although not all structures were monitored during the same time period (Huijser et al. 2016a:54-65). Within the monitoring time periods, there were 95,274 successful crossings through the 29 crossing structures by 20 different species of medium sized or large sized terrestrial wild mammals, 29 of which were by grizzly bears (Huijser et al. 2016a: Table 5, p. 59). Grizzly bears exclusively used large culverts; although these were the most common type of structure within the area known to be used by grizzly bears (Huijser et al. 2016a:65). Although the vast majority of the crossings were by white-tailed deer (69%), there is limited use of the crossing structures by grizzly bears. Since the completion of Huijser et al. (2016a), there have been a total of six additional grizzly bear crossings in these structures in 2016 and 2017, for a total of 35 documented crossings (W. Camel-Means, CSKT Wildlife Management Program, personal communication, May 30, 2018).

Recently, federal, state, and tribal agencies managing grizzly bears in the NCDE collaborated on the development of an interagency Conservation Strategy for NCDE Grizzly Bears (NCDE Subcommittee 2018). The NCDE Conservation Strategy identifies a Primary Conservation Area (PCA), which is the area now known as the recovery zone. It also identifies three additional management zones (Zone 1, Zone 2, and Zone 3) outside the PCA, each with varying levels of habitat protections depending on their relative importance to the NCDE grizzly bear population. The strategy's objective is to maintain a recovered grizzly bear population in the NCDE area sufficient to maintain a healthy population in biologically suitable habitats within areas identified as the PCA and Zone 1.

The PCA would be managed as a source area where the objective is continual occupancy by grizzly bears and maintenance of habitat conditions that are compatible with a stable to increasing grizzly bear population. The most conservative habitat protections would apply to the PCA. Management Zone 1 is delineated around the PCA, similar to the 10-mile buffer concept described in the Recovery Plan. The objective in Zone 1 is continual occupancy by grizzly bears but at expected lower densities than inside the PCA. Habitat protections would focus on managing motorized route densities to be compatible with a stable to increasing grizzly bear population. Attractant storage rules would also be implemented. The PCA and Zone 1 together make up the demographic monitoring area (DMA) and would be the area within which NCDE grizzly bear population data are collected and sustainable mortality limits will apply. Grizzly bears are also expected to occupy habitat outside the PCA in Zones 1 and 2, where they may serve as a source population to other grizzly bear ecosystems in the lower-48 States. There are two of these areas in the NCDE Conservation Strategy: (1) the Ninemile Demographic Connectivity Area (DCA), and (2) the Salish DCA. The Ninemile DCA is located between Highway 200, US Highway 93 North (including the proposed action's action area), and Interstate 90 (NCDE Subcommittee 2018: Figure 2), and is adjacent to the action area. Currently, occupancy of the Ninemile DCA is low, with only two reproductive female grizzly bears being documented between 2010 and 2019, and likely requires crossing of US Highway 93 North (Costello et al. 2020).

The objective in Management Zone 2 is to maintain existing resource management and recreational opportunities and allow agencies to respond to demonstrated conflicts. The strategy indicates that grizzly bear occupancy within Zone 2 is not necessary to maintain a recovered status for the NCDE but it would be beneficial to other ecosystems if grizzly bears were able to occupy the zone in low densities. Because both male and female grizzly bears are already known to occur on occasion in portions of Zone 2 without any protections specifically in place for grizzly bears, maintaining a healthy population in the PCA and Zone 1, while reducing the potential for conflicts between grizzly bears and people in Zone 2 are goals of the strategy. The strategy indicates that the objective in Zone 2 is not necessarily continual occupancy but instead, to have a few males (or females) move through this area into other ecosystems, therefore less rigorous habitat protections are appropriate. The strategy indicates that public lands in Zone 2 will be managed to provide the opportunity for grizzly bears to move between the NCDE and adjacent ecosystems (i.e., the greater GYE or the Bitterroot ecosystem) under the current direction in USFS and BLM Resource Management Plans. Here, the management emphasis will be on conflict prevention and response. Attractant storage rules would be implemented on most federal and state lands.

Management Zone 3 of the NCDE Conservation Strategy does not provide habitat linking to other grizzly bear ecosystems. Grizzly bears currently occupy parts of Zone 3 (adjacent to Zone 1), and their numbers are expected to increase, but this may be incompatible with human presence because land ownership is mostly private and agricultural uses predominate. In Zone 3, occupancy will not be actively discouraged and management emphasis will be on conflict response.

We note that the documents listed above that have been developed since the 1993 Recovery Plan are draft or in various stages of implementation. However, at this time, the Service holds that the strategies described in these documents, and updates, reflect the best available science on grizzly bear recovery.

3. Analysis of the Species/Critical Habitat Likely to be Affected

The biological assessment determined that the projects would likely adversely affect grizzly bears. Therefore, formal consultation with the Service was initiated and this BO has been written to determine whether or not activities associated with these actions are likely to jeopardize the continued existence of grizzly bears. Grizzly bears are listed as threatened under the Act. Critical habitat has not been designated for this species; therefore none would be affected by the proposed actions.

C. ENVIRONMENTAL BASELINE

This section assesses the effects of past and ongoing human and natural factors that have led to the current status of the species, its habitat and ecosystem in the action area. Environmental baseline is defined as "… 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 an 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).

The "action area" is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR 402.02). In delineating the action area, we evaluated the farthest reaching physical, chemical, and biotic effects of the action on the environment. For the purposes of this BO, we have defined the action area to be two 5^{th}-order HUCs (sub-watersheds), as each sub-watershed approximates the size of Bear Management Unit subunits within the NCDE recovery zone. The action area encompasses the Mission Creek (1701021205), and Flathead River-Pablo Reservoir (1701021206) sub-watersheds. This includes portions of the Flathead Indian Reservation, National Bison Range, State, and private lands within the sub-watersheds' boundaries.

1. Status of the Species within the Action Area

To the east of the action area is the Mission Mountain Range, which is part of the NCDE (Mission Range BMU). This includes the Mission Mountain Tribal Wilderness Area, a second wilderness area that includes an 11,495-acre Grizzly Bear Conservation Area, where grizzly bears congregate in late summer and fall to feed on army cutworm moths, and the South Fork Primitive Area. Together, these areas encompass over 150,000 acres of tribally protected and managed habitat immediately east of the action area (RESPEC 2017:29). Biologists have documented an increasing presence of grizzly bears utilizing the valley bottom west of the Mission Mountains. Beginning in 2005, CSKT biologists started monitoring grizzly bear movements on the Flathead Indian Reservation with global positioning system collars placed on individual bears captured on the reservation. Since 2005, at least 28 bears have been captured and collared on the reservation (CSKT 2014).

Data collected to date indicate that 37 female grizzly bears have been fitted with GPS collars, and have occupied home ranges that included the Mission Range BMU during 2001 – 2019. Of these, 14 occupied ranges primarily on the west slope, 8 occupied ranges on both the west and east slopes, and 15 occupied ranges primarily on the east slope. Of the 22 GPS-collared female grizzly bears with home ranges on the west or both slopes of the Mission Range, 11 (50%) were documented west of US Highway 93 North, and were known to have crossed the highway between Evaro and Polson. Among the documented crossings by these collared bears, the number of crossings per individual in the action area averaged 13 (range 2 to 39). Among this sample, collared female grizzly bears spent as much as 64% of their time on the west side of US Highway 93 North. These data indicate that a significant proportion of bears that occupy the Mission Range BMU also occupy the Mission Valley, and regularly cross US Highway 93 North (Appendix B: Costello et al. 2020). More recently, there have been 23 individual radio-marked female bears in the adjacent Mission Range BMU from 2010 – 2019. Within each 6-year period, the number of individual female grizzly bears that contributed to its occupancy ranged from 9 to 14, with an average of 10.6 (Appendix B: Costello et al. 2020). The average number of females with home ranges primarily on the west or both slopes of the Mission Mountains was 7.1 (range 6 to 10)

Finally, grizzly bears freely move about the action area, particularly at night. Concentrated use occurs along the Post Creek riparian corridor, within the foothills habitat east of Kicking Horse Reservoir, and on the Ninepipe National Wildlife Refuge (CSKT 2014). Throughout the rest of the action area, grizzly bear activity has been documented around St. Ignatius, the National Bison Range and the Moiese Valley, along Mud Creek, and much of the action area east of US Highway 93 (CSKT unpublished data). The Post Creek riparian corridor provides security cover, as well as feeding opportunities, for grizzly bears, while the Ninepipe/Kicking Horse area provides large tracts of relatively undeveloped habitat for bears to use. It is speculated that much of the expansion in grizzly bear use of the area west of US Highway 93 is due to lower residential development in this portion of the action area (S. Courville, CSKT Wildlife Management Program, personal communication, February 2018).

2. Factors Affecting Species Environment within the Action Area

Grizzly bears in the NCDE suffer from both natural and human-caused mortality, with the latter being the driving force behind grizzly bear survival rates. Of 69 grizzly bear mortalities documented in the action area from 1973 through 2019, 67 were known to be human-caused (Montana Fish, Wildlife and Parks unpublished data). Within the action area, the top three sources of human-caused mortality during this time period are: automobiles (30%; 21 of 69 [2 vehicle-caused mortalities did not occur on US Highway 93 North]), management removals (which include livestock depredations; 28%), and defense of life (19%). The remaining sources of human-caused mortality include poached/malicious, capture mortalities, undetermined causes, and mistaken identification during hunting season (Montana Fish, Wildlife and Parks unpublished data). In addition to mortalities, a grizzly bear was reported struck by a vehicle in 2016 while crossing US Highway 93, however, the status of this bear is unknown because no carcass was retrieved (W. Camel-Means, CSKT Wildlife Management Program, personal communication, June 2018). While this 2016 vehicle collision may not have resulted in a mortality, it is important to note because it resulted in injury. Despite these mortalities, the survival rate for independent females in the NCDE, the single-most important cohort affecting population trend, is high: 0.947 (CI = 0.913 – 0.969; Costello and Roberts 2020).

Management removals of nuisance bears following human-grizzly bear conflicts are sometimes necessary. The majority of management removals result from conflicts at sites associated with frequent or permanent human presence. Unsecured attractants such as garbage, human foods, pet/livestock foods, animal carcasses, etc., are usually the source of these conflicts and subsequent removals. Of the 94 management removals in the NCDE recovery zone (including the 10 mile buffer surrounding it), between 2004 and 2016, at least 37% (35 of 94) were related to attractants and may have been avoided if preventative measures had been taken (USFWS unpublished data). These conflicts involved food conditioned bears actively seeking out unsecured attractants or bears that were habituated to human presence seeking natural sources of food in areas near human structures or roads.

The effect of traffic on habitat connectivity for wildlife is difficult to determine because several factors affect the specific thresholds at which traffic becomes a barrier to wildlife. Species vary in their sensitivity to traffic levels, and in their responses to it. For species sensitive to traffic volumes, they may adapt and cross the roadway at night when traffic levels are lower. For a guild of carnivores in winter, that did not include grizzly bears, Alexander et al. (2005) found that a threshold to carnivore movement across roads was between 300 and 500 vehicles per day (winter average daily traffic [WADT] volume; average annual daily traffic [AADT] was 3,000 to 5,000 vehicles per day). Several studies have documented similar diurnal to nocturnal shifts for grizzly bears, with disproportionate use of roads during the night, and have attributed these patterns to differences in human use (McLellan and Shackelton 1988, Mueller et al. 2004, Waller and Servheen 2005, Northrup et al. 2012). Waller and Servheen (2005), in a study of the effects of U.S. Highway 2 (approximate AADT of 2,000 vehicles per day) in northwest Montana on grizzly bears, found that bears were much more likely to cross the road at night when traffic volumes were approximately 30 vehicles per hour (95% CI = 20 – 40 vehicles/hr). Most road crossings in Waller and Servheen (2005:993, Figure III-3) occurred between 11 PM and 7 AM. In a study of grizzly bear use of roads in Banff National Park in Canada, Chruszcz et al. (2003) found that female bears were located further from roads with traffic volumes between 2,000 and 3,000 vehicles per day, but were more likely to cross such roads than male grizzly bears, particularly during the berry season. However, data suggested that grizzly bears avoided crossing an unmitigated section of the Trans-Canada Highway that had an AADT volume of 14,600 vehicles per day. Thus, while grizzly bears are willing to cross roads with AADT < 3,000 vehicles per day, and avoid crossing roads with AADT > 14,600 vehicles per day, it is difficult at this point to determine the specific traffic volume at which roads become a barrier to movement for grizzly bears. Within the action area, AADT was 9,050 vehicles per day in 2017 (Montana Department of Transportation, unpublished data), with monthly average daily traffic (MADT) ranging from 5,573 to 10,955 vehicles per day in January and July 2016, respectively (Figure III-2; Montana Department of Transportation 2016:18). The average hourly traffic volume (vehicles per hour) for 2016 ranged from a low of 21.29 vehicles per hour between 2 AM and 3 AM, to a high of 657.57 vehicles per hour from 4 PM to 5 PM (Figure III-3; Montana Department of Transportation, unpublished data). Despite these annual and average hourly traffic volumes, several adult female grizzly bears cross US Highway 93 within the action area. During the period they were monitored with GPS collars, seven adult females have crossed the highway a combined 121 times. Several of the females had cubs while crossing multiple times. One of the family groups (i.e., sow and cubs) crossed the highway fourteen times during a two year period. The majority of the crossing times occurred between 12 AM and 3:30 AM. These crossing times correspond with the period when the average hourly traffic volumes are lowest (Figure III-3). For the second female with cubs, one cub was killed by a vehicle while crossing the highway in 2015 (S. Courville, CSKT Wildlife Management Program, unpublished data, March 2019). This same female and two of her three cubs were all hit by a vehicle while crossing the highway at 10:30 PM on July 27, 2018. The third cub was later euthanized.

Figure III-2. Monthly average daily traffic (MADT) volumes in vehicles per day for U.S. Highway 93 (Montana Department of Transportation 2016:18).

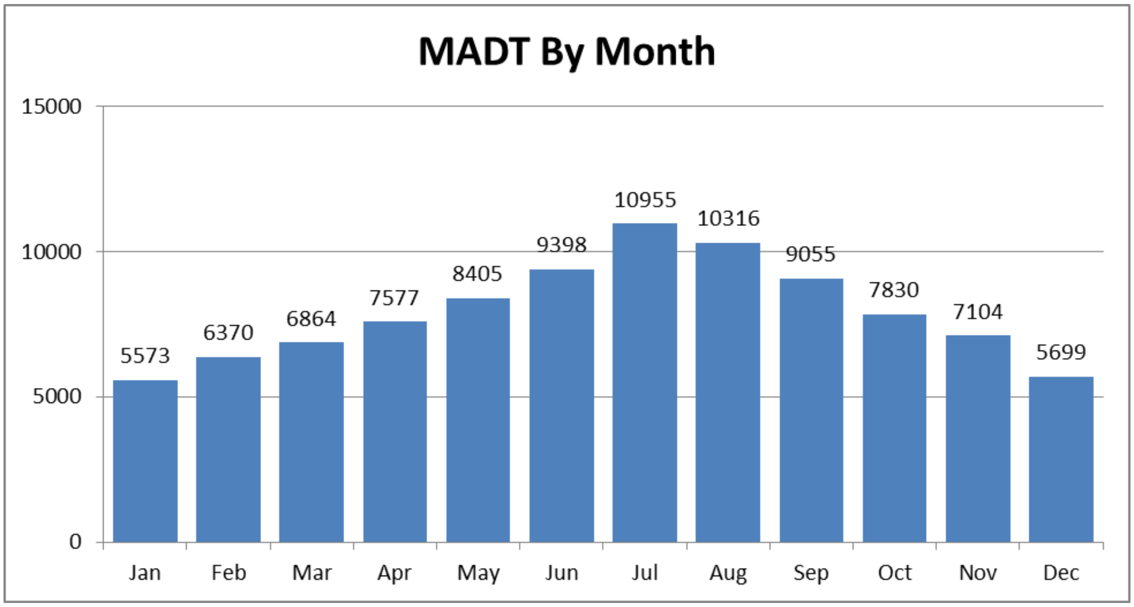
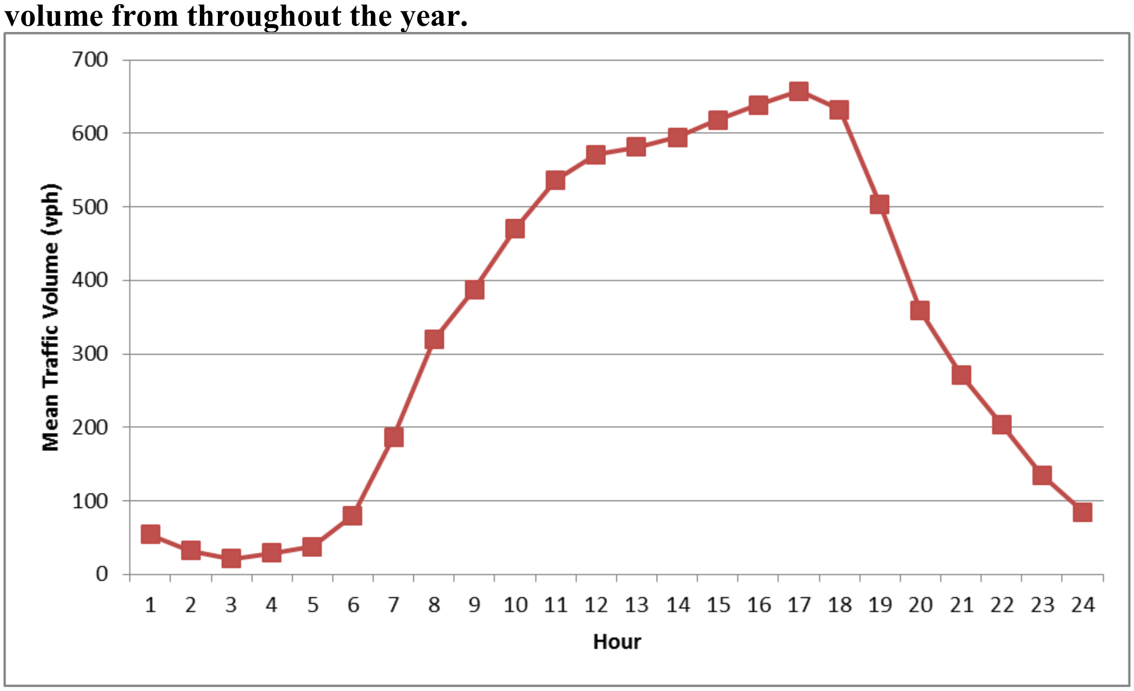


Figure III-3. Average annual hourly traffic volume (vehicles per hour) for U.S. Highway 93, located at Route Post 26.3, 1 mile south of Ravalli, Montana, for 2016 (Montana Department of Transportation, unpublished data). Data represents average hourly traffic volume from throughout the year.



Within the action area, between 2006 and 2009 eighteen crossing structures of various types and dimensions were constructed with the goal to help all wildlife safely move between cross-highway habitats, and to improve habitat connectivity and improve public safety by minimizing animal/vehicle collisions (RESPEC 2017:20). Of these eighteen crossing structures, two meet the recommended minimum dimensions (40 ft x 15 ft; Clevenger and Huijser 2011:pp. 129, 143) for grizzly bears, but there have been 35 grizzly bear crossings documented in five structures from 2009 to 2017 (Huijser et al. 2016a:63; W. Camel-Means, CSKT Wildlife Management Program, personal communication, May 29, 2018). All seventeen grizzly bear-vehicle collisions on US Highway 93 between Evaro and Polson have occurred within the action area, with many/several occurring near existing or proposed crossing structures (Table III-2).

Table III-2. Grizzly bear-vehicle collision locations on US Highway 93, and proximity to large mammal crossing structures (approximately 24 ft wide x 13 ft high). Vehicle collision locations derived from Montana Fish, Wildlife and Parks (unpublished data) and CSKT Wildlife Management Program (unpublished data). Measurements approximated in GIS.

