UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1201 NE Lloyd Blvd., Suite 1100
PORTLAND, OREGON 97232-1274

Refer to NMFS No.: WCRO-2019-03979

January 31, 2020

Lt. Col. Christian N. Dietz
U.S. Army Corps of Engineers
Walla Walla District
201 North Third Avenue.
Walla Walla, Washington 99362

Re: Endangered Species Act Section 7 Formal Consultation for the Clear Creek Bank Stabilization Project; HUC 17060304

Dear Lt. Col. Dietz:

Thank you for the letter dated January 16, 2020, requesting initiation of consultation on the subject action with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7(a)(2) of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.). The enclosed document contains a biological opinion (Opinion) prepared by NMFS on the effects of the U. S. Army Corps of Engineers' (COE) proposed project. In this Opinion, NMFS concludes that the action, as proposed, is not likely to jeopardize the continued existence of Snake River Basin steelhead or result in the destruction or adverse modification of designated critical habitat for this species.

As required by section 7 of the ESA, NMFS provides an incidental take statement (ITS) with the Opinion. The ITS describes reasonable and prudent measures (RPMs) NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements, that the COE and/or any person who performs the action must comply with to carry out the RPMs. Incidental take from actions that meet these terms and conditions will be exempt from the ESA take prohibition.

NMFS also reviewed the likely effects of the proposed action on essential fish habitat (EFH), pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1855(b)), and concluded that the action would adversely affect the EFH of Chinook and coho salmon. Therefore, we have included the results of that review in Section 3 of this document.

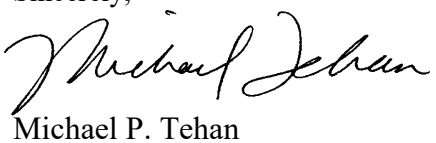
This document also includes five Conservation Recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH. These Conservation Recommendations are a subset of the ESA terms and conditions, and involve reducing effects of the action on EFH components such as stream substrate condition for spawning and rearing Chinook and coho

salmon. Section 305(b)(4)(B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving these recommendations.

If the response is inconsistent with the EFH Conservation Recommendations, the COE must explain why the recommendations will not be followed, including the justification for any disagreements over the effects of the action and the recommendations. In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many Conservation Recommendations are provided as part of each EFH consultation, and how many are adopted by the action agency. Therefore, in your statutory reply to the EFH portion of this consultation, we ask that you clearly identify the number of Conservation Recommendations accepted.

Please contact Mr. Dennis Daw, Snake River Branch, 208-378-5698, or dennis.daw@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,



Michael P. Tehan
Assistant Regional Administrator
Interior Columbia Basin Office
NOAA Fisheries, West Coast Region

Enclosure

cc:

K. Sarensen – USFWS
M. Lopez – NPT
W. Schrader – COE
D. Mitchell.--COE

Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation

NMFS Consultation Number: WCRO-2019-03979

Clear Creek Bank Stabilization

Action Agencies: U.S. Army Corps of Engineers

Affected Species and Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or Critical Habitat?	Is Action Likely to Jeopardize the Species?	Is Action Likely to Destroy or Adversely Modify Critical Habitat?
Snake River Basin steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	No

Fishery Management Plan That Identifies EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	Yes

Consultation Conducted by: National Marine Fisheries Service, West Coast Region

Issued By:

Michael P. Tehan
Assistant Regional Administrator

Date: January 31, 2020

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ACRONYMS

BA	Biological Assessment
BMP	Best Management Practices
COE	U.S. Army Corps of Engineers
CWA	Clean Water Act
DPS	Distinct Population Segment
DQA	Data Quality Act
EFH	Essential Fish Habitat
ESA	Endangered Species Act
IDFG	Idaho Department of Fish and Game
IDEQ	Idaho Department of Environmental Quality
MSA	Magnuson-Stevens Fishery Conservation and Management Act
ITS	Incidental Take Statement
MPG	Major Population Groups
NMFS	National Marine Fisheries Service
NTU	Nephelometric Turbidity Units
OHWM	Ordinary High Water Mark
Opinion	Biological Opinion
PBF	Physical and Biological Features
RPM	Reasonable and Prudent Measures
SWS	Stillwater Sciences
Tribe	Nez Perce Tribe

1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3 below.