Year	Age Class	Approximate Reference Post	Approximate Distance to Nearest Crossing Structure (yds)	Status of Structure [1]
1998	Subadult	41.4	100	Proposed
2001	Adult	37.8	35	Proposed
2002	Adult	37.9	235	Proposed
2010	Subadult	41.4	490	Proposed
2012	Adult	34.8	570	Constructed
2012	Cub	34.8	780	Constructed
2013	Unknown	37.7	135	Proposed
2015	Cub	44.1	50	Proposed
2016	Unknown	34 – 36 [2]	unknown	Two Constructed
2018	Cub	35.4	1,860	Constructed

2018	Adult and 3 cubs	44.8	1,107	Proposed
2018	Adult	44.1	100	Proposed
2018	2 Cubs	34.7	317	Constructed
2019	Subadult	41.4	495	Proposed
2019	Cub	35.4	1,751	Constructed
2019 [3]	Cub	~34.0		
2020	Adult	~40.9	120	Proposed

[1] Status of crossing structure at the time of the vehicle collision.
[2] Approximate location
[3] Cub was found off of the road so exact location of collision could not be determined, and relative distances could not be calculated.

As discussed in the *Status of the Species* section, grizzly bear-vehicle collisions within the NCDE recovery zone, and a 10 mile buffer surrounding it, have been increasing as a proportion of documented human-caused mortalities since 1990 (Figure III-1), and now account for approximately 15.2 percent of human-caused mortalities (61 of 402 human-caused mortalities are due to collisions with vehicles; Montana Fish, Wildlife and Parks unpublished data). This is not unexpected, given the increase in bear population numbers, and the expansion of grizzly bear distribution into more human-populated areas over time (Appendix B: Costello et al. 2020). However, the grizzly bear-vehicle collisions that have occurred within the action area represents a significant portion of the total highway mortalities within the NCDE recovery zone, and a 10 mile buffer surrounding it (Table III-1, Appendix B: Costello et al. 2020). The length of the project area between St. Ignatius and Ronan, where all of the US Highway 93 North grizzly bear mortalities have occurred, constitutes only 2 percent of the approximately 700 miles of highway in the NCDE's demographic monitoring area (DMA), but constitutes 28 percent of the vehicle-caused mortalities documented since 1990, and more than one-third since 2010 (Appendix B: Costello et al. 2020). Additionally, the number of grizzly bear mortalities per mile due to vehicle collisions in the project area is 2.48 times higher than on other highways in the DMA (Costello et al. 2020: Table 1). Thus, grizzly bear-vehicle collisions within the action area are disproportionately high, compared with the rest of the NCDE. Despite the level of grizzly bear-vehicle collisions in the action area, and that 4 independent females (i.e., female grizzly bears that are no longer dependent on their mothers) have been hit between 2010 and 2020, the grizzly bear population in the NCDE is increasing at a rate of 2.3 percent since 2004 (Costello et al. 2016). Additionally, all recovery criteria for the NCDE have been met (USFWS 2018:5-6). Thus, currently, the existing level of vehicle-caused mortalities within the action area is not impacting the ecosystem-wide population (Appendix B: Costello et al. 2020).

D. 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 CFR §402.02] These effects are considered along with the predicted cumulative effects to determine the overall effects to the species for purposes of preparing a BO on the proposed action.

1. General Effects of Roads on Grizzly Bears

This section provides a general discussion of direct and indirect effects of motorized access management on grizzly bears as affected by road densities. Research has confirmed adverse impacts of roads on grizzly bears (Mace et al. 1996, Mace et al. 1999). Negative impacts associated with roads and excessive road densities influence grizzly bear population and habitat use patterns in numerous, widespread areas. The Grizzly Bear Compendium (IGBC 1987) summarized impacts reported in the literature including:

- Avoidance/displacement of grizzly bears away from roads and road activity;
- Habitat loss, modification, and fragmentation due to roads and road construction, including vegetative and topographic disturbances;
- Changes in grizzly bear behavior, especially habituation to humans, due to ongoing contact with roads and human activities conducted along roads; and
- Direct mortality from road kills, legal and illegal harvest, and other factors resulting from increased human-bear encounters.

The Interagency Grizzly Bear Committee (IGBC) Taskforce provided standardized definitions for roads and standardized methods to measure road densities and define analysis areas within the recovery zones as a result of grizzly bear research information on open and total road densities and grizzly bear core areas (IGBC 1998). The Service considers the management of roads in the recovery zones one of the most important factors in grizzly bear habitat conservation and the IGBC Taskforce guidelines as the best direction with which to manage roads within the recovery zones.

Displacement and security. Some grizzly bears, particularly subadults, readily habituate to humans and consequently suffer increased mortality risk. However, many grizzly bears under-use or avoid otherwise preferred habitats that are frequented by people. Such under-use of preferred habitat represents modification of normal grizzly bear behavior. Negative association with roads arises from the grizzly bears' response to vehicles, vehicle noise and other human-related noise around roads, human scent along roads, and hunting and shooting along or from roads. Grizzly bears that experience such negative consequences learn to avoid the disturbance and annoyance generated by roads. Some may not change this resultant avoidance behavior for long periods after road closures. Even occasional human-related vehicle noise can result in annoying grizzly bears to the extent that they continue to avoid roaded habitat.

All factors contributing to direct links between roads and displacement from habitat have not been quantified. The level of road-use by people is likely an important factor in assessing the potential displacement caused by any road. Contemporary research, however, indicates that grizzly bears consistently were displaced from roads and habitat surrounding roads, often despite relatively low levels of human use (Mattson et al. 1987, McLellan and Shackleton 1988, Aune and Kasworm 1989, Kasworm and Manley 1990, Mace and Manley 1993, Mace et al.1996).

Avoidance behavior is often strongest in adult grizzly bears, with males selecting for high quality habitats and absence of humans (Gibeau et al. 2002). Males that were found using high quality habitat near roads, did so during the night where hiding cover was available (ibid). However, adult females were more likely to avoid humans all together, rather than seek out the highest quality habitats. Mueller et al. (2004) reported all age and sex classes used habitats closer to high-use roads (i.e., >100 vehicles or people per month during May-October) and development during the human inactive period. All bears showed a considerably greater avoidance of high-use roads and development during periods of high human activity. They did show however, that regardless of the time of day, subadult bears were found closer to high-use roads than adult bears. Gibeau et al. (2002) also demonstrated that subadults were almost always closer to human activity than adults.

In Montana, Aune and Stivers (1982) reported that grizzly bears avoided roads and adjacent corridors even when the area contained preferred habitat for breeding, feeding, shelter and reproduction. McLellan and Shackleton (1988) found that grizzly bears used areas near roads less than expected in southeastern British Columbia and estimated that 8.7 percent of the total area was rendered incompatible for grizzly bear use because of roads. In Montana, Mace and Manley (1993) reported use of habitat by all sex and age classes of grizzly bears was less than expected in habitats where total road densities exceeded two miles per square mile. Twenty-two percent of the South Fork Study area exceeded two miles per square mile. Adult grizzly bears used habitats less than expected when open motorized access density exceeded one mile per square mile. Further, female grizzly bears in the South Fork Study area tended to use habitat more than 0.5 mile from roads or trails greater than expected. As traffic levels on roads increased, grizzly bear use of adjacent habitat decreased (Mace et al. 1996). In Yellowstone, Mattson et al. (1992) reported wary grizzly bears avoided areas within two kilometers (1.2 miles) of major roads and four kilometers (2.4 miles) of major developments or town sites.

Mace et al. (1996) and other researchers have used 500 meters as the zone of influence around roads. Waller and Servheen (2005) also demonstrated avoidance of areas within 500 meters of U.S. Highway 2. Benn and Herrero (2002) set zones of influence of 500 meters and 200 meters around roads and trails, respectively. They reported that all 95 human-caused grizzly bear mortalities with accurate or reasonable locations that occurred in Banff and Yoho National Parks between 1971 and 1998 occurred within these zones of influence along roads and trails or around human settlements. Gibeau and Stevens (2005) documented bears further from roads when distant from high quality habitat, indicating avoidance behavior.

Research suggests that grizzly bears benefit from forest road closures aimed at minimizing traffic on roads within important seasonal habitat, especially in low elevation habitats during the spring (Mace et al. 1999). When roads are located in important habitats such as riparian zones, snow chutes and shrub fields, habitat loss through avoidance behavior can be significant. Mace et al. (1996) found that most of the forest roads within grizzly bear seasonal ranges were either closed to vehicles or used infrequently by humans. Some grizzly bears avoided areas with a high total road density even when the roads were closed to public travel. If human-related disturbances such as high levels of road use continue in preferred habitats for extended periods of time, grizzly bear use of the area may be significantly limited, particularly use by female grizzly bears. In the Swan Mountain study (Mace et al. 1996), female grizzly bear home range selection of unroaded cover types was greatest and as road densities increased, selection declined. Zager (1980) reported the underuse of areas near roads by females with cubs. Aune and Kasworm (1989) and McLellan (1989a) found that female cubs generally established their home range within or overlapping with their mother's home range, whereas males generally dispersed from their mother's home range. Long-term displacement of a female from a portion of her home range may result in long-term under-use of that area by female grizzly bears because cubs have limited potential to learn to use the area. In this way, learned avoidance behavior could persist for more than one generation of grizzly bears before grizzly bears again utilize habitat associated with closed roads. Thus, displacement from preferred habitats may significantly modify normal grizzly bear behavioral patterns.

Conversely, grizzly bears can become conditioned to human activity and show a high level of tolerance especially if the location and nature of human use are predictable and do not result in overtly negative impacts for grizzly bears (Mattson 1993). In Glacier National Park, Jope (1985) suggested grizzly bears in parks habituate to high human use and showed less displacement, even in open habitats. Yonge (2001) found that grizzly bears near Cooke City, Montana, were willing to consistently forage in very close proximity to high levels of human use if cover was sufficient and energetically efficient feeding opportunities were present. Both Mattson (1993) and Yonge (2001) postulated that areas with higher levels of human activity might have a positive effect for bears by serving as a kind of refugia for weaker population cohorts (subadults and females with cubs) seeking to avoid intra-specific competition (adult males). However, Mattson qualified this observation by adding that the beneficial effects vary as to whether hunting is allowed, and how closely the human population is regulated. Further, food conditioned grizzly bears were much more likely to be killed by humans.

Both Yonge (2001) and Mattson (1993) indicated that increases in human use levels can be deleterious if some human activities are unregulated, such as use of firearms, presence of attractants, nature and duration of human uses. Conversely, a level of coexistence between humans and grizzly bears can be achieved if such activities are controlled. Near Cooke City, Montana, the New World Mine reclamation project had minimal effects on grizzly bears, in part because reclamation activities were temporally and spatially predictable and people associated with the work had carefully regulated firearm-carry provisions, and attractants were unavailable to grizzly bears (Tyers, unpublished 2006).

Ruby (2014) studied grizzly bear habitat use along Montana Highway 83 in the heavily forested Swan Valley and found that grizzly bears exhibited little negative selection for high open road densities within the Swan Valley study area. Ruby (2014) used location data from 24 grizzly bears instrumented with GPS collars using the Swan Valley of the Flathead National Forest from 2000 to 2011 to characterize grizzly bear movement and habitat-use patterns. Use of GPS collars enabled grizzly bears to be tracked on a 24-hour basis. Ruby found that grizzly bears use high-quality habitats around human development and are not completely displaced. Rather, bears adopted movement patterns in close proximity to open roads and homes so that they were active during night time-periods when human activity was lowest. Although human activity associated with human site development in the rural landscape of the Swan Valley did not affect habitat selection, Ruby (2014) noted that it can result in human encounters resulting in grizzly bear mortality or management-related removals from the population. Where resources are not limiting, grizzly bear movement patterns that avoid periods of human activity may be an important strategy for limiting mortality risk to grizzly bears. These results may differ in the Mission Valley due to differences in habitat (i.e., the Mission Valley is primarily grassland) and housing density.

Low-elevation riparian habitats are of significant seasonal importance to grizzly bears. Grizzly bears typically use the lowest elevations possible for foraging during spring. Craighead et al. (1982) described the value of low-elevation habitats to grizzly bears. Montana Fish, Wildlife and Parks concluded that maximum numbers of grizzly bears can be maintained only if the species continues to have the opportunity to use both the temperate and subalpine climatic zones (Dood et al. 1986).

Research identified the following individual home-range selection patterns in local grizzly bear population segments: (1) some individual animals live almost exclusively (except for denning) in low elevation habitats; (2) other individuals maintain home ranges in more mountainous or remote locations; and (3) some individuals migrate elevationally on a seasonal basis (Servheen 1981, Aune and Stivers 1982).

Specific causes or factors involved in the selection or preferences for certain home ranges by grizzly bears are not well understood. Mace and Manley (1993) found that grizzly bear home ranges in the South Fork Study area included remote areas in high elevations. South Fork Study grizzly bear habitat-use data, road density analyses of the South Fork Study area, previous studies and CEM analysis (U.S. Forest Service 1994a, Mace et al. 1999) suggested that low-elevation habitats were not freely available to grizzly bears because of high road densities and associated human use in these areas. High road densities in low-elevation habitats may result in avoidance of or displacement from important spring seasonal habitat for some grizzly bears or high mortality risk for those individuals that venture into and attempt to exploit resources contained in these low-elevation areas.

Conditioning to Human Attractants. Continued exposure to human presence, activity, noise, and other elements can result in conditioning, which is essentially the loss of a grizzly bear's natural wariness of humans. High road densities and associated increases in human access into grizzly bear habitat can lead to the conditioning of grizzly bears to humans. Conditioning in turn increases the potential for conflicts between people and grizzly bears. Conditioned grizzly bears often obtain human food or garbage and become involved in nuisance bear incidences, and/or threaten human life or property. Such grizzly bears generally experience high mortality rates as they are eventually destroyed or removed from the population through management actions. Conditioned grizzly bears are also more vulnerable to illegal killing because of their increased exposure to people. In the Yellowstone region, humans killed habituated grizzly bears over three times as often as non-habituated grizzly bears (Mattson et al. 1992).

Subadult grizzly bears are more often vulnerable to conditioning and illegal killing or they conflict with people and are removed through management action. Subadult grizzly bears frequently traverse long distances or unknown territory, increasing the likelihood of encountering roads, human residences or other developments where human food or other attractants are available, increasing the potential for conditioning and/or conflicts with people. Between 1988 and 1993, six of seven grizzly bear management removals from the Flathead National Forest and surrounding area involved subadults (U.S. Forest Service 1994a, 1994b). In the Yellowstone ecosystem, roads impacted individual age and sex classes of grizzly bears differently. Subadults and females with young were most often located near roads, perhaps displaced into roaded, marginal habitat by dominant grizzly bears (Mattson et al. 1987, Mattson et al. 1992).

Grizzly bears face direct mortality risks on public land relatively infrequently in the NCDE. Management action due to human food conditioning does occur. However, on Forest Service administered lands, grizzly bear mortalities more often resulted from mistaken identity during legal hunting season, illegal or malicious killing, or automobile and train collisions (K. Ake 2011 *in litt.*). Glacier National Park received an average of 1.9 million visitors a year from 2000 through 2010 with concentrated use in developed areas and dispersed in the backcountry (National Park Service 2011). Between 2000 and 2010, only 9 grizzly bear mortalities were attributed to human-causes in Glacier Park (K. Ake 2011 *in litt.*). Four of these were related to accidental automobile and train collisions, three were related to management removals, one was related to research capture, and one was related to mistaken identification while hunting. In comparison, in 2010 alone, seven grizzly bears were removed from private lands within the NCDE because of human causes related to management removal (4), automobile collision (1), illegal shooting (1), and unknown causes (1). Approximately 114 human-caused mortalities occurred on private land from 2000 to 2010, the majority involving management removals related to conditioning of food attractants, garbage, and/or livestock.

Ake et al. (1998) summarized human-caused grizzly bear mortality locations for the period 1984 to 1996. An estimate of the amount of time grizzly bears spent in rural, roaded, and backcountry area (Mace and Waller 1998) was then compared with mortality locations. Although grizzly bears spent less than 5 percent of time in rural settings, 56 percent of human-caused grizzly bear mortality occurred in rural roaded areas. Grizzly bear mortality data collected since 1998 support the premise of increased risk to grizzly bears in rural roaded areas. In the NCDE, mortalities associated with roaded rural (mostly private) areas exceeded the sum of mortalities from Forest Service roaded areas and areas away from roads.

2. Traffic Volumes

The stated purpose of the project is to improve the level of service, mobility, traffic flow, system linkage and safety on the transportation system (RESPEC 2017:2). Within the project area, AADT was 9,050 vehicles per day in 2017, and is expected to grow at an annual growth rate of 1.2% to a projected AADT of 12,060 in 2041. Within the larger, original Evaro to Polson corridor AADT in 2017 was 8,700 vehicles per day, with a projected annual growth rate of 1.0%, for an AADT of 11,050 in 2041 (Montana Department of Transportation, unpublished data). Thus, traffic volume within the action area will gradually approach levels (e.g., AADT > 14,600) where grizzly bears have been observed to avoid crossing roads over the next 23 years (Chruszcz et al. 2003). As traffic volumes increase, it is expected that grizzly bears will avoid crossing Highway 93 North and that vehicle collisions with grizzly bears will increase due to the shorter interval between passing vehicles, and the slower rate at which cubs are able to cross the road.

3. Effects of the Project on Grizzly Bears in the Action Area

The proposed project would result in indirect effects to grizzly bears in the form of their ability to cross, or be inhibited from crossing, US Highway 93, and through vehicle collisions. Direct effects during construction would likely be insignificant and discountable due to the implementation of conservation measures that would manage attractants and locate high activity sites (e.g., staging areas, field offices, and sleeping quarters) away from high use grizzly bear areas like Post Creek (RESPEC 2017:15). Indirect effects would arise from an increasing grizzly bear population, increasing traffic volumes, a wider road surface, and permeability of the highway to attempted bear crossings.

Effects to Individuals--The proposed action would replace the existing 26 ft to 40 ft wide roadway in the Post Creek and Ninepipes segments with a road ranging from 40 ft to 112 ft wide (FHWA 2008). The new road would include two-lane (40 ft wide), two-lane with a passing lane (52 ft wide), and four-lane divided highway (112 ft wide) segments. The wider road surface in the project corridor would incrementally increase the difficulty for wildlife crossing the highway. Existing road width is 26 – 40 feet, and the proposed project would include segments varying between 40 and 112 ft wide, increasing road width by up to 430 percent. The US Highway 93 Ninepipe/Ronan Improvement Project Final Supplemental Environmental Impact Statement (Final SEIS; FHWA 2008: p. 4-5) states that under existing conditions, traffic in the rural segment (i.e., Post Creek and Ninepipes) is frequently congested, with long platoons of vehicles that cause time delays. With delays, driver frustration increases causing an increased frequency of unsafe driving practices. By widening the roadway and straightening the road alignment between Post Creek and Gunlock Road, the project would increase the level of service that the road provides to motorists, and should result in reduced traffic congestion. Such changes increase a driver's confidence, increase sight distance, and allows for drivers to more easily anticipate the road course and upcoming traffic situations (Duncan 1974, Martens et al. 1997, Shinar 2007), as well as provides additional room for object avoidance, and reduced risk of road departure due to obstacle avoidance. However, such modifications to the roadway, particularly near riparian areas receiving grizzly bear use, may increase the risk of vehicle collisions with grizzly bears because of: (1) the increasing grizzly bear population in the action area; (2) grizzly bear activity in the action area is primarily nocturnal; (3) the wider road surface to cross (up to

430 percent wider over existing conditions) increases the time bears are exposed to vehicles; and (4) the combined changes to road width and grade that are proposed to increase driver safety, also increase drivers' confidence to compensate by speeding (Shinar 2007 *in* Ben-Bassat and Shinar 2011: 2142). Thus, while the purpose of the proposed project is to provide a safer road for drivers, and the Administration and Department cannot control driver behavior, the safer road will likely result in drivers compensating for the safer, and less congested roadway with increased speeds, and increasing the risk of collisions with grizzly bears at night. Some of this may be partially mitigated through the construction of the wildlife crossing structures.

To reduce the effects of the changes to the road and increasing traffic volumes (i.e., AADT) to all wildlife species, including grizzly bears, the Administration and Department have proposed 16 wildlife crossing structures at five locations, including wing fencing that would be a minimum of 150 yards (0.085 mi) at crossings designed for large mammals (RESPEC 2017:8-9). Additionally, to address grizzly bear-vehicle mortalities that have occurred in a previously reconstructed segment of road near St. Ignatius, the Administration and Department have proposed to construct fence to help guide grizzly bears and other wildlife to existing crossing structures. This proposal would include four segments of fencing that would include 0.53, 0.46, 0.20, and 1.24 mile segments of fencing. Fence end treatments have yet to be determined (Biological Assessment amendment 2020:2). Huijser et al. (2016a) evaluated the effectiveness of such measures on previously reconstructed segments of US Highway 93 between Evaro and Polson. For perspective, if wildlife vehicle collisions are reduced by at least 30 – 50 percent in all areas with fences on both sides of the road using five years of post-construction monitoring data, the mitigation measures are considered to have sufficiently improved road safety along the mitigated road sections with regard to wildlife vehicle collisions (Huijser et al. 2014). On previously reconstructed portions of US Highway 93 between Evaro and Polson, large wild mammal carcasses (collected by road maintenance personnel) were on average 17.79 percent lower in the fenced road sections along US Highway 93. Wildlife crashes (data collected by law enforcement personnel) were 50.62 percent lower on average. Wildlife vehicle collisions (average of the carcass and crash data) were reduced by 33.52 percent (Huijser et al. 2016a:103). Based on a before-after comparison for 13 fenced road sections along the previously reconstructed and mitigated, sections of US Highway 93, this measure of effectiveness was not met for large wild mammal carcasses, but it was met for wildlife crashes and for wildlife vehicle collisions (Huijser et al. 2016a:103). While the mitigations in the previously constructed sections of road did result in a reduction of wildlife vehicle collisions, their effectiveness was relatively low compared to other studies (79 – 97 percent reduction; Reed et al. 1982, Ward 1982, Woods 1990, Clevenger et al . 2001, Dodd et al. 2007 *in* Huijser et al. 2016a: 38). Further, when animals approach a fenced section of highway they may follow the fence (LeBlond et al. 2007) until they encounter a suitable crossing structure or an at-grade crossing opportunity at a fence end. Huijser et al. (2016a:42) found that fence end effects, where there is a concentration of wildlife vehicle collisions inside a mitigated road section at and near fence ends, extended 0.2 mi beyond unfenced road sections, and 0.2 mi into the fenced sections. Thus, a fence <0.4 mi in length may be under partial or full influence of fence end effects. Huijser et al. (2016b) evaluated the effectiveness of short sections of wildlife fencing (< 437 yds) combined with wildlife underpasses in the previously reconstructed portions of US Highway 93 in reducing wildlife vehicle collisions and providing crossing opportunities for large mammals. Hujser et al (2016b:64) compared the use of wildlife structures with short (0.0 – 0.25 mi), medium (0.87 –

1.68 mi), and long (3.79 - 3.85 mi) segments of fencing and found the number of large mammal crossings through the underpasses varied greatly between the individual structures, regardless of the length of the fenced road section. There was no indication that the number of large mammals that used the isolated underpasses with no or short fences was consistently different from underpasses associated with longer fenced road sections (0.87 – 3.85 mi). This study along US Highway 93 found that while wildlife fences can guide wildlife towards safe crossing opportunities, regardless of the presence or length of wildlife fences, large mammal use of underpasses is heavily influenced by other factors, including the location of the structure in relation to the surrounding habitat, wildlife population density, and wildlife movements (Huijser et al. 2016b: 66).

Many studies have shown the importance of crossing structure design on passage rates (e.g., Yanes et al. 1995, Clevenger and Waltho 2000, Ascensao and Mira 2007) while others have demonstrated that location is most important (Foster and Humphrey 1995, Land and Lotz 1996). Andis et al. (2017) investigated the effects of location using 15 structures of similar design (elliptical, corrugated metal arch-style underpasses with soil substrate) that were constructed between Evaro and Polson on US Highway 93. While all structures had positive performance measures for all wildlife species, the performance of individual structures for species passage was highly variable, demonstrating that even congruent structures of the same design can yield different performance. This suggests that location may be more important than design (Andis et al. 2017:10).

Of the 42 wildlife crossing structures that have previously been constructed on US Highway 93, only five have documented use by grizzly bears (Huijser et al. 2016a:63, W. Camel-Means CSKT Wildlife Management Program, personal communication, May 30, 2018). All structures that were used by grizzly bears have been large culverts that were 17 - 24 ft wide and ranged in height from 13 – 24 ft (Huijser et al. 2016a:65, Huijser et al. 2016b: Appendix B). Documented use of these structures by grizzly bears indicates that only solitary grizzly bears have used the structures, not family groups (W. Camel-Means, CSKT Wildlife Management Program, personal communication, May 30, 2018). Clevenger and Huijser (2011:129) recommend that underpasses intended for grizzly bears be a minimum of 40 ft wide and 15 ft high. The proposed project would construct eight wildlife underpasses for large mammals, including grizzly bears (Table III-3). They differ from previously constructed crossing structures in that they are all open span bridges, rather than large elliptical culverts. Grizzly bears use various types of wildlife crossing structures, ranging from culverts to overpasses (Clevenger and Waltho 2005, Sawaya et al. 2014, Huijser et al. 2016a). However, grizzly bears select larger and more open structures (e.g., overpasses and open span bridges; Ford et al. 2017). Over time, singleton grizzly bears (i.e., males and non-reproductive females) learn to use underpasses, while family groups (i.e., females with young) strongly select for overpasses and open span bridges (Ford et al. 2017:715).

Table III-3. Large mammal crossing structures proposed as part of the US Highway 93 Ninepipe/Ronan Improvement Project.

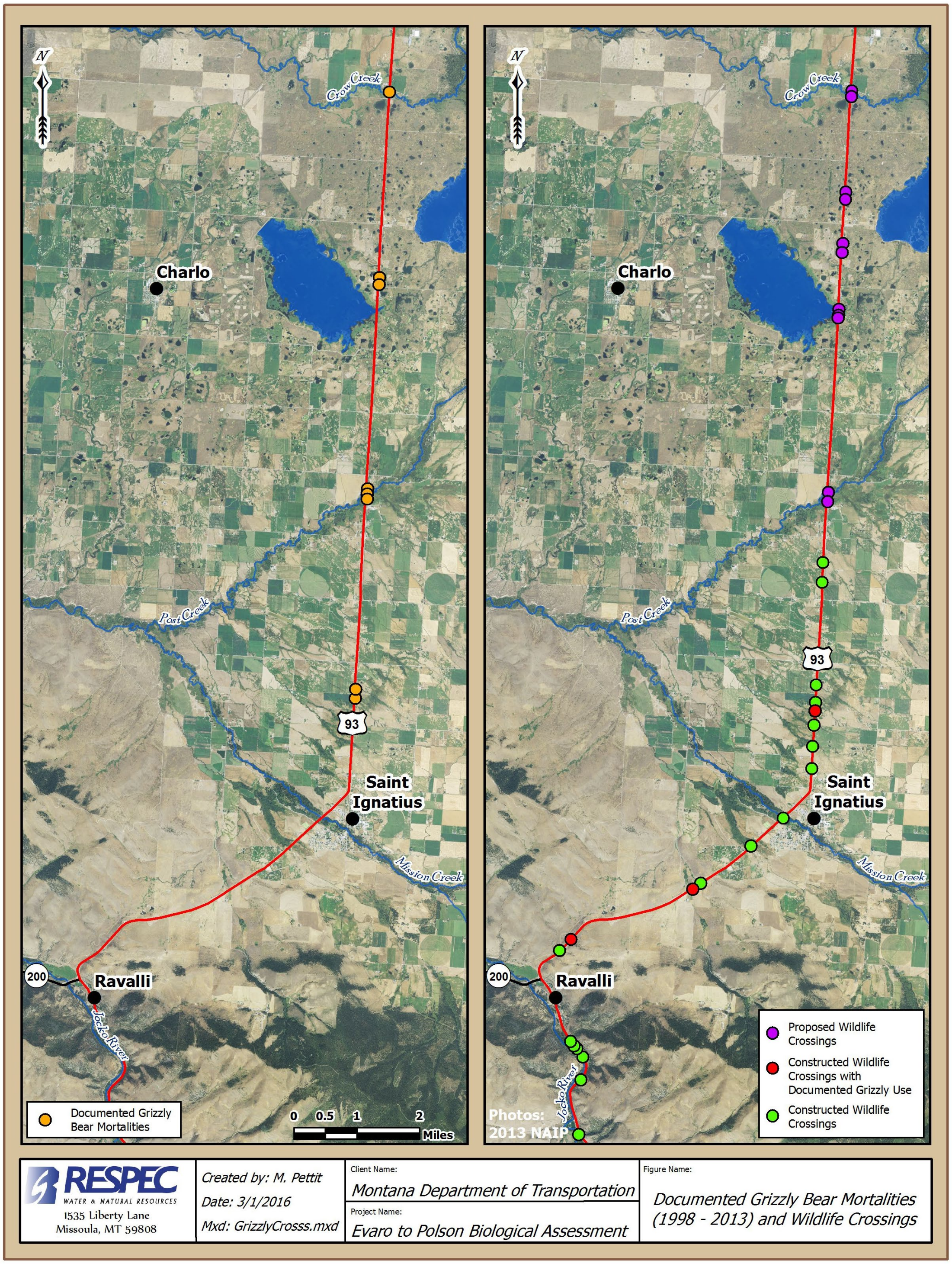
Crossing Structure	Approximate Route Post	Type	Width x Height (ft)
Post Creek Bridge	37.7	open span bridge	500 x 8 – 14
Ninepipe Reservoir Bridge	40.8	open span bridge	660 x 10 – 13
Kettle Pond 1 Bridge 1	41.7	open span bridge	59 x 10 - 13
Kettle Pond 1 Bridge 2	41.7	open span bridge	59 x 10 - 13
Kettle Pond 2 Bridge 1	42.5	open span bridge	59 x 10 - 13
Kettle Pond 2 Bridge 2	42.5	open span bridge	59 x 10 - 13
Crow Creek Bridge 1	44.2	open span bridge	121 x 10 – 13
Crow Creek Bridge 2	44.2	open span bridge	150 x 10 – 13

Gibeau et al. (2001) found that highway crossings by grizzly bears were concentrated in specific locations and occurred during the day as well as the night. Waller and Servheen (2005), and Costello et al. (2020) also found locations where grizzly bears crossed a major highway, including within the action area, to be spatially clustered. However, Waller and Servheen (2005) reported that grizzly bears crossed more often at night, even when outside their normal periods of activity, to take advantage of periods with lower traffic volumes. Areas with a high frequency of bear crossings were characterized by close proximity to a major drainage, rugged terrain, high quality habitat, and low human access. Several studies have documented similar diurnal to nocturnal shifts for grizzly bears, with disproportionate use of roads during the night, and have attributed these patterns to differences in human use (McLellan and Shackelton 1988, Mueller et al. 2004, Waller and Servheen 2005, Northrup et al. 2012). Thus, cover and low human occurrence are key features at preferred crossing sites. The Post Creek Bridge, Ninepipe Reservoir Bridge, and both Crow Creek Bridges crossing structures typify many of these characteristics: (1) they are located in major drainages; (2) there is high quality habitat along the riparian area; and (3) they are open-span bridges, which are a type of crossing structure preferred by singleton grizzly bears and family groups (i.e., adult female with young; Ford et al. 2017:715).

The proposed crossing structures (Table III-3) would be located along topographic features that correspond with where there have been previous grizzly bear highway mortalities (Table III-2 and Figure III-4), and receive concentrated use by GPS collared grizzly bears (CSKT Wildlife Management Program, unpublished data, Costello et al. 2020). To date, no collared female grizzly bears have been documented using the previously-constructed crossing structures. One such collared female with young crossed the highway fourteen times during a two-year period (CSKT Wildlife Management Program, unpublished data). All proposed crossing structures exceed the minimum recommended width of 40 ft, with the four Kettle Pond structures having the shortest widths at 59 ft. All proposed structures are marginal in meeting the minimum height recommendation of 15 ft, but will all have a minimum of 150 yds of wing fencing to guide wildlife to the structure. Given these parameters, and the preference of family groups for overpasses and open span bridges that are larger than the proposed structures (Ford et al. 2017), the proposed structures are marginally sized in terms of vertical clearance, and will likely provide occasional use by predominately male grizzly bears, and some use by family groups. In theory, the proposed structures would have a higher likelihood of being used by all ages, genders, and group status (i.e., single and family groups) if vertical clearances between the ground and structure exceeded 15 feet (Huijser et al. 2016a, Huijser et al. 2016b, Clevenger and Huijser 2011), wing fencing on each side of the structures exceed 0.4 mile to aid in funneling grizzly bears and other wildlife towards them (Huijser et al. 2016b) and utilize available grizzly bear crossing location data (e.g., Costello et al. 2020: Figure 6) to determine the extent of necessary fencing, and that they are situated in appropriate locations for grizzly bears (Andis et al. 2017). Otherwise, the proposed structures may receive infrequent use by grizzly bears, as demonstrated in the previously constructed structures in the corridor (Huijser et al. 2016a:63, W. Camel-Means CSKT Wildlife Management Program, personal communication, May 30, 2018).

Barrier Effects to Population—In spite of the mortality of grizzly bears from automobile collisions (representing 15% of the human-caused grizzly bear mortalities between 2004 and 2019; N = 62 of 406), the NCDE grizzly bear population exhibited an annual growth of 2.3 percent since 2004 (Costello et al. 2016). Within the NCDE, grizzly bear mortalities from vehicle collisions have increased dramatically since 2000 (see Figure III-1; Montana Fish, Wildlife and Parks unpublished data). Within the action area, twenty grizzly bear mortalities from vehicle collisions have been confirmed, including all age classes and genders, primarily on US Highway 93 (Montana Fish, Wildlife and Parks unpublished data). Highway traffic volumes will invariably continue to rise in response to predicted regional and national growth, and within the next few decades many highways through grizzly bear habitat that have historically had relatively low levels of traffic will reach traffic levels that may become problematic for grizzly bears and other wildlife. Within the action area, the average annual daily traffic (AADT) volume along U.S. Highway 93 is 9,050 vehicles per day, with projections of 9,500 vehicles per day in 2021, and 12,060 vehicles per day in 2041 (Montana Department of Transportation, unpublished data). Additionally, there are currently only two consecutive hours per night where average hourly traffic volumes are ≤30 vehicles per hour, and four consecutive hours per night where average hourly traffic volumes are ≤40 vehicles per hour (Figure III-3). As previously discussed, several studies (McLellan and Shackelton 1988, Mueller et al. 2004, Waller and Servheen 2005, Northrup et al. 2012) have documented that grizzly bears cross roads more often at night, even when outside their normal periods of activity, to take advantage of periods with lower traffic volumes. Thus, there are four consecutive one-hour periods during the night where vehicle traffic is ≤ 40 vehicles/hr, which would be within the traffic volume range that Waller and Servheen (2005) found grizzly bears were more likely to cross U.S. Highway 2 south of Glacier National Park. While existing traffic volumes likely do not restrict grizzly bear crossings of U.S. Highway 93, there is still a mortality risk to crossing during the nighttime hours. Additionally,

Figure III-4. Comparison of grizzly bear highway mortalities (1998 – 2016) with proposed large mammal crossing structures along US Highway 93 (RESPEC 2017:Figure 3-2, p. 32).



with the increasing number of cubs being hit (Table III-2), it may be more difficult for the less mobile among the grizzly bear population.

However, as traffic levels increase, it is reasonable to expect that grizzly bears in the U.S. Highway 93 corridor will respond by adjusting their crossing habits. At some threshold level, possibly when nighttime traffic volumes exceed the hourly rates expressed in Waller and Servheen (2005), U.S. Highway 93 may present a barrier to grizzly bear movement in the action area. The proposed project design and conservation measures will likely improve highway permeability for grizzly bears to a degree, limited largely to single bears, rather than to family groups. However, because the traffic volume threshold associated with adverse effects to grizzly bears is not empirically known, there is the potential within the project's life that traffic could increase to a level at which adverse effects to grizzly bears results when bears remain deterred from the corridor and from access to foraging habitats.

As discussed above, the Administration and Department propose to install eight open span bridges (i.e., wildlife underpasses; Table III-3) to facilitate wildlife movement across US Highway 93. For application to grizzly bears, Clevenger and Huijser (2011:129) recommend that underpasses be a minimum of 40 ft wide and 15 ft high. The dimensions listed for each proposed structure in Table III-3 show that each structure exceeds the minimum width requirements for grizzly bears, and that no proposed structure meets the minimum height requirements.

Clevenger and Barrueto (2014) analyzed the long-term effectiveness (1997 – 2014) of 40 crossing structures of varying types and sizes along the Trans-Canada Highway in Banff National Park for a suite of wildlife species, including grizzly bears. Eleven of the wildlife underpasses were bridges that ranged in height from 5.2 ft to 9.8 ft (mean = 8.6 ft), and passed between 4 and 332 grizzly bears (mean = 52; the range for 10 of the 11 structures was 4 to 57 grizzly bears, mean = 24.2 grizzly bears) between 1997 and 2014. In their analysis, Clevenger and Barrueto (2014) found that grizzly bears, particularly females with cubs, preferred overpasses to underpasses, and grizzly bears did not exhibit any preference for underpass size; however, none of the underpasses in this study met the minimum height recommendations in Clevenger and Huijser (2011). They found that grizzly bears in their study area, especially males, appeared to have adapted to, and eventually used all types of crossing structures; although, grizzly bears continued to show a strong preference for overpasses and the smallest crossing structures remained underutilized 17 years after construction. On a high volume highway (16,960 AADT) such as the Trans-Canada Highway, Clevenger and Barrueto (2014:130) state that the degree of behavioral plasticity grizzly bears would be able to display with regards to using small structures if the large, preferred ones are not available would be speculation. However, based on their data, they predict that in the absence of preferred structure types, there would be sex-biased dispersal across the high-volume highway with primarily male dispersal and no or limited female dispersal across the highway. The pattern of sex-biased dispersal has been seen on U.S. Highway 2 south of Glacier National Park (Waller and Servheen 2005), and Highway 3 in Alberta and British Columbia (Proctor et al. 2012). As previously discussed, within the action area, the average annual daily traffic (AADT) volume along U.S. Highway 93 is 9,050 vehicles per day, and using a 1% annual growth rate for traffic on this roadway, traffic volume is projected to be 9,500 vehicles per day in 2021, and 12,060 vehicles per day in 2041. Thus, the proposed crossing structures may be of adequate size for grizzly bears, but may be of low permeability to reproductive females. With occupancy of the Ninemile DCA by reproductive females being a goal of the NCDE Conservation Strategy, such occupancy of this DCA may be adversely affected because it likely necessitates the crossing of US Highway 93 in the action area by reproductive females. As a result, connectivity to other Ecosystems, like the Bitterroot Ecosystem, may be impaired (Costello et al. 2020).

Effects to Recovery Criteria—As previously stated in the *Status of the Species* section, partial demographic recovery criteria for the NCDE recovery zone include that known, human-caused mortality is not to exceed 4 percent of the current population estimate, of which no more than 30 percent shall be females, and that recovery in the NCDE cannot be achieved without occupancy of the Mission Mountains portion of the NCDE. As of 2018, all of the recovery criteria for the NCDE have been met (USFWS 2018). In an evaluation of these recovery criteria, including data from 2019, Costello et al. (2020:4, Table 2, Appendices B and D; Appendix B) found that the population-based goals have been met.

Costello et al. (2020) also found that the Mission Mountains portion of the NCDE continue to be occupied. For recovery purposes, an area is considered to be occupied if there are females with young present; presence of reproductive females is documented through visual observations of radio-marked females; locations of radio-marked females known to have offspring; verified remote camera photos; other verified visual observations; and from known or probable mortalities of family units (i.e., death of the mother, dependent young, or both; Costello et al. 2020:6). Costello et al. (2020:6-7) reports the documented presence of 23 individual radio-marked female bears in the Mission Range BMU during 2010-2019. In 6-year periods, the number of individual grizzly bears that contributed to occupancy ranged from 9 to 14, with an average of 10.6 (Costello et al. 2020: Table 4). The distribution of these females indicates that in 6-year periods the number of females with home ranges primarily on the west or both slopes of the Mission Mountains ranged from 6 to 10, with an average of 7.1. Within those 6-year periods, there were a range of 4-8 independent female mortalities observed, including bears hit by vehicles on US Highway 93 North, and due to other causes (Appendix B: Costello et al. 2020: Table 4; Appendix H). Since 2009, there have been four independent females involved in vehicle collisions on US Highway 93 North, with the most recent two being hit in 2018 and 2019, (Appendix B: Costello et al. 2020: Appendix H). In addition to these three independent females, during the same time period (2009 – 2019) four dependent females, six dependent males, and three independent males have been killed by vehicles on US Highway 93 North in the action area (Costello et al. 2020: Appendix B).

Costello et al. (2020:8-9; Table 5; Figure 6) also examined the risk of vehicular collisions among GPS-collared female grizzly bears. From 2001-2019 37 female grizzly bears had home ranges that included the Mission Range BMU, with 14 occupying home ranges primarily on the west slope, 8 occupying ranges on both the west and east slopes, and 15 occupying ranges primarily on the east slope. Of the 22 bears with home ranges on the west or both slopes of the Mission Range 50 percent (n = 11) were documented west of US Highway 93 North, crossing the highway a combined 139 times, with the number of documented crossings per individual ranging from 2 to 39 (average = 13). Among these eleven independent females (i.e., they are independent from their mothers, but may have dependent cubs of their own), the bears spent as much as 64 percent of their time west of US Highway 93 North. Thus, of the known independent female grizzly bears in the Mission Range, a significant proportion are potentially vulnerable to highway mortality. Of these crossings, Costello et al. (2020: Figure 6) mapped 134 crossings by GPS-collared independent female grizzly bears that occurred between Pablo and Ravalli, Montana. Many of these crossings occurred in the general vicinity of the eight proposed large mammal crossing structures (Table III-3). However, the width of the area surrounding the proposed crossing structures where actual bear crossings occurred was far greater than what would be encompassed by the proposed minimum of 150 yards of wing fencing on each side of the structure. Thus, as proposed, with a proposed minimum of 150 yards of wing fencing on each side of the structure, and structures with vertical clearances that may be deficient (particularly for grizzly bear family groups) many of the independent female grizzly bears that occupy the Mission Range may be at risk for collisions with vehicles on US Highway 93 North. While vehicle mortalities of independent female grizzly bears on US Highway 93 North is currently a relatively small component (n = 3 since 2013), taking into account the grizzly bear population growing annually at a rate of 2.3 percent, other sources of mortality, and trends in grizzly bear-vehicle collisions in the NCDE (Figure III-1), it is likely that vehicle mortalities on this road will become a larger component of mortality affecting continued occupation of the Mission Mountains.

It is the Service's opinion that the project's construction of a wider road surface, in conjunction with a steadily growing grizzly bear population in the action area and NCDE that has primarily nocturnal activity (Stacy Courville, CSKT Wildlife Management Program, pers. comm., February 2018), is reasonably certain to result in the indirect effects of vehicle collisions with grizzly bears, and may serve as a barrier to movement and restrict demographic connectivity for the following reasons:

1. The proposed wider road surface would increase the existing 26 - 40 ft wide road surface to a 40 - 112 ft wide surface.
2. The changes in road width and straightening of the horizontal alignment in certain road sections could influence (i.e., increase) vehicle speeds or driver behavior (i.e., decrease attentiveness).
3. Similar road mitigations along previously reconstructed sections of US Highway 93 did result in reductions in wildlife vehicle collisions, but their effectiveness was relatively low compared to other studies.
4. The relatively low use of only a few previously constructed crossing structures on US Highway 93 by grizzly bears.
5. AADT volumes > 9,000 vehicles per day, with non-denning period monthly average daily traffic volumes ranging between 7104 and 10955 vehicles per day, and only four consecutive one-hour periods at night with hourly traffic volumes ≤40.
6. That females with cubs prefer overpasses to underpasses.

Thus, there are, and will likely continue to be, increasingly more grizzly bears using the action area, primarily at night when driver visibility is lower, with a wider road to cross at traffic volumes that may soon present a barrier to movement.

4. Other Effects or Consequences

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, and may occur outside the immediate area involved in the action [50 CFR 402.02]. Other activities that will be associated with these projects include development of borrow material sites, staging areas for equipment, gravel stockpiles, and temporary asphalt plants. The combination of activities necessary at such sites often results in large and loud undertakings that operate continuously for long periods of time. Contracts for the proposed projects will contain special provisions stating that the contractor is to conduct project-related activities outside of construction limits in a manner which will not adversely affect federally listed species and/or designated critical habitat. Such measures include, but are not limited to those listed in the description of the proposed action (pp. 4-5).

E. 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.

Within the action area, domestic livestock will persist on private lands. Historically, two grizzly bear family groups were removed from the population for depredating chickens on private lands, and other grizzly bears have been removed for preying on cattle and sheep (Montana Fish, Wildlife and Parks, unpublished data).

The CSKT Kerr Dam Fish and Wildlife Mitigation settlement with Pacific Power and Light (PPL) Montana is a mitigation plan and monetary settlement with the goal of mitigating the impacts of Seli'š Ksanka Qlispe' (Kerr Dam) during the period from 1985 to 2035 (PPL no longer owns the dam; it is now owned by a corporation of the CSKT). The settlement includes acquiring approximately 3,398 acres of wildlife habitat, much of it surrounding the Ninepipe National Wildlife Refuge and Kicking Horse Reservoir. These lands would then be restored and enhanced for wildlife production. A key component of the mitigation work would be to acquire habitats that are adjacent to or complement those owned by Montana Fish, Wildlife and Parks and the Service. Such areas provide foraging habitat for grizzly bears (Herrera Environmental Consultants 2005).

F. CONCLUSION

After reviewing the current status of the grizzly bear, the environmental baseline for the action area, the effects of the action, and the cumulative effects, it is the Service's opinion that the effects of the US 93 Evaro to Polson project on grizzly bears is not likely to jeopardize the continued existence of the grizzly bear. No critical habitat has been designated for this species; therefore, none will be affected. Implementing regulations for section 7 (50 C.F.R. § 402) define "jeopardize the continued existence of" as to "engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species." Our conclusion is based on but not limited to the information presented in the 2017 biological assessment (RESPEC 2017), information from the final conservation strategy for the NCDE (NCDE Subcommittee 2018), the Grizzly Bear Demographics in the NCDE report (Costello et al. 2016), Costello et al. (2020), correspondence during this consultation process, information in our files, and informal discussions among the Service, the Administration and Department, and Confederated Salish and Kootenai Tribes' wildlife biologists.

The US 93 Evaro to Polson project may result in adverse effects to individual grizzly bears, and grizzly bears inhabiting the Mission Valley and Mission Range, as a result of increased difficulty crossing U.S. Highway 93 due to the wider roadway, an increased risk of vehicle collisions due to the increasing grizzly bear population, and likely changes in driver behavior resulting from the wider, straighter roadway, and increasing traffic volumes. Based on the best available scientific information reviewed in this consultation, such adverse effects may impact the recovery of the NCDE grizzly bear population through reductions in independent female grizzly bears, and the ability to eventually recruit dependent females into the breeding population (due to mortality) in the Mission Range. Occupancy of the Mission Range is a criteria for recovery of this species. Although a population would exist throughout the NCDE, recovery may be compromised due to effects to females in the Mission Range. Throughout the NCDE, however, grizzly bear survival would not be compromised. While there may be some limitations on the ability to maintain occupancy in the Mission Range, it is our opinion that the proposed action would not appreciably reduce the likelihood of both the survival and recovery of grizzly bears in the wild. Thus, due to the proposed action there will be a reduction in numbers, but it will not appreciably reduce both survival and recovery. Below we summarize key factors of our rationale for our non-jeopardy conclusion as detailed and analyzed in this BO.

Factors related to the US 93 Evaro to Polson project:

- Vehicle collisions account for 30 percent (n = 21) of the 69 grizzly bear mortalities in the action area, from 1973 to 2019, but 15.2 percent of the human-caused mortalities in the NCDE. Since at least 2004, the grizzly bear population has been steadily increasing in the NCDE. This correlates with an increasing frequency of grizzly bear-vehicle collisions over time, and that most grizzly bear-vehicle collisions have occurred in unmitigated sections of US Highway 93.

- To partially mitigate for the increased difficulty crossing the proposed roadway at-grade, the Department and Administration will install eight open span bridges, with a minimum of 150 yds of wing fencing, in locations that are likely to receive use by grizzly bears. While the proposed structures are marginally sized, open span bridges are one of the more preferred crossing structure types for use by grizzly bear family groups (Ford et al. 2017).

- To address exceedance of incidental take of grizzly bears that occurred under the 2005 BO, the Department and Administration propose to install new fencing at previously constructed wildlife crossing structures, and to extend the existing fencing at existing structures in the vicinity of Mission Creek and St. Ignatius, Montana.

- During construction, the Department and Administration will require contractors to manage grizzly bear attractants, and to locate high activity sites (e.g., staging areas, field offices, and sleeping quarters) at locations away from high grizzly bear activity (e.g., Post Creek).

Although we expect some individual grizzly bears may be adversely affected within the action area, the survival and recovery of the NCDE grizzly bear population would not be impaired. By extension, because both survival and recovery of the NCDE grizzly bear population would not be impaired, neither would the survival and recovery of the listed entity (i.e., grizzly bears in the coterminous United States).

Factors related to the NCDE grizzly bear population:

- Kendall et al. (2009) produced a final total NCDE grizzly bear population estimate of 765 grizzly bears for 2004 (Ibid.), more than double the recovery plan estimate for that year.

- Kendall et al. (2009) also indicated that in 2004 (http://www.nrmsc.usgs.gov):

    1) Female grizzly bears were present in all 23 BMUs.
    2) The number and distribution of female grizzly bears indicated good reproductive potential.
    3) The occupied range of NCDE grizzly bears now extends 2.6 million acres beyond the 1993 recovery zone.
    4) The genetic health of NCDE grizzly bears is good, with diversity approaching levels seen in undisturbed populations in Canada and Alaska.
    5) The genetic structure of the NCDE population suggests there has been population growth between 1976 and 2004.
    6) Human development is just beginning to inhibit interbreeding between bears living north and south of the U.S. Highway 2 corridor, west of the Continental Divide.

- Montana Fish, Wildlife and Parks research conducted between 2004 and 2014 indicates a positive trend for NCDE grizzly bears (Costello et al. 2016). The research indicates an annual growth of 2.3 percent since 2004 (Costello et al. 2016). A survival rate for adult females was documented at 94.7 percent (*Ibid.*).

- Using the 2004 population estimate and the percent annual growth, as of 2020, approximately 1,044 grizzly bears occupied the NCDE (Costello 2019).

- The NCDE grizzly bear population currently meets the demographic recovery criteria related to the number of BMUs occupied by family groups and sustainable human-caused mortality levels for both total and female grizzly bears (US Fish and Wildlife Service 2020).

- The NCDE grizzly bear population is increasing, explaining the expansion of its range into areas outside the recovery zone. Female grizzly bears with young have been observed outside of the recovery zone, indicating that a number of females are able to find the resources needed to establish home ranges and survive and reproduce outside the recovery zone, despite the lack of specific habitat protections. Using verified grizzly bear locations, Costello et al. (2016) estimated that bears currently occupy an area of roughly 13.6 million acres, more than double the size of the recovery zone.

- The NCDE Food Storage Order is in effect throughout the NCDE recovery zone and zone 1 (the DMA) on National Forest lands and Glacier National Park, and on many National Forest lands outside the DMA. These agencies have been fairly successful at managing attractants on federal lands under the current NCDE food storage order.

- Montana Fish, Wildlife and Parks' bear specialist program is expected to continue to work with the public to reduce risks to grizzly bears on private and public lands. In cooperation with other agencies, this program has made notable strides toward an informed public and reduced the availability of attractants to grizzly bears on private and public lands.

- The NCDE recovery zone encompasses 8,906 square miles, of which 2,656 square miles is wilderness and 1,503 square miles is Glacier National Park, which contains highest quality grizzly bear habitat. Considering these lands only, nearly half of the NCDE is essentially roadless or free of motorized use (47 percent). Further, the Flathead National Forest, which makes up 40 percent of the NCDE recovery zone, currently contributes approximately 1.5 million acres of additional grizzly bear core area. The four other National Forests in the NCDE also provide additional substantial core areas.

- The majority of the NCDE is managed by the U.S. Forest Service and National Park Service, whose access management outside of wilderness areas or otherwise protected area is directly based on IGBC Guidelines. The current access management conditions on federal lands across the ecosystem have contributed to the recovery of grizzly bears in the NCDE.

- Despite the growth of the human population and the increase in the number of grizzly bear-human conflicts and grizzly bear mortalities, the preponderance of evidence suggests an increasing number of grizzly bears in the NCDE recovery zone: a total population estimate of 1,044 grizzly bears (Costello 2019), an estimated positive population trend of 2.3 percent annually (Costello et al. 2016) and the current distribution of grizzly bears (Costello et al. 2016). Based on the best available information, the Service concludes that the status of the NCDE grizzly bear population is robust and meets recovery goals.

Recovery zones were established to identify areas necessary for the recovery of a species and are defined as the area in each grizzly bear ecosystem within which the population and habitat criteria for recovery are measured. The NCDE recovery zone is adequate for managing and promoting the recovery and survival of these grizzly bear populations (U.S. Fish and Wildlife Service 1993). Areas within the recovery zones are managed to provide and conserve grizzly bear habitat. The recovery zone contains large portions of wilderness and national park lands, which are protected from the influence of many types of human uses occurring on lands elsewhere. Multiple use lands are managed with grizzly bear recovery as a primary factor. As anticipated in the Recovery Plan, the NCDE grizzly bear population has responded to these conditions, is increasing, and is at recovered levels. In addition, the grizzly bears have been expanding and continue to expand their existing range outside of the recovery zones, as evidenced by the verified records of grizzly bears on or near portions of the action area.

Grizzly bears outside the recovery zone probably experience a higher level of adverse impacts due to land management actions than do grizzly bears inside. As anticipated in the recovery plan, we expect more grizzly bears will inhabit the national forests in the future. We expect grizzly bears will occur outside of the recovery zone at lower densities than within the recovery zone as a result of suboptimal habitat conditions, which include higher road densities, fewer areas secure from motorized access, and more human presence. While adverse effects may occur on some of the individual grizzly bears using the action area now and into the future, considering the large size of the NCDE recovery zone, favorable land management within the recovery zone, and the robust status of this grizzly bear population, adverse effects on grizzly bears as a result of this project would not have negative effects on the status of the NCDE grizzly bear population. This population is robust, the recovery zone is large, and management within the recovery zone favors the needs of grizzly bears. These results signal successful land management related to grizzly bear recovery under the strategy detailed in the 1993 Recovery Plan. Therefore, we conclude that the distribution, reproduction, or numbers of grizzly bears in the NCDE are not likely to be reduced.

Because the project would not reduce the reproduction, numbers, or distribution of grizzly bears in the NCDE, and by extension, the rest of the listed entity, and considering the status of the NCDE grizzly bear population, we conclude that the level of adverse effects is not reasonably expected to reduce appreciably the likelihood of both the survival and recovery of grizzly bears.

G. INCIDENTAL TAKE STATEMENT

Section 9 of the Act, and Federal regulations pursuant to section 4(d) of the Act, prohibit the *take* of endangered and threatened species, respectively without special exemption. *Take* is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct (Act, section 3). *Harm* is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns, including breeding, feeding, or sheltering (50 CFR 17.3). *Harass* is defined by the Service as an intentional or negligent act or omission that creates the likelihood of injury to listed wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering (50 CFR 17.3). *Incidental take* is defined as take that results from, but is not the purpose of, the carrying out of an otherwise lawful activity conducted by a Federal agency or applicant (50 CFR 402.02). Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the Terms and Conditions of this Incidental Take Statement.

The US Highway 93 Evaro to Polson consultation was reinitiated in 2012 because incidental take of grizzly bears had been exceeded due to grizzly bear-vehicle collisions. Since the original BO was issued in 2001, eight of the twelve projects that were proposed as part of the original action have been completed. The eight previously completed projects are similar to the currently proposed actions in that they widened and straightened the road, installed numerous wildlife crossing structures and associated wildlife exclusion fencing, and were anticipated to have similar effects to grizzly bears. For these reasons, this incidental take statement replaces and supersedes all previously issued incidental take statements for the US Highway 93 Evaro to Polson project, and is applicable to US Highway 93 North from RP 6.8 to 59.0.

1. Amount or Extent of Take Anticipated

Roads affect wildlife at both the individual and population levels, especially for rare species like grizzly bears with large home ranges that include many roads. Individuals are affected through traffic mortality, and also by the behavioral or physical barrier presented by the road. Local effects occur through reductions in the local population size because of traffic mortality, and also through reduced landscape connectivity because of the barrier effect of the road. Ultimately, regional effects may then occur in the form of reduced regional population size and persistence resulting from this combination of mortality and reduced connectivity. However, it is difficult to differentiate between the effects of increased mortality and the effects of decreased landscape connectivity on the regional population scale (Forman et al. 2003). The effects at the population level may not be as apparent, at least not for several generations. This is especially true for carnivore species, as a result of their long life spans that allow individuals to exist for some time without persisting as a population (Evink et al. 1998).

As previously stated, there have been 61 confirmed, and one unconfirmed, grizzly bear mortalities (of 402) caused by collisions with vehicles on roads within the NCDE recovery zone (including a 10 mile buffer surrounding it) between 2004 and 2019. Within the 61 grizzly bear mortalities due to vehicle collisions, there have been five instances where the adult female was killed, and cubs were orphaned, and one instance where the adult female and several cubs were killed in the same event. The Service considers that grizzly bear-vehicle collisions are a consequence of, but not the purpose of, the existence and operation of highways. Such takings are, therefore, considered "incidental" to the highway's existence and operation. The number of individual grizzly bears affected by the proposed improvements to the four remaining segments of US Highway 93 North is relatively low, compared to the population of the NCDE; however, these effects are still considered a "taking" even if only one grizzly bear is involved.

The Service anticipates that the indirect effects associated with the proposed improvements to the U.S. Highway 93 corridor could add to the existing level of incidental take of grizzly bears occurring because the proposed wider and straighter road would likely result in increased driver confidence, sight distance, and an ability to anticipate the road course and upcoming traffic situations. While such conditions promote driver safety, drivers respond to such confidence with increased speeds (Shinar 2007 *in* Ben-Bassat and Shinar 2011: 2142). How individual drivers respond to such conditions is their own responsibility. However, higher speeds on a wider road, coupled with an increasing grizzly bear population that is active in the action area primarily at night time (when visibility and sight distances are reduced) increases the likelihood of adding to the existing level of incidental take through vehicle collisions. Thus, these indirect effects could potentially result in incidental take in the form of harm from injury and death of grizzly bears. There have been 17 grizzly bear-vehicle collisions resulting in 20 known mortalities, and one undetermined result, in the action area on US Highway 93 between 1998 and 2019 (Table III-2; Montana Fish, Wildlife and Parks unpublished data, CSKT Wildlife Management Program, unpublished data). Additionally, the grizzly bear population in the NCDE is increasing at a rate of 2.3 percent per year (Costello et al. 2016), and the number of grizzly bears in the action area has been steadily increasing. From 2006 to 2010, 42 wildlife crossing structures were built within the action area, and approximately 18 miles of wildlife guide fencing was installed to help route animals to the crossing structures. However, of 29 crossing structures monitored from 2008 through 2017, only five crossing structures were utilized by grizzly bears for a total of 35 crossings by lone grizzly bears (i.e., no family groups were documented using the structures; Huijser et al. 2016a, W. Camel-Means, CSKT Wildlife Management Program, personal communication, May 30, 2018). Meanwhile, seven adult female grizzly bears that were monitored with GPS collars, crossed US Highway 93 North a combined 121 times, with several females accompanied by cubs crossing the road at-grade multiple times (S. Courville, CSKT Wildlife Management Program, unpublished data, March 2019). The proposed action would construct eight additional crossing structures for large mammals (dimensions of each described in Table III-3) that would have a minimum of 150 yards of wing fencing (RESPEC 2017:8), which would be similar to the existing crossing structures. As proposed, the new crossing structures and associated wing fencing are expected to receive infrequent use by grizzly bears, similar to existing crossing structures, due to reduced vertical clearances and fence end effects (Huijser et al. 2016a).

After accounting for past grizzly bear-vehicle collisions, the increasing grizzly bear population, the increasing trend in grizzly bear-vehicle collisions, traffic volumes on US Highway 93 growing at a rate of 1.2 percent annually, current use of existing crossing structures, the proposed action, and the existing level of incidental take that is occurring, the Service anticipates that **no more than an average of four grizzly bears over any six-year period (i.e., the average number of grizzly bear-vehicle collisions in the current year and five prior years) will be hit by vehicles in the US Highway 93 Evaro to Polson corridor in the future.** This will account for grizzly bear-vehicle collisions resulting in either injury or mortality of grizzly bears. Of the anticipated average of four grizzly bears over any six-year period, the Service anticipates that there will be **no more than an average of two female grizzly bears (any age class; i.e., both dependent and independent aged females) over any six-year period that will be hit by vehicles in the US Highway 93 Evaro to Polson corridor in the future (i.e., the female component is a subset of the overall estimate). This level of incidental take is expected to be perpetual, and will be evaluated annually based on the current year, and five previous years' grizzly bear-vehicle collisions.** The female incidental take component is based on the previously mentioned considerations, as well as recent trends in female grizzly bear-vehicle collisions in the action area (Table III-2). Because this consultation was reinitiated due to incidental take being exceeded by grizzly bear-vehicle collisions, incidental take will be calculated based on existing grizzly bear-vehicle collisions. Therefore, should more than an average of four grizzly bears over any six-year period, or more than an average of two female grizzly bears over any six-year period, be hit by vehicles incidentally to the construction and operation of US Highway 93 between Evaro and Polson (RP 6.8 to 59.0), the Administration should immediately reinitiate formal consultation with the Service in order for the protective coverage of section 7(o)(2) to continue. Additionally, should the level of incidental take associated with grizzly bear-vehicle collisions on US Highway 93 between reference post 6.8 and reference post 59.0 reach, but not exceed, the anticipated incidental take level, the Administration should informally consult with the Service regarding the adequacy of existing mechanisms to minimize potential take. The six-year moving average is useful in time-series data to smooth out "noise" (i.e., randomness or short-term fluctuations) to focus on longer-term trends. A six-year moving average for grizzly bear-vehicle collisions is used to determine incidental take because it is consistent with the manner in which demographic recovery criteria are tracked in the grizzly bear recovery plan, allows for annual recalculation of grizzly bear-vehicle collisions that occur on US Highway 93, and balances the years with higher grizzly bear-vehicle collisions with the years with no collisions. A female-specific component of incidental take is included because they are the reproductive unit in the population, and they are a primary measure by which species' recovery is evaluated. From 2004 to 2019, automobile collisions account for 61 of 402 (15.2 percent) human-caused grizzly bear mortalities in the NCDE recovery zone (including a 10 mile buffer surrounding it). Beginning in 2015, female grizzly bears have increasingly become a larger component of grizzly bear-vehicle collisions within the action area (Montana Fish, Wildlife and Parks unpublished data).

Based on research detailed earlier in this BO, the Service has defined harm of grizzly bears in terms of adverse habitat conditions caused by high traffic volumes, which displace individuals from key habitat to the extent that significant under-use of habitat by grizzly bears occurs. We anticipate that take may occur indirectly as a form of harm, whereby the presence and operation of the highway would modify grizzly bear habitat to the extent that it would impair essential behavioral patterns, including breeding, feeding, or sheltering. The presence and operation of highways may impede the ability of grizzly bears to access essential habitats. This may manifest in the sex-biased dispersal across the highway with primarily male dispersal and no, or limited, female dispersal across the highway, and could result in a reduction in otherwise available food resources, which could in turn result in reduced fitness and impairment of reproduction or recruitment of young. These effects on individual grizzly bears will be difficult to detect in the short term and may be measurable only as long-term effects on the species' habitat and population levels. The Service anticipates that incidental take of grizzly bears would occur from the displacement or avoidance effects due to increased traffic volume as a result of the existence and operation of the highway.

According to Service policy, as stated in the Endangered Species Consultation Handbook (March 1998) (Handbook), 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 instances where incidental take is difficult to quantify, the Service uses a surrogate measure of take.

The Service has elected to use traffic volume as a surrogate for the effects of grizzly bear avoidance or inhibition to cross US Highway 93 in the action area. Waller and Servheen's (2005) study of the effects of U.S. Highway 2 in Montana on grizzly bears found 85% of all grizzly bear crossings occurred at night, when mean traffic volumes during crossings was 30 vehicles/hr (95% CI: 20 – 40 vehicles/hr), and that adult females with cubs of the year (n = 2) did not cross the highway, but did so when accompanied by yearlings or 2-year-olds (n = 2). This and other studies indicates that grizzly bears are capable of adjusting their behavior, to an extent, to respond to traffic volumes; but that traffic volumes may rise to a level that inhibits or even blocks the permeability of the habitat bisected by the road. Therefore, it is the Service's opinion that behavioral patterns of adult female grizzly bears may be inhibited **when the mean hourly nighttime traffic volumes within the US Highway 93 Evaro to Polson corridor exceed an average of 30 vehicles/hr for ≥4 one-hour periods between 10:00 PM and 7:00 AM during the non-denning period (April through November), and the highway may become a barrier to movement when there are no one-hour periods between 10:00 PM and 7:00 AM during the non-denning period when the mean hourly nighttime traffic volumes are less than an average of 40 vehicles/hr**.

2. **Effect of the take**

In the accompanying BO, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species. However, the Service asked Dr. Cecily Costello, a Research Wildlife Biologist with Montana Fish, Wildlife & Parks, and a member of the NCDE Trend Monitoring Team, to review the anticipated incidental take and evaluate its effects on the NCDE grizzly bear population's ability to meet recovery criteria (Appendix B: Costello et al. 2020). Of the NCDE recovery criteria listed in the Status of the Species section (p. III-11), the recovery criteria that could be affected by the anticipated incidental take are:

1. Known, human-caused mortalities not to exceed 4 percent of the population estimate; and that no more than 30 percent of this limit be females. The limits are calculated based on a 6-year average and cannot be exceeded in two consecutive years.

2. Recovery in the NCDE cannot be achieved without occupancy of the Mission Mountains portion of the NCDE, where occupancy is defined as the presence of reproductive females.

To evaluate the effects of the anticipated incidental take due to vehicle collisions on the first recovery criteria, Costello et al. (2020:4) conducted a retrospective analysis, because it is difficult to predict the numbers of mortalities as grizzly bear population densities increase within human-populated areas. To simulate the effects of the take due to vehicle collisions, Costello et al. (2020: Table 2; Appendices B and D) calculated the mortality limits for the recovery criteria and compared them to observed data for 6-year periods starting with 2009-2014 and ending with 2014-2019. During 2009-2019, 16 vehicle-caused mortalities (7 female, 9 males) were observed on US Highway 93 North in the action area. Additional mortalities were simulated to bring the average annual number of vehicle-caused mortalities in the action area to the anticipated incidental take of 4 grizzly bears, assuming an equal sex ratio of 2 females and 2 males, which added a total of 17 female and 14 male simulated mortalities during the 2009 to 2019 time frame.

When accounting for these additional simulated mortalities, Costello et al. (2020:4; Table 2) found that neither the overall nor the female mortality limit was exceeded. However, the female limit was met, but not exceeded in one year (Costello et al. 2020: Table 2). Thus, the retrospective analysis indicates that neither the anticipated incidental take of an average of 4 grizzly bears being hit by vehicles over any 6-year period, or the subcomponent of an average of no more than 2 female grizzly bears (any age class; i.e., both dependent and independent aged females) hit by vehicles over any 6-year period, would exceed the human-caused mortality recovery criteria. However, the retrospective analysis does have the limitation that we cannot fully predict the potential increase in mortalities from all causes (e.g., vehicle-caused, management removals, defense of life, etc.) that might occur as more grizzly bears inhabit the human-populated areas of the NCDE (Costello et al. 2020:5).

The second recovery criteria that could be affected by the anticipated incidental take of grizzly bears due to vehicle collisions is the stipulation that the Mission Range BMU must be continually occupied on a 6-year basis, with occupation defined as the presence of reproductive females. Presence of reproductive females is documented through visual observations of radio-marked females; locations of radio-marked females known to have offspring; verified remote camera photos; other verified visual observations; and from known or probable mortalities of family units (e.g., death of the mother, dependent young, or both). Because opportunities for aerial observations in the NCDE are limited, information from radio-marked bears is heavily relied upon for documenting occupancy (Costello et al. 2020:6). In order to evaluate the effects that the anticipated incidental take would have on the ability to maintain occupancy of the Mission Range BMU, Costello et al. (2020:6-8) similarly conducted a retrospective analysis based on the number of females contributing to documented occupancy of the Mission Range BMU during 6-year periods between 2009 and 2019, with periods beginning with 2009-2014 and ending with 2014-2019. The analysis assumed that all simulated mortalities were independent bears. Since 1990, independent bears have accounted for 47 percent of vehicle-caused mortalities on US Highway 93 North in the action area, and 46 percent of vehicle-caused mortalities throughout the NCDE (Costello et al. 2020:7). More recently, however, dependent bears have accounted for 63 percent of the vehicle-caused mortalities on US Highway 93 North in the action area since 2009 (Costello et al. 2020: Appendix B).

The NCDE Trend Monitoring Team documented the presence of 23 individual radio-marked female grizzly bears in the Mission Range BMU during 2010-2019. Within each 6-year period, the number of individual grizzly bears that contributed to occupancy (i.e., females with cubs) averaged 10.6 (range 9 to 14). Of the bears that contributed to occupancy, an average of 7.1 bears (range 6 to 10) had home ranges primarily on the west or both slopes of the Mission Mountains during the 6-year periods (Costello et al. 2020:7; Table 4). Within the 6-year periods, 4 to 8 independent female mortalities were observed, including bears hit by vehicles on US Highway 93 and killed by other causes (Costello et al. 2020: Table 4; Appendix H). To simulate the effect of the anticipated incidental take, Costello et al. (2020) simulated additional mortalities to bring the average annual numbers of vehicle-caused mortalities in the action area to the anticipated incidental take of an average of 4 grizzly bears over any 6-year period, adding 17 simulated independent female mortalities. Thus, independent bears accounted for 20 of 24 vehicle-caused mortalities during the simulation. These numbers may be an overestimate because: (1) the simulated vehicle-caused bear mortalities were assumed to all be independent females; (2) since 1990, 47 percent of the vehicle-caused mortalities on US Highway 93 North in the action area have been independent females; and (3) since 2009, 63 percent of the vehicle-caused mortalities on US Highway 93 North in the action area have been dependent bears.

Costello et al.'s (2020:8) results of simulated additional mortalities (where simulated mortalities were only independent females) indicate that the anticipated incidental take of an average of two female grizzly bears (any age class; i.e., both dependent and independent aged females) over any six-year period being hit by a vehicle, if met, but not exceeded, would result in 13 to 15 independent female mortalities during each 6-year period, using a retrospective analysis. While during this time period the number of individual grizzly bears that contributed to occupancy (i.e., females with cubs) averaged 10.6 (range 9 to 14), the anticipated incidental take numbers combined with other sources of human-caused mortality exceed the population of independent females known to be present in the Mission Range BMU. Costello et al. (2020) acknowledges that the documented females with offspring do not represent all of the reproductive females that are present in the landscape (i.e., not all reproductive females were radio-marked), and therefore cannot be interpreted as a comparison with the total number of resident reproductive females. Consequently, Costello et al. (2020:8) concluded that the anticipated incidental take of an average of four grizzly bears over any six-year period due to vehicle collision, with a subcomponent of an average of two female grizzly bears (any age class; i.e., both dependent and independent aged females) over any six-year period due to vehicle collision, may adversely impact the local population, and consequently, the ability to maintain reproductive females in the Mission Range BMU "may rely heavily on the presence of females with home ranges on the east slope."

It is possible that the effects of the anticipated incidental take on the ability to maintain reproductive females in the Mission Range BMU will not be as severe as Costello et al. (2020:8) modeled.

First, the simulated mortalities involved independent bears only. As previously indicated, 47 percent of the vehicle-caused mortalities on US Highway 93 North in the action area have been independent females since 1990, and since 2009, 63 percent of the vehicle caused mortalities on US Highway 93 North in the action area have been dependent bears, of which, 40 percent (4 of 10) were dependent females (Costello et al. 2020: Appendix B). Additionally, Costello et al. (2020:8-9; Tables 5 and 6) indicated that 11 radio-marked independent females between 2001 and 2019 were documented west of US Highway 93, and were known to have crossed the highway between Evaro and Polson a combined 139 times (average = 13 crossings per bear, range 2 to 39 crossings), many times with cubs. During this period, there were 5 independent females mortalities due to vehicle collisions, and 10 dependent bear mortalities due to vehicle collisions (Table III-2, Costello et al. 2020: Appendix B). This may indicate that recruiting dependent females into the breeding population may become diminished in the future.

Second, Costello et al. (2020:8) indicated that the radio-marked females with offspring, upon which the analysis is based, is part of a population of resident reproductive females, whose number is not known. In light of these trends and uncertainties in the number of unmarked resident reproductive females, it is highly likely that the simulations that assumed all simulated mortalities were independent females overestimated the effects of the anticipated incidental take on the ability to maintain occupancy of reproductive females in the Mission Range BMU. Given (1) the relatively low number of independent female mortalities that have occurred on US Highway 93 North in the action area (Table III-2, Costello et al. 2020: Appendices B and H), and (2) while independent females cross the highway are at risk of vehicle collisions, since 2009, their offspring have been more likely to be hit by a vehicle. Thus, given recent trends, independent, reproductive females are more likely to persist, while recruitment of independent females may be impeded by the incidental take from vehicle collisions. As a result, there is a remote risk to maintaining the occupancy of reproductive females in the Mission Range BMU.

Therefore, the ability to meet recovery criteria for the NCDE may not be compromised. Further, considering the grizzly bear recovery strategies (U.S. Fish and Wildlife Service et al. 2013; U.S. Fish and Wildlife Service 1993) and the size, status, and distribution of the NCDE grizzly bear population, incidental take of grizzly bears in the action area is not likely to affect the recovery of the NCDE grizzly bear population.

Previously, the anticipated level of incidental take issued with 2001 BO (that was associated with the existence and operation of the reconstructed segment of US Highway 93 from Evaro to Polson) was two grizzly bears during any ten-year period in the future. This has been replaced and effectively increased to an average of four grizzly bears over any six-year period being harmed through injury or mortality due to vehicle collisions into the future. This would include as a subcomponent no more than an average of two female grizzly bears (any age class; i.e., both dependent and independent aged females) over any six-year period that will be hit by vehicles into the future. Given the 2.3 percent per year rate of population increase for grizzly bears in the NCDE, and that between 2004 and 2019 there have been 61 confirmed grizzly bear mortalities due to vehicle collisions, out of 402 human-caused mortalities (i.e., 15.2 percent over 15 years), the increase in allowable incidental take over the 2001 BO will not reduce appreciably the likelihood of both the survival and recovery of grizzly bears in the wild, and thus, will not jeopardize the continued existence of the species.

3. 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 of listed species resulting from proposed actions. The measures described below are non-discretionary and must be undertaken by the Administration and the Department so that they become binding conditions of any contract issued, as appropriate, for the exemption in section 7(o)(2) to apply. The Administration and Department have a continuing duty to regulate the activity that is covered by this incidental take statement. If the Administration and Department (1) fail to assume and implement the terms and conditions or (2) fail to require a contractor to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the contract, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Administration and Department must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 C.F.R. § 402.14(i)(3)].

A. The Administration and the Department shall ensure that project design elements which minimize the potential for adverse effects and take on grizzly bears are implemented as described for the US 93 Ninepipe/Ronan Improvement Project (RESPEC 2017, pp. 8-12, and 14-15).

B. The Administration and the Department shall monitor to validate the traffic patterns and projections made that were used to predict effects upon grizzly bears, and to determine whether incidental take thresholds pertaining to traffic volumes have been met or exceeded (validation monitoring).

C. The Administration and the Department shall ensure the effectiveness of crossing design features through monitoring, maintenance, and adaptive management to minimize the potential for grizzly bear injury and mortality through vehicle collisions and reduced road permeability (validation and effectiveness monitoring; adaptive management).

4. Terms and Conditions and Reporting Requirements

In order to be exempt from the prohibitions of section 9 of the Act, the Administration and Department must comply with the following terms and conditions, which implement the reasonable and prudent measure described above and which outline reporting and monitoring requirements. These terms and conditions are non-discretionary:

The following terms and conditions implement RPM A:

In order for the effects analysis in the biological opinion to be valid, conservation measures and design elements must be implemented as proposed in the biological assessment and BA amendment (RESPEC 2017). As such, some conservation measures are included here to ensure their implementation and to aid in minimizing incidental take. These items, as proposed in the biological assessment and BA amendment are identified in *italics*.

1. As proposed, the measures outlined in the biological assessment (RESPEC 2017, pp. 8-12, and 14-15) must be implemented throughout all aspects of these project's design and implementation, including the driving of test piles at Post Creek. Unless otherwise specified, these measures must be implemented on all of the remaining proposed projects. These measures include, but are not limited to:

    a. *Promptly clean up any project-related spills, litter, garbage, and debris.*

    b. *Store all food, food related items, petroleum products, antifreeze, garbage, and personal hygiene items inside a closed, hard-sided vehicle or commercially manufactured bear resistant containers.*

    c. *Remove garbage from the project site daily and dispose of it in accordance with all applicable regulations.*

    d. *Notify the Project Manager of any animal carcasses found in the area.* The Confederated Salish and Kootenai Tribes Wildlife Management Program has indicated that they want to be notified by the Project Manager for all carcasses of grizzly bears, black bears, mountain lions, deer, and elk.

e. *Notify the Project Manager of any bears observed in the vicinity of the project.* The Project Manager will immediately notify the Confederated Salish and Kootenai Tribes Wildlife Management Program at 406-675-2700.

f. Specific to the Post Creek project (UPN 8008000) within 400 meters (0.25 mile) of the Post Creek bridge, no work will occur between 9:00 PM and 6:00 AM from April 1 to June 30. This is to allow post-denning bears the opportunity to move east and west along the Post Creek riparian zone.

g. In the vicinity of Post Creek, locating construction staging areas, field offices, and sleeping quarters according to the following restrictions:

i. On the west side of the corridor, locate these facilities south of Dublin Gulch Road/Red Horn Road or north of West Post Creek Road/East Post Creek Road.

ii. *On the east side of the corridor, locate these facilities south of Dublin Gulch Road/Red Horn Road.*

2. To minimize adverse impacts to grizzly bears in a segment of US Highway 93 that was reconstructed prior to 2011, the Administration and Department have proposed the US 93 North-Wildlife Fencing (NH 5-2(185)30; UPN 9828000) project *to construct fence to help guide grizzly bear and other wildlife to existing crossing structures* near St. Ignatius, Montana (BA amendment 2020). The proposed project includes four segments of fencing, of various lengths, in the vicinity of Pistol Creek, Sabine Creek, Mission Creek, and Lower Mission/Lee. To ensure that designs for the proposed fencing and approach measures meet the requirements for grizzly bears, to the extent feasible based on site specific constraints (e.g., landowner and right-of-way challenges), the Department *will consult with biologists from the Confederated Salish and Kootenai Tribes' Wildlife Program and the Service early and iteratively in the design stage of the project to incorporate agreed upon changes*. Should ongoing research on fence end treatments *reveal a treatment option* that is effective at deterring grizzly bears from entering the roadway at approaches, that the Department, CSKT, and Service believe is appropriate for this project, it will be proposed for inclusion as part of the project. *Adaptive management will be pursued if additional needs or specific changes are identified and deemed necessary and feasible*. As previously negotiated with the Department, these measures were to be constructed by November 30, 2021. However, due to delays with project nomination within the Department, this date has been extended to November 30, 2022.

<u>The following terms and conditions implement RPM B</u>

3. The Administration and Department shall monitor the average daily traffic (ADT) volumes within the Evaro to Polson corridor, including mean traffic volume by hour during the non-denning period (April through November) until the last of the proposed projects have been completed. Prior to completion of the last project, if the average annual daily traffic (AADT) volume $\geq$ 14,000 vehicles per day, OR there are no 1-hour

periods between 10:00 PM and 7:00 AM during the non-denning period when the average hourly traffic volume is ≤ 40 vehicles/hr, then the Administration and Department will:

a. Meet with biologists from the Confederated Salish and Kootenai Tribes' Wildlife Management Program and the Service to:
    i. Evaluate the effects that traffic volumes are having on the permeability of US Highway 93 to grizzly bears through the use of information from, but not limited to, available collar, mortality, and traffic volume data; and
    ii. Determine what, if any, adaptive management measures, based on site conditions, the best available science, and feasibility (e.g., landowner constraints, right-of-way limitations, funding), could be taken to encourage greater use of the large mammal crossing structures in the US 93 Ninepipe/Ronan Improvement Project by grizzly bears in an effort to increase the permeability of the highway corridor. Adaptive management measures may include, but are not limited to, measures that improve the effectiveness of the proposed crossing structures for grizzly bears crossing the highway (e.g., fencing, fence end treatments, etc).
b. Document the outcome of the aforementioned meeting(s); and
c. Implement the adaptive management measures that are determined necessary by the Service's species experts.

Rationale: These traffic volumes are to be monitored because these measures are being used as a surrogate to determine if incidental take is occurring in the form of harm, that impacts adult female grizzly bears by significantly impairing behavioral patterns, including breeding, feeding, or sheltering. Adaptive management measures that are determined to be necessary by the Service's species experts would be required to be implemented because incidental take, as specified in the incidental take statement, will have been exceeded. The Department currently has a permanent long-term traffic monitoring station located on US Highway 93 North at Ravalli (station A-008; 1 Mi. S. of Ravalli) that can be used for this monitoring. While the area of the incidental take coverage due to traffic volumes encompasses US Highway 93 North from Evaro to Polson (RP 6.8 to 59.0), should adaptive management be deemed necessary under this term and condition, the area for adaptive management is limited to the area of US Highway 93 North that contains the remaining proposed projects, from RP 37.1 to 48.3.

<u>The following terms and conditions implement RPM C</u>

4. The Administration and Department will re-evaluate the design of the remaining proposed large mammal crossing structures in the Post Creek, Ninepipe Reservoir, Kettle Pond 1, Kettle Pond 2, and Crow Creek areas (RESPEC 2017:9), and the amount of necessary fencing associated with each structure, to incorporate the best available science to enable the structures to pass all demographic components (e.g., genders and age classes) of the action area's grizzly bear population. The Administration and Department will report their findings to the Service and the Confederated Salish and Kootenai Tribes Wildlife Department by December 31, 2022, detailing the design features considered for improving grizzly bear passage in the proposed structures, and describing how they will be incorporated into the future structures' design, and possible factors that may hinder

their incorporation and/or implementation. The Service recognizes that many factors which may constrain structure design (e.g., seismic, geotech, etc.) will not be investigated by the Department until after a project has been nominated and approved for funding. The findings of this report would be a source for consideration by the Administration and the Department when re-evaluating these projects moving forward.
Rationale: When the proposed action, and associated crossing structures, were designed conceptually in 2008, the proposed crossing structures were designed according to the best available science at that time, and were designed to accommodate all wildlife species. However, the state of knowledge regarding wildlife crossing structure use, particularly with regards to grizzly bears, has evolved (e.g., Clevenger and Huijser 2011, Clevenger and Barrueto 2014, Huijser et al. 2016a, Huijser et al. 2016b, Ford et al. 2017), and knowledge of how grizzly bears are using the action area and crossing structures in the previously reconstructed sections now exists (CSKT 2014, Huijser et al. 2016a, S. Courville, CSKT Bear Specialist, pers. comm., March 2018, Costello et al. 2020).

5. Beginning with the year in which construction of each of the eight proposed large mammal crossing structures is completed, the Administration and Department shall monitor each of the structures for a period of five years to evaluate grizzly bear utilization of the crossing structures. This term and condition pertains to the proposed structures in the Post Creek, Ninepipe Reservoir, Kettle Pond 1, Kettle Pond 2, and Crow Creek areas (RESPEC 2017:9), and are located from Red Horn Road/Dublin Gulch Road (RP 36.8) and extends north to Baptiste Road/Spring Creek Road (RP 48.7). Monitoring will be conducted at each of the eight proposed large mammal crossing structures to evaluate grizzly bear utilization of the crossings for 5 years. Monitoring tools may include, but are not limited to use of remote cameras, or grizzly bear GPS collar data, in coordination with the tribal grizzly bear specialist.

6. Should the level of incidental take from grizzly bear-vehicle collisions be met, but not exceeded, the Administration and Department shall coordinate with the Service to adaptively manage the fencing associated with the eight proposed large mammal wildlife crossing structures that will be located in the area from Red Horn Road/Dublin Gulch Road (RP 36.8) and extends north to Baptiste Road/Spring Creek Road (RP 48.7). The purpose of the adaptive management would be to further facilitate wildlife use of the structures. The need and degree of adaptive management would consider the type and location of incidental take, the degree of utilization of the crossing structures by grizzly bears, and project feasibility (e.g., landowner constraints, right-of-way limitations, funding).

Reporting Requirements

In order to monitor the impacts of incidental take, the Federal agency or any applicant must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [(50 CFR 402.14 (i)(3)]. To demonstrate that the US 93 Ninepipe/Ronan Improvement Project is adequately reducing the potential for and minimizing the effect of any incidental take that may result, and that the assumptions made in this consultation are valid, the Administration and Department shall complete a report with the information listed below and submit it to the Service's Montana Ecological Services Office by March 1 of each year for the preceding calendar year, for a period of 5 years after construction of the final proposed large mammal crossing structure. Thus, each structure would be monitored for a 5-year period post-construction. Traffic volumes would be monitored until completion of the final proposed project. Crossing structure monitoring will be done for those large mammal crossing structures that will be constructed in the area from Red Horn Road/Dublin Gulch Road (RP 36.8) and extends north to Baptiste Road/Spring Creek Road (RP 48.7). The report shall include:

1. The dates that construction were initiated and concluded for each project;
2. The number of (a) individual grizzly bear, and (b) grizzly bear family group approaches to each crossing structure, and the number of successful crossings by (a) and (b) through each structure;
3. The average daily traffic volumes for (a) the year; and (b) the individual months of April through November; and
4. The mean traffic volumes by hour for (a) the year; and (b) during the non-denning period (April through November).

Closing statement

The Service is unable to precisely quantify the number of grizzly bears that will be incidentally taken as a result of the US Highway 93 Evaro to Polson project. Therefore, we use a surrogate measure for the amount of take we anticipate and provide, in the incidental take statement, specific measures of the incidental take we anticipate. We use the number of vehicle collisions with grizzly bears as a direct measure of take, and mean hourly traffic volumes along US Highway 93 between Evaro and Polson as our surrogate measure of the incidental take that we anticipate as a result of the project.

Reasonable and prudent measures, with their implementing terms and conditions, are typically designed to minimize the impact of incidental take that might otherwise result from the proposed actions. If, during the course of the actions, the level of take occurring exceeds that anticipated in this incidental take statement, such incidental take represents new information requiring reinitiation of consultation and review of the incidental take statement. The federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

H. CONSERVATION RECOMMENDATIONS

Sections 7(a)(1) of the Act directs federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans or to develop information. The recommendations provided here relate only to the proposed actions and do not necessarily represent complete fulfillment of the agency's section 7(a)(1) responsibility for the species.

1. The Service recommends that the Administration and the Department incorporate the best available science and grizzly bear location data into the design of the proposed structures, and associated wing fencing, to encourage use of the structures by all ages and genders of grizzly bears in action area.

2. The Service strongly encourages that a formalized collaboration process, such as facilitated meetings between the Service, the Confederated Salish and Kootenai Tribes, the Administration, and the Department, be employed to work through issues that could delay the design and implementation of projects that would reduce grizzly bear-vehicle collisions within the action area. Due to an increasing grizzly bear population and increasing traffic volumes, grizzly bear-vehicle collisions will continue, and likely increase, within the action area until effective wildlife crossing structures and fencing are installed in locations that would be conducive to grizzly bear crossings.

3. Participate in ongoing interagency efforts to identify, map, and manage linkage habitats essential to grizzly bear movement. Please contact the Service's Grizzly Bear Recovery Coordinator or Montana Fish, Wildlife and Parks for information.

4. The Service strongly encourages the Administration and the Department to search for and implement innovative approaches to increase the permeability of Montana's highway corridors to wildlife, especially for mid- to large-sized forest carnivore species. There is growing awareness of the serious additive effects of highways on wildlife through habitat fragmentation, wildlife mortality, loss of habitat, avoidance of otherwise suitable habitat by wildlife, and related increases in human activity in proximity to highway corridors. The development of trials of various techniques and structures, along with modifications to existing structures, would provide valuable information on the efficacy of these strategies in a range of locations. Such information would be indispensable when planning future highway projects, allowing decisions regarding potential crossing applications to be based on actual data rather than on assumptions or estimates. This would focus and prioritize limited construction and conservation budgets and facilitate using the best technology at the most appropriate locations, maximizing benefits to wildlife as efficiently as possible.

I. REINITIATION NOTICE

This concludes consultation on the action outlined in your October 24, 2017 request for consultation on the effects of the US 93 Evaro to Polson projects on grizzly bears. As provided in 50 C.F.R. § 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 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 that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. The Service retains the discretion to determine whether the conditions listed in (1) through (4) have been met and reinitiation of formal consultation is required. 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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K. Appendix A

US 93 Evaro to Polson Wildlife Crossing Summary Table. Adapted from RESPEC (2017:Appendix A).

Structure Name	Crossing Location by Reference Post	Type	Size (w x h; ft)	Length (ft)	Years Constructed
Frog Creek	7.80	Corrugated Metal Pipe	10 x 7	95	2008-2010
North Evaro	8.75	Corrugated Metal Pipe	25 × 17	85	2008–2010
Rail Road Xing	9.68	Bridge	39 × 23	340	2008–2010
Finley Cr #1	10.05	Corrugated Metal Pipe	26 × 18	105	2008–2010
Finley Cr #2	10.25	Corrugated Metal Pipe	26 × 18	72	2008–2010
Evaro Overpass	10.35	Overpass (concrete arch)	49 wide	197 top	2008–2010
Finley Cr #3	10.50	Corrugated Metal Pipe	25 × 17	81	2008–2010
Finley Cr #4	10.82	Corrugated Metal Pipe	26 × 18	83	2008–2010
Schley Creek	10.90	Corrugated Metal Pipe	25 × 17	100	2008–2010
EF Finley Cr	12.25	Corrugated Metal Pipe	25 × 17	80	2008–2010
Agency Creek	15.62	Concrete Box Culvert	6 × 6	115	2008–2009
Jocko #1	18.82	Concrete Box Culvert	7 × 7	148	2004–2005
Jocko #2	18.86	Concrete Box Culvert	7 × 7	141	2004–2005
Jocko #3	18.90	Concrete Box	7 × 7	131	2004–2005

		Culvert			
Jocko River	18.95	Bridge	54 × 12	394	2004–2005
Schalls Flats	23.00	Concrete Box Culvert	8 × 8	122	2006–2007
Jocko/Spring Cr	23.20	Bridge	39 × 10	100	2006–2007
Ravalli Curves #1	24.20	Corrugated Metal Pipe	22 × 16	72	2006–2007
Ravalli Curves #2	24.80	Corrugated Metal Pipe	22 × 16	84	2006–2007
Jocko Side Channel	25.75	Bridge	39 × 12	100	2006–2007
Ravalli Curves #3	26.06	Concrete Box Culvert	4 × 6	90	2006–2007
Ravalli Curves #4	26.13	Concrete Box Culvert	7 × 5	82	2006–2007
Ravalli Curves #5	26.28	Concrete Box Culvert	4 × 6	80	2006–2007
Copper Creek	26.40	Corrugated Metal Pipe	25 × 18	60	2006–2007
Ravalli Hill #2	28.10	Corrugated Metal Pipe	17 × 24	128	2006–2007
Ravalli Hill #1	28.40	Corrugated Metal Pipe	17 × 24	102	2006–2007
Pistol Cr #1	30.48	Corrugated Metal Pipe	17 × 24	131	2006–2007
Pistol Cr #2	30.65	Corrugated Metal Pipe	17 × 24	131	2006–2007
Sabine Creek	31.75	Corrugated Metal Pipe	24 × 13	48	2006–2007
Mission Creek	32.43	Bridge	51 w × 10 h	131	2006–2007

Mission Stockpass	33.42	Concrete Box Culvert	7 × 7	94	2006–2007
Post Cr #1	33.80	Corrugated Metal Pipe	24 × 16	95	2006–2007
Post Cr #2	34.08	Corrugated Metal Pipe	24 × 16	72	2006–2007
Post Cr #3	34.40	Corrugated Metal Pipe	24 × 13	64	2006–2007
Post Cr #4	34.50	Corrugated Metal Pipe	6 ×4	130	2006–2007
Post Cr #5	34.75	Corrugated Metal Pipe	8 × 8	104	2006–2007
Post Cr #6	36.40	Corrugated Metal Pipe	6 × 4	96	2006–2007
Post Cr #7	36.73	Corrugated Metal Pipe	6 × 4	104	2006–2007
Ronal Canal #1	48.75	Concrete Span Arch	28 × 10	146	2007–2009
Ronan Stockpass	49.17	Concrete Culvert	14 × 14	155	2007–2009
Ronal Canal #2	49.30	Concrete Span Arch	28 × 10	170	2007–2009
Mud Creek	50.95	Concrete Span Arch	42 × 14	65	2007–2009
Mud Creek (Old Hwy 93)	50.92	Concrete Span Arch	42 × 14	39	2006–2007
Polson Hill	57.75	SSPP Concrete	12 × 22	104	

L. Appendix B

Analyses of Vehicle-caused Grizzly Bear Mortalities in the US Highway 93 Corridor

May 2020

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Introduction

On behalf of the NCDE Trend Monitoring Team, we were asked by Mike McGrath, USFWS Montana Ecological Services Office, to provide information to inform the biological opinion for the US 93 Evaro to Polson highway project. Mr. McGrath asked that we try to evaluate the impact of anticipated incidental take of a six-year annual average of 4 grizzly bears mortalities on demographic objectives in the Grizzly Bear Recovery Plan (1993) and/or the NCDE Conservation Strategy (2018). The observed mortality in the project area has been slightly skewed toward males, therefore he asked that we evaluate the take under two assumptions: (1) that anticipated take is skewed toward males with an average of 1.7 females and 2.3 males, and (2) that anticipated take is equal between sexes with an average of 2 females and 2 males.

This report includes 3 sections. In the first section, we summarized the vehicle-caused mortalities within the NCDE with special emphasis on the mortalities within the project area. In the second section, we evaluated the effects of the anticipated incidental take on the NCDE population, on meeting demographic objectives, and on the local population of females within Mission Range and Valley. In the third section, we compared the locations of vehicle-caused mortalities and estimated locations of bear crossing events documented from GPS-collared bears to determine if specific sites could be identified for highway mitigation.

1. Analyses of vehicle-caused mortalities

As described in the NCDE Conservation Strategy, partner agencies document known and probable grizzly bear mortalities within the Demographic Monitoring Area (Fig. 1). Since 1990, vehicle-caused mortalities of grizzly bears within this area have increased in number and increased as a proportion of documented mortalities (Fig. 2). This is not unexpected, due to the increase in bear population numbers, as well as the expansion of grizzly bear distribution into more human-populated areas over time.

Most vehicle-caused mortalities have occurred on highways, but some have occurred on secondary roads and gravel roads. Among highway mortalities, those that have occurred on US Highway 93 within the project area (Fig. 1; within rectangle) are uniquely clustered compared to others. The mortalities that have occurred on US 2, Montana 200, and most of Montana 83 are dispersed across a sizable length of the highway. Measuring from the lowest to highest mile marker encompassing the mortalities on each highway, the number of mortalities or incidents that occurred per mile of road was approximately 10 times higher within the project area compared to other highways (Table 1). Even compared to a relatively dense cluster of vehicle mortalities on Montana 83 near Condon (Fig. 1; within circle), mortalities and incidents per mile were more than double for the project area on Highway 93.

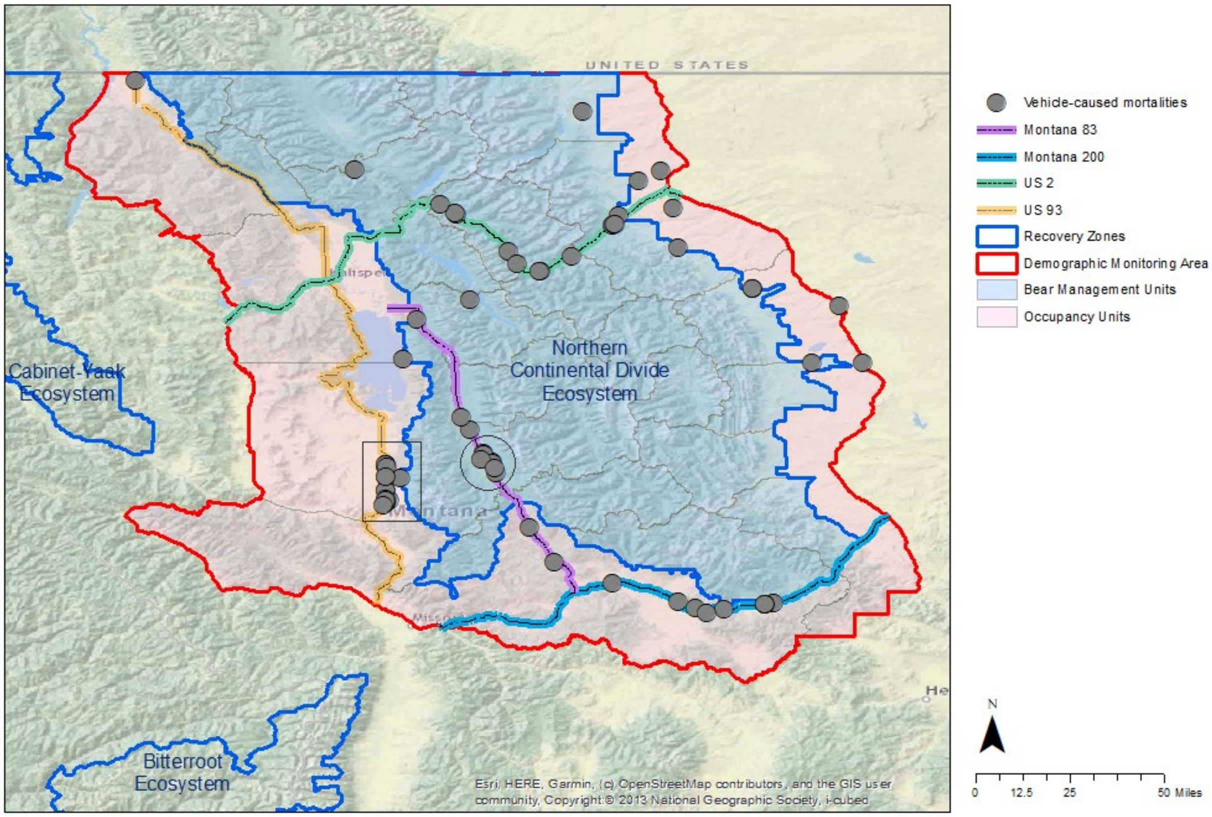

Fig. 1. Locations of vehicle-caused grizzly bear mortalities documented within the Demographic Monitoring Area (DMA) of the Northern Continental Divide Ecosystem, 1990–2019.

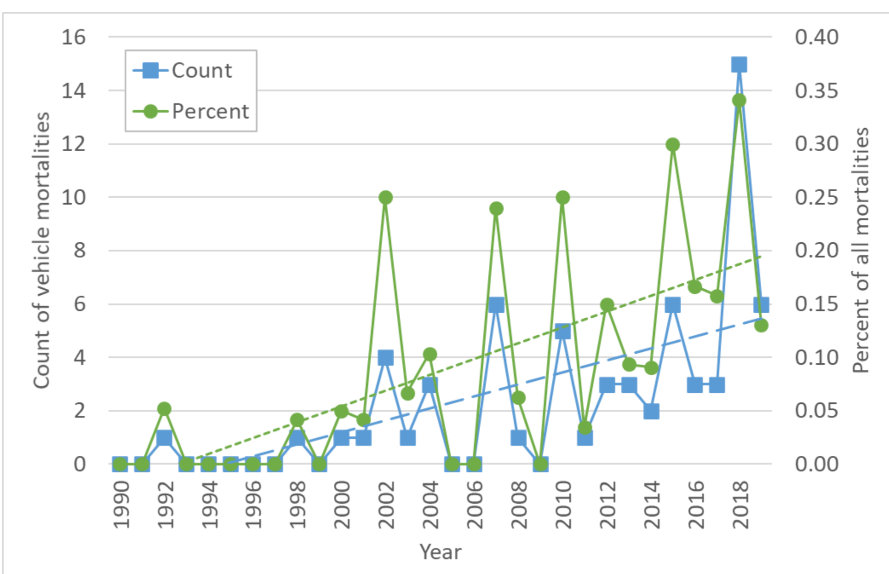

Fig. 2. Count of vehicle-caused mortalities of grizzly bears, and their proportion of documented mortalities in the Demographic Monitoring Area of the Northern Continental Divide Ecosystem, 1990-2019.

Table 1. Comparison of vehicle-caused mortalities of grizzly bears in the Highway 93 project area to other highways within the Demographic Monitoring Area of the Northern Continental Divide Ecosystem, 1990–2000.

Highway	Number of mortalities	Number of incidents	Mileage	Mortalities per mile	Incidents per mile
US 93 (project area)	19	15	9	2.11	1.67
Montana 83 (cluster)	6	6	7	0.85	0.85
US 2	11	11	50	0.22	0.22
Montana 200	10	7	37	0.27	0.19
Montana 83 (length)	12	12	75	0.16	0.16

This cluster of highway mortalities also represents a significant fraction of the total highway mortalities within the DMA. The length of highway between St. Ignatius and Ronan (where all of the mortalities have occurred) constitutes only about 2% of the ~700 miles of highway in the DMA, however the vehicle-caused mortalities in this section represent 27% of the vehicle-caused mortalities documented since 1990 and more than one third since 2010 (Fig. 3).

Vehicle-caused mortalities have accounted for an increasing percentage of documented mortalities within the DMA since 1990, but this percentage is higher for the region surrounding the Highway 93 Project Area. For 10-year periods beginning in 1990, vehicle-caused mortalities accounted 1%, 9%, and 17% of all documented mortalities within the DMA (Fig. 4). By comparison, vehicle caused mortalities in the project area accounted for 25%, 32%, and 35% of mortalities within the Flathead Indian Reservation (FIR).

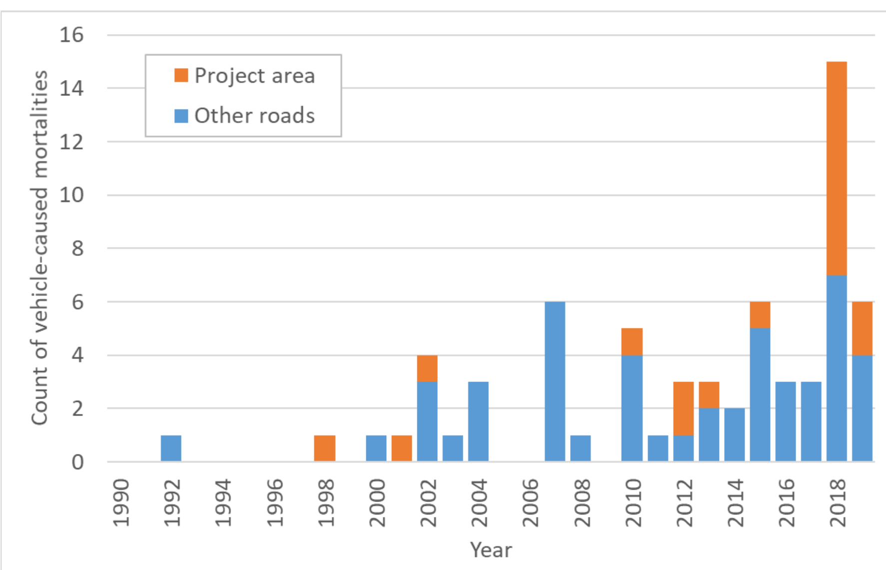

Fig. 3. Count of vehicle-caused mortalities of grizzly bears that occurred within the Highway 93 project area versus all other roads within the Demographic Monitoring Area of the Northern Continental Divide Ecosystem, 1990-2019.

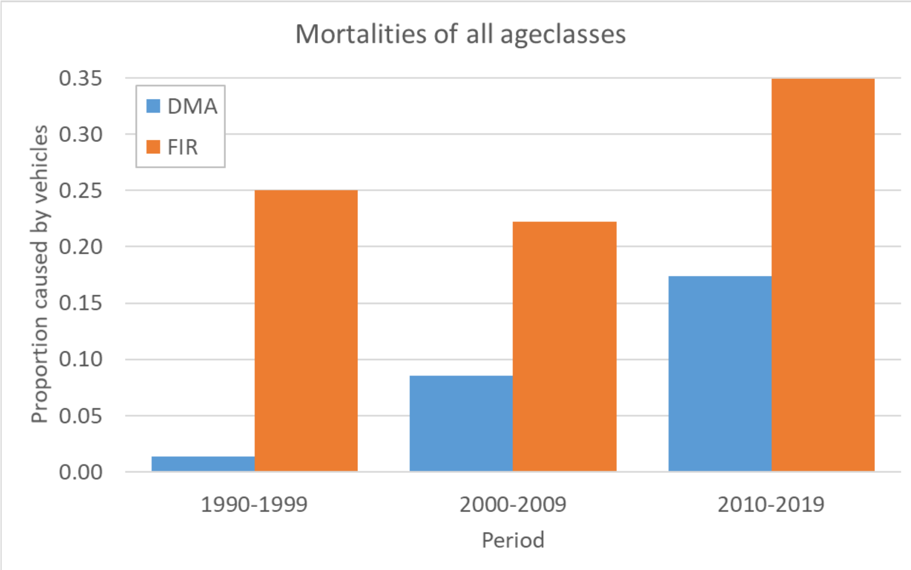

Fig. 4. Vehicle-caused mortalities as a percentage of all documented mortalities within the Demographic Monitoring Area of the Northern Continental Divide Ecosystem and within the Flathead Indian Reservation, 1990–2019.

2. Evaluation of anticipated incidental take

It is difficult to predict the numbers of mortalities in coming years as grizzly bear population densities increase within the human-populated areas of Zone 1. Therefore, to evaluate the potential impact of an anticipated incidental take of a six-year average of 4 grizzly bears on the NCDE population, we used observed mortality data and retrospectively simulated the impact of additional mortalities on our ability to meet the mortality thresholds outlined in the Recovery Plan and the Conservation Strategy .

The Recovery Plan identifies a limit on the number of human-caused mortalities based on the estimated population size. This limit is applied to bears of all age classes and pertains to mortalities that occur within the Recovery Zone plus a 10-mile buffer. The Recovery Plan stipulates that human-caused mortalities not exceed 4% of the population estimate and that no more than 30% of this limit be females. The limits are calculated based on a 6-year average and cannot be exceeded in 2 consecutive years. We calculated the mortality limits and compared them to observed data for 6-year periods starting with 2009–2014 and ending with 2014–2019 (Table 2; Appendices A–D). During 2009–2019, 16 vehicle-caused mortalities (7 females, 9 males) were observed in the project area. We simulated additional mortalities to bring the average annual number of vehicle-caused mortalities in the project area to the anticipated take of 4 grizzly bears. We first assumed a sex ratio of 1.7 females to 2.3 males, which added 12 female and 17 male simulated mortalities between 2009 and 2019. We then assumed an equal sex ratio of 2 females and 2 males, which added 17 female and 14 male simulated mortalities between 2009 and 2019. When accounting for these additional simulated mortalities, neither the overall nor the female mortality limit was exceeded, although the female limit was met in one year (Table 2).

Table 2. Annual mortality limits and observed counts of total and female grizzly bear mortalities within the Recovery Zone plus a 10-mile buffer of the Northern Continental Divide Ecosystem based on 6-year averages for periods 2009–2014 to 2014–2019. Additional mortalities were simulated to achieve an average of 4 vehicle-caused mortalities within the Highway 93 project area. Simulations were run assuming a sex-ratio skewed toward males (1.67 females and 2.33 males) and assuming an equal sex-ratio (2 females and 2 males) for mortalities within the Highway 93 Project Area.

		Year					
Sex	Criteria/observed/simulated	2014	2015	2016	2017	2018	2019
Total	**Maximum limit**	**39**	**39**	**40**	**41**	**42**	**43**
	Observed	21	21	21	20	23	25
	Assuming 1.7 females and 2.3 males	24	24	25	23	26	27
	Assuming 2 female and 2 males	24	24	25	23	26	27
Female	**Maximum threshold**	**12**	**12**	**12**	**12**	**13**	**13**
	Observed	9	9	10	8	9	10
	Assuming 1.7 females and 2.3 males	10	10	12	10	10	11
	Assuming 2 female and 2 males	10	11	12	10	10	11

The Conservation Strategy describes thresholds for the numbers of total reported and unreported mortalities of independent-aged bears (≥2 years old) based on the estimated population size and a requirement to maintain a projected 90% probability that the population size will remain above 800 bears. The mortality thresholds apply within the DMA, are calculated on a 6-year average, and include estimates of unreported mortalities. We compared the mortality thresholds to observed data for 6-year periods starting with 2009–2014 and ending with 2014–2019 (Table 3; Appendices A–B & E–F). As described above, during 2009–2019, 16 vehicle-caused mortalities (7 females, 9 males) were observed in the project area. This included 3 independent females and 3 independent males. As above, we simulated additional mortalities to bring the average annual numbers of vehicle-caused mortalities in the project area to the anticipated take of 4 grizzly bears; adding 12 female and 17 male simulated mortalities when assuming a sex ratio of 1.7 females to 2.3 males, and adding 17 female and 14 male simulated mortalities when assuming an equal sex ratio. Age class is not considered in assessment of incidental take, therefore we assumed all simulated mortalities involved independent bears. Thus, independent bears accounted for 35 of 45 observed and simulated mortalities (78%) under the assumption of a skewed sex ratio and 37 of 47 female mortalities (79%) under the equal sex ratio assumption. Since 1990, independent bears have accounted for 47% of vehicle-caused mortalities in the project area and 46% of vehicle-caused mortalities ecosystem-wide, therefore these simulated numbers may represent a higher proportion of independent bears than might be expected. When accounting for these simulated vehicle-caused mortalities, mortality thresholds for the NCDE population were not exceeded (Table 3).

Together, these analyses suggest that the anticipated level of incidental take would not adversely impact the ecosystem-wide population. However, this retrospective analysis has limitations in that we cannot fully predict the potential increase in mortalities that might occur as more grizzly bears inhabit the human-populated areas of Zone 1.

Table 3. Annual mortality thresholds and observed estimates of total reported and unreported mortalities of independent female and male grizzly bears in the Demographic Monitoring Area of the Northern Continental Divide Ecosystem based on 6-year averages for periods 2009–2014 to 2014–2019. Additional mortalities were simulated to achieve an average of 4 vehicle-caused mortalities within the Highway 93 project area. Simulations were run assuming a sex-ratio skewed toward males (1.67 females and 2.33 males) and assuming an equal sex-ratio (2 females and 2 males) for mortalities within the Highway 93 Project Area.

		Year					
Sex	Criteria/observed/simulated	2014	2015	2016	2017	2018	2019
Female	**Maximum threshold**	**22**	**22**	**22**	**22**	**22**	**23**
	Observed	14	14	16	14	15	16
	Assuming 1.7 females and 2.3 males	16	16	18	16	16	16
	Assuming 2 females and 2 males	16	16	18	16	17	17
Male	**Maximum threshold**	**28**	**28**	**28**	**28**	**28**	**29**
	Observed	16	16	15	19	21	21
	Assuming 1.7 females and 2.3 males	17	17	17	21	23	23
	Assuming 2 females and 2 males	17	17	17	20	22	22

As described above, sustainability of mortality numbers is estimated on a population-wide basis, based on the estimated population size. Because we do not calculate regional population estimates, it is difficult to evaluate the sustainability of the anticipated incidental take on the local population segment in the vicinity of the Flathead Reservation. We evaluated the anticipated incidental take in relation local occupancy of females with offspring. The Mission Range is mapped as one of the 23 Bear Management Units (BMUs) used for documenting occupancy of females with offspring in the Recovery Plan and Conservation Strategy (Figs. 1 and 5). Both documents stipulate occupancy of at least 21 of 23 BMUs on a running 6-year basis. The Recovery Plan also stipulates that the Mission Range BMU, specifically, must be continually occupied on a 6-year basis. The Conservation Strategy also identifies an objective of maintaining occupancy of females with offspring within 6 of 7 Occupancy Units (OUs) within Zone 1 on a running 6-year basis (Fig. 1 and 5). Two OUs are in the vicinity of the Highway 93 Project Area Parts (Flathead Reservation and Ninemile Connectivity Area; Fig. 5) and occupancy of the Ninemile OU is recognized as important for facilitating potential movements of dispersing bears to other Recovery Zones, including the Cabinet-Yaak and Bitterroot Ecosystems. Presence of reproductive females is documented through visual observations of radio-marked females; locations of radio-marked females known to have offspring; verified remote camera photos; other verified visual observations; and from known or probable mortalities of family units (death of the mother, dependent young, or both). Opportunities for aerial observations are limited in the NCDE, therefore information obtained from radio-marked bears is heavily relied upon for documenting occupancy.

We compared observed and simulated mortalities to the number of females contributing to documented occupancy of the Mission Mountain BMU during 6-year periods between 2009–2014 and 2016–2019. The Trend Monitoring Team documented presence of 23 individual radio-marked female bears in the Mission Range BMU during 2010–2019. Within each 6-year period, the number of individual grizzly bears that contributed to the occupancy tally ranged from 9 to 14, with an average of 10.6 (Table 4). Importantly, the numbers of females with home ranges primarily on the west or both slopes of the Mission Mountains ranged from 6 to 10, with an average of 7.1. Within the 6-year periods, 4–8 independent female mortalities were observed, including bears hit by vehicles in Highway 93 and other causes (Table 4; Appendices G–H). As above, we simulated additional mortalities to bring the average annual numbers of vehicle-caused mortalities in the project area to the anticipated take of 4 grizzly bears; adding 12 simulated female mortalities when assuming a sex ratio of 1.7 females to 2.3 males, and adding 17 simulated female mortalities when assuming an equal sex ratio. Again, we assumed all simulated mortalities involved independent bears. Thus, independent bears accounted for 15 of 19 vehicle-caused mortalities (79%) under the assumption of a skewed sex ratio and 20 of 24 vehicle-caused mortalities (83%) under the equal sex ratio assumption. Since 1990, independent bears have accounted for 47% of vehicle-caused mortalities in the project area and 46% of vehicle-caused mortalities ecosystem-wide, therefore these simulated numbers may represent a higher proportion of independent bears than might be expected among vehicle-caused mortalities.

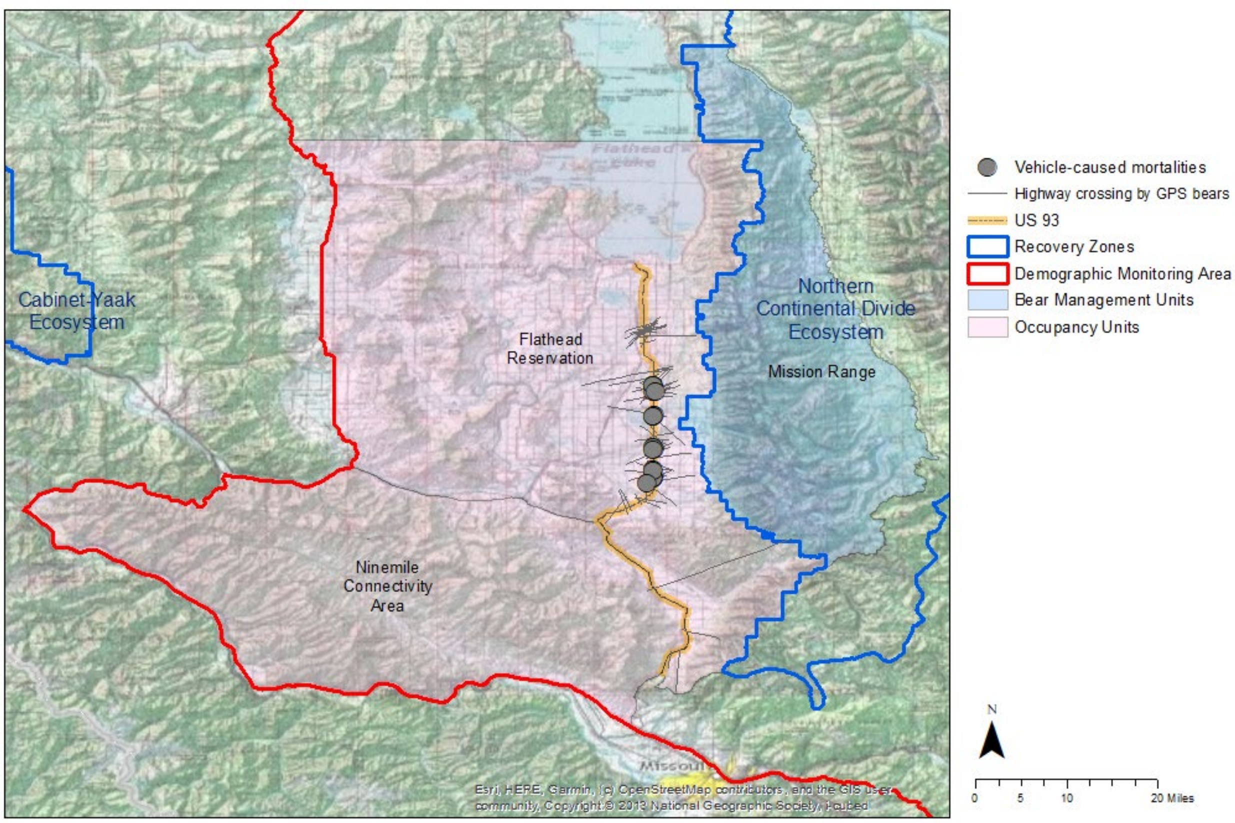

Fig. 5. The Highway 93 Project Area and documented vehicle-caused mortalities of grizzly bears (1990–2019), documented highway crossing by GPS-collared female grizzly bears (2001-2019), and units identified for documenting occupancy of grizzly bear females with offspring within the Recovery Zone and Zone 1 of the Northern Continental Divide Ecosystem.

Table 4. Counts of GPS-collared female grizzly bears that contributed to occupancy of the Mission Range BMU (classified according to the location of their home range) and observed and simulated mortalities of independent females within the Flathead Indian Reservation during 6-year periods from 2009–2014 to 2014–2019. Additional mortalities were simulated to achieve an average of 4 vehicle-caused mortalities within the Highway 93 project area. Simulations were run assuming a sex-ratio skewed toward males (1.67 females and 2.33 males) and an equal sex-ratio (2 females and 2 males) for mortalities within the Highway 93 Project Area.

Count	Area of home range	2014	2015	2016	2017	2018	2019
Females	West slope Mission Range	4	4	5	3	7	6
	Both slopes Missions Range	2	2	3	3	3	1
	East slope Mission Range	3	3	3	3	4	5
	Total	9	9	11	9	14	12
Mortalities	Observed	4	6	6	5	8	7
	Assuming 1.7 females and 2.3 males	13	14	14	13	13	11
	Assuming 2 females and 2 males	15	16	16	15	14	13

Simulations of additional mortalities assuming incidental take of 1.7 females and 2.3 males resulted in 11–13 female mortalities during each 6-year period, which represents 126% (range 92–144%) of all documented females and 188% (130–217%) of the documented females with home ranges on the west or both slopes. Simulations of additional mortalities assuming an incidental take of 2 females and 2 males resulted in 13–15 female mortalities during each 6-year period, which represents 144% (range 100–178%) of all documented females and 215% (range 140–250%) of the documented females with home ranges on the west of both slopes. Granted, the documented females with offspring represent only a sample of the reproductive females present in the landscape, therefore this cannot be interpreted as a comparison with the total number of resident reproductive females. Nonetheless, these numbers suggest that the anticipated incidental take of 4 bears annually may adversely impact the local population. Consequently, our ability to maintain occupancy of reproductive females in the Mission Range BMU may rely heavily on the presence of females with home ranges on the east slope.

Documented occupancy of the Ninemile Connectivity Area during 2010-2019 has involved only two reproductive females, including one radio-marked bear captured in 2013 and one unmarked bear observed in 2018. Occupancy of this OU likely necessitates the crossing of Highway 93 within the Project Area. Besides the 11 independent female mortalities observed in or near the Mission range BMU, we observed 2 mortalities in the Flathead Reservation or Ninemile OUs, suggesting that additional vehicle-caused mortalities may adversely impact our ability to maintain occupancy and consequently provide for connectivity to other Ecosystems.

We also examined highway crossings among our GPS-collard bears to understand the risk of vehicular death in this area. We identified 37 female bears that occupied home ranges that included the Mission Range BMU during 2001-2019: 14 occupied ranges primarily on the west slope, 8 occupied ranges on both the west and east slopes, and 15 occupied ranges primarily on the east slope. Of the 22 bears with home ranges on the west or both slopes of the Mission Range, 11 (50%) were documented west of Highway 93 and were known to have crossed Highway 93 between Evaro and Polson (Table 5).

Table 5. Documented highway crossings by GPS-collared female grizzly bears with home ranges overlapping the Mission Range Bear Management Unit within the Northern Continental Divide Ecosystem, 2001–2019.

Area of home range	Bears that crossed: number (percent)	Total crossings	Crossings per bear: mean (range)
West slope Mission Range (n = 14)	7 (50%)	106	15.1 (2–39)
Both slopes Missions Range (n = 8)	4 (50%)	33	8.3 (2–27)
East slope Mission Range (n = 15)	0	0	0

Numbers of documented crossings/individual in the project area ranged from 2 to 39 with an average of 13. Among this sample, bears spent as much as 64% of their time on the west side of Highway 93. These data indicate that a significant proportion of Mission Mountain bears also occupy the Mission Valley, regularly cross Highway 93, and are potentially vulnerable to highway mortality.

3. Locations of vehicle-caused mortalities and estimated bear crossings

We mapped highway crossings as straight lines connecting the two sequential locations on either side of Highway 93, therefore exact location of the crossing was only approximated. Of the 138 mapped crossing, 134 occurred within the corridor between Pablo and Ravalli. We classified the general location of theses crossings according to landscape features. Spatially, locations of vehicle-caused mortalities were closely correlated with most of the estimated locations of bear crossing events documented from GPS-collared bears (Table 6; Fig. 6). Crossing locations varied by individual, largely due to differences in the location of their home range, therefore sampling variance likely affected these data. However, both mortalities and crossing events were highly associated with creek bottoms, presumably because they provide some vegetative cover near the highway. Depending on logistics, mitigation efforts to provide safer crossing opportunities could be focused on these localities.

Table 6. Locations of documented vehicle-caused mortalities of grizzly bears (1990–2019) and estimated locations of crossing events by GPS-collared grizzly bears (2001–2019) in the Highway 93 Project Area.

Location	Mortalities	Mortality events	Bears that crossed	Crossing events
Mud Creek	0	0	1 (9%)	27 (20%)
Crow Creek	6 (32%)	3 (21%)	1 (9%)	30 (22%)
Ninepipes Wetland	3 (16%)	2 (14%)	3 (27%)	7 (5%)
Post Creek	3 (16%)	3 (21%)	7 (73%)	20 (14%)
Ashley/Matt Creek	7 (37%)	6 (43%)	4 (36%)	42 (30%)
Mission/Sabine Creeks	0	0	2 (18%)	5 (4%)
Pistol Creek	0	0	2 (18%)	3 (2%)

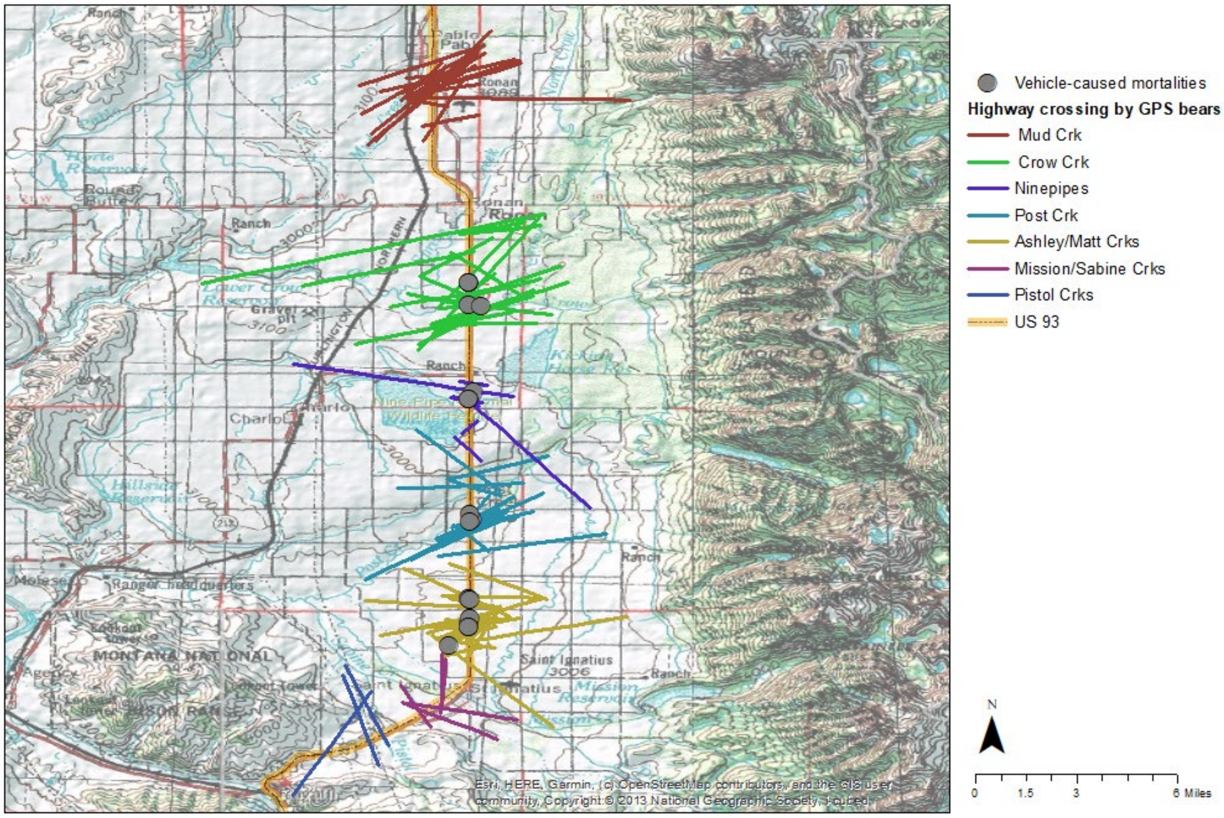

Fig. 6. Locations of documented vehicle-caused mortalities of grizzly bears (1990–2019) and estimated locations of crossing events by GPS-collared grizzly bears (2001–2019) in the Highway 93 Project Area.

Appendix A. Observed counts of dependent (DEP; <2 years old) and independent (IND; ≥2 years old) mortalities of female and male grizzly bears killed by vehicles in the Highway 93 project area during 2009–2109 and additional mortalities simulated to achieve an average of 4 vehicle-caused mortalities within the project area with a sex ratio skewed toward males (1.7 females and 2.3 males).

Sex	Year	Observed DEP (A)	Observed IND (B)	Simulated IND (C)	Total DEP & IND (A+B+C)	Total DEP & IND 6-yr average	Total IND (B+C)	Total IND 6-yr sum
Female	2009	0	0	2	2		2	
	2010	0	0	1	1		1	
	2011	0	0	1	1		1	
	2012	0	0	3	3		3	
	2013	0	1	1	2		2	
	2014	0	0	1	1	1.7	1	10
	2015	1	0	1	2	1.7	1	9
	2016	0	0	1	1	1.7	1	9
	2017	0	0	1	1	1.7	1	9
	2018	3	1	0	4	1.8	1	7
	2019	0	1	0	1	1.7	1	6
	Total	4	3	12	19		15	
Male	2009	0	0	2	2		2	
	2010	0	1	1	2		2	
	2011	0	0	2	2		2	
	2012	1	1	2	4		3	
	2013	0	0	2	2		2	
	2014	0	0	2	2	2.3	2	13
	2015	0	0	2	2	2.3	2	13
	2016	0	0	2	2	2.3	2	13
	2017	0	0	2	2	2.3	2	13
	2018	3	1	0	4	2.3	1	11
	2019	2	0	0	2	2.3	0	9
	Total	6	3	17	26		20	

Appendix B. Observed counts of dependent (DEP; <2 years old) and independent (IND; ≥2 years old) mortalities of female and male grizzly bears killed by vehicles in the Highway 93 project area during 2009–2019 and additional mortalities simulated to achieve an average of 4 vehicle-caused mortalities within the project area with an equal sex ratio (2.0 females and 2.0 males).

Sex	Year	Observed DEP (A)	Observed IND (B)	Simulated IND (C)	Total DEP & IND (A+B+C)	Total DEP & IND 6-yr average	Total IND (B+C)	Total IND 6-yr sum
Female	2009	0	0	2	2		2	
	2010	0	0	2	2		2	
	2011	0	0	2	2		2	
	2012	0	0	4	4		4	
	2013	0	1	1	2		2	
	2014	0	0	0	0	2.0	0	12
	2015	1	0	1	2	2.0	1	11
	2016	0	0	2	2	2.0	2	11
	2017	0	0	2	2	2.0	2	11
	2018	3	1	0	4	2.0	1	8
	2019	0	1	1	2	2.0	2	8
	Total	4	3	17	24		20	
Male	2009	0	0	1	1		1	
	2010	0	1	0	1		1	
	2011	0	0	1	1		1	
	2012	1	1	3	5		4	
	2013	0	0	3	3		3	
	2014	0	0	1	1	2.0	1	11
	2015	0	0	1	1	2.0	1	11
	2016	0	0	1	1	2.0	1	11
	2017	0	0	1	1	2.0	1	11
	2018	3	1	1	5	2.0	2	9
	2019	2	0	1	3	2.0	1	7
	Total	6	3	14	23		17	

Appendix C. Observed counts of total and female mortalities of grizzly bears in the Recovery Zone plus a 10-mile buffer of the Northern Continental Divide Ecosystem during 2009–2019 and additional mortalities simulated to achieve an average of 4 vehicle-caused mortalities in the Highway 93 project area with a sex ratio skewed toward males (1.7 females and 2.3 males).

	Total				Female			
Year	Observed	Simulated	Sum	6-yr average	Observed	Simulated	Sum	6-yr average
2009	17	4	21		6	2	8	
2010	16	2	18		4	1	5	
2011	27	3	30		13	1	14	
2012	18	5	23		4	3	7	
2013	28	3	31		13	1	14	
2014	18	3	21	24	11	1	12	10
2015	19	3	22	24	9	1	10	10
2016	17	3	20	25	11	1	12	12
2017	18	3	21	23	1	1	2	10
2018	39	0	39	26	11	0	11	10
2019	39	0	39	27	18	0	18	11

Appendix D. Observed counts of total and female mortalities of grizzly bears in the Recovery Zone plus a 10-mile buffer of the Northern Continental Divide Ecosystem during 2009–2019 and additional mortalities simulated to achieve an average of 4 vehicle-caused mortalities in the Highway 93 project area with an equal sex ratio (2.0 females and 2.0 males).

	Total				Female			
Year	Observed	Simulated	Sum	6-yr average	Observed	Simulated	Sum	6-yr average
2009	17	3	20		6	2	8	
2010	16	2	18		4	2	6	
2011	27	3	30		13	2	15	
2012	18	7	25		4	4	8	
2013	28	4	32		13	1	14	
2014	18	1	19	24	11	0	11	10
2015	19	2	21	24	9	1	10	11
2016	17	3	20	25	11	2	13	12
2017	18	3	21	23	1	2	3	10
2018	39	1	40	26	11	0	11	10
2019	39	2	41	27	18	1	19	11

Appendix E. Estimates of total reported and unreported (TRU) mortalities of independent female and male grizzly bears in the Demographic Monitoring Area of the Northern Continental Divide Ecosystem during 2009–2019 and additional mortalities (D) simulated to achieve an average of 4 vehicle-caused mortalities in the Highway 93 project area with a sex ratio skewed toward males (1.7 females and 2.3 males).

Sex	Year	Agency Removal[a] (A)	Telemetry[b] (B)	Observed reported[c] (C)	Simulated reported (D)	Sum reported (C+D)	Estimated reported & unreported[d] (F)	TRU (A+B+F)	TRU 6-year average
Female	2009	1	4	1	2	3	4	9	
	2010	2	3	0	1	1	2	7	
	2011	3	0	7	1	8	12	15	
	2012	0	1	3	3	6	15	16	
	2013	3	2	5	1	6	10	15	
	2014	3	1	9	1	10	28	32	16
	2015	2	1	2	1	3	6	9	16
	2016	3	3	3	1	4	12	18	18
	2017	0	0	2	1	3	4	4	16
	2018	1	6	4	0	4	12	19	16
	2019	5	1	6	0	6	10	16	16
Male	2009	1	1	6	2	8	17	19	
	2010	4	0	2	1	3	6	10	
	2011	7	0	4	2	6	10	17	
	2012	5	1	7	2	9	13	19	
	2013	5	2	3	2	5	18	25	
	2014	1	0	2	2	4	12	13	17
	2015	4	0	5	2	7	16	20	17
	2016	2	0	2	2	4	6	8	17
	2017	6	3	8	2	10	29	38	21
	2018	7	1	9	0	9	23	31	23
	2019	11	1	5	0	5	14	26	23

[a] Count of agency-sanctioned removals, including those involving radio-marked bears

[b] Count of deaths for bears wearing functional radio-transmitters, except for agency removals

[c] Count of non-radioed bear deaths reported by the public or discovered by agency personnel (including observed vehicle-caused mortalities in Highway 93 project area)

[d] Bayesian estimate of the total number of reported and unreported deaths of non-radioed bears, predicted from the number of reported deaths of non-radioed bears (including simulated vehicle-caused mortalities).

Appendix E. Estimates of total reported and unreported (TRU) mortalities of independent female and male grizzly bears in the Demographic Monitoring Area of the Northern Continental Divide Ecosystem during 2009–2019 and additional mortalities (D) simulated to achieve an average of 4 vehicle-caused mortalities in the Highway 93 project area with an equal sex ratio (2.0 females and 2.0 males).

Sex	Year	Agency Removal[a] (A)	Telemetry[b] (B)	Observed reported[c] (C)	Simulated reported (D)	Sum reported (C+D)	Estimated reported & unreported[d] (F)	TRU (A+B+F)	TRU 6-year average
Female	2009	1	4	1	2	3	4	9	
	2010	2	3	0	1	1	3	8	
	2011	3	0	7	1	8	13	16	
	2012	0	1	3	3	6	16	17	
	2013	3	2	5	1	6	10	15	
	2014	3	1	9	1	10	27	31	16
	2015	2	1	2	1	3	6	9	16
	2016	3	3	3	1	4	13	19	18
	2017	0	0	2	1	3	6	6	16
	2018	1	6	4	0	4	12	19	17
	2019	5	1	6	0	6	11	17	17
Male	2009	1	1	6	2	8	16	18	
	2010	4	0	2	1	3	5	9	
	2011	7	0	4	2	6	9	16	
	2012	5	1	7	2	9	15	21	
	2013	5	2	3	2	5	19	26	
	2014	1	0	2	2	4	11	12	17
	2015	4	0	5	2	7	15	19	17
	2016	2	0	2	2	4	4	6	17
	2017	6	3	8	2	10	28	37	20
	2018	7	1	9	0	9	24	32	22
	2019	11	1	5	0	5	15	27	22

[a] Count of agency-sanctioned removals, including those involving radio-marked bears

[b] Count of deaths for bears wearing functional radio-transmitters, except for agency removals

[c] Count of non-radioed bear deaths reported by the public or discovered by agency personnel (including observed vehicle-caused mortalities in Highway 93 project area)

[d] Bayesian estimate of the total number of reported and unreported deaths of non-radioed bears, predicted from the number of reported deaths of non-radioed bears (including simulated vehicle-caused mortalities).

Appendix G. Observed counts of mortalities of independent female grizzly bears in or near the Mission Range Bear Management Unit, Northern Continental Divide Ecosystem, 2009–2019 and additional mortalities (D) simulated to achieve an average of 4 vehicle-caused mortalities in the Highway 93 project area with a sex ratio skewed toward males (1.7 females and 2.3 males).

Year	Observed Highway 93	Observed other causes	Simulated	Total	Total 6-yr sum
2009	0	0	2	2	
2010	0	1	1	2	
2011	0	1	1	2	
2012	0	0	3	3	
2013	1	1	1	3	
2014	0	1	1	2	14
2015	0	2	1	3	15
2016	0	1	1	2	15
2017	0	0	1	1	14
2018	1	2	0	3	14
2019	1	0	0	1	12

Appendix G. Observed counts of mortalities of independent female grizzly bears in or near the Mission Range Bear Management Unit, Northern Continental Divide Ecosystem, 2009–2019 and additional mortalities (D) simulated to achieve an average of 4 vehicle-caused mortalities in the Highway 93 project area with an equal sex ratio (2.0 females and 2.0 males).

Year	Observed Highway 93	Observed other causes	Simulated	Total	Total 6-yr sum
2009	0	0	2	2	
2010	0	1	2	3	
2011	0	1	2	3	
2012	0	0	4	4	
2013	1	1	1	3	
2014	0	1	0	0	15
2015	0	2	1	3	16
2016	0	1	2	3	16
2017	0	0	2	2	15
2018	1	2	0	3	14
2019	1	0	1	2	13