1.1 Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (Opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq.), and implementing regulations at 50 CFR 402, as amended. We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available through NMFS' Public Consultation Tracking System. A complete record of this consultation is on file at the NMFS office in Boise, Idaho.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR 600.

1.2 Proposed Action

Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies (50 CFR 402.02). The U.S. Army Corps of Engineers (COE) has proposed to permit a bank stabilization project within the 50-year floodplain, adjacent to the property of Mr. Ted Sellitti, within the lower section of Clear Creek, a tributary to the Middle Fork Clearwater River (HUC 17060304) near Kooskia, Idaho. The COE proposes to issue a Clean Water Act (33 CFR 1344) Section 404 permit to reconstruct approximately 85 linear feet of bank in Clear Creek that was washed away during spring high flows.

The proposed action includes the excavation of approximately 70 cubic yards of rock and gravel from a point bar, immediately downstream of the site, which will be used to reconstruct the bank. Approximately 36 cubic yards of rock will be obtained from an offsite, upland source. The placement of larger rock along the reconstructed bank, the construction of two bank barbs, and the reconstruction of an existing rock barb will protect the bank from future erosion. The total length of the bank to be reconstructed is 85 linear feet with a total of 106 cubic yards of rock and gravel to be used during construction. Willow cuttings will be incorporated into the rock and gravel placed below the ordinary high water mark. The bank being reconstructed was washed out during spring 2019 floods and is adjacent to the Sellitti property. The bank has eroded to the point that the deck on the back of the Sellitti home is starting to fall into the stream (Figure 1).

Figure 1. Looking upstream at the location of proposed bank restoration. (Arrow indicates remnants of an existing rock barb)

The preferred work proposal is that all work be completed during low flow when most of the work can be accomplished in the dry. Under this scenario, the only portion of the work proposed that would be completed in the water would be the construction of the ends of the rock barbs closest to the center of the stream channel. It would be expected that the water would be less than a foot deep at the ends of the rock barbs when constructed.

However, due to unusually high levels of precipitation during the recent months, and forecasted for the immediate future, the stream levels are presently higher than normal and may be higher still when the work is completed. Also due to the possibility of spring runoff causing more bank erosion and loss of personal property, the current work cannot be delayed until lower base flows return in the coming summer. Therefore, work may need to proceed when a substantial portion of the work area is wetted. The action will be completed by February 29, 2020.

In order to complete an analysis that ensures that all potential effects on ESA-listed Snake River Basin steelhead are considered, NMFS will complete this Opinion assuming that all work will be completed when the work area is wetted.

1.3.2 Conservation Measures

The COE proposes the following Best Management Practices (BMP's) to minimize impact on listed fish and their habitat due to the bank stabilization project.

Table 1. Conservation measures.

Category	Specific Measures
In-stream work	• The landowner or contractor will isolate the stream channel within the work site location during construction. • All in stream work will be completed by February 29, 2020. • The isolation area will cover the entire wetted portion of the work area. • The in-stream work area will be isolated from the stream channel by silt fences or similar device. • Excavation of gravels from the adjacent point bar shall not leave pits or depressions. Any mounds, pits or depressions created by the excavation must be leveled when excavation is completed. • Excavated material must not be stockpiled below the ordinary high water mark. • Equipment must operate from the high bank and not below the ordinary high water mark.
Fish salvage	• Fish will be captured and removed from the isolated instream work areas prior to construction. • A qualified fish biologist will conduct or supervise the following steps: the silt fencing will be installed; fish will be captured through seining and relocated to the stream; if necessary, electrofishing will be conducted to capture and relocate fish not caught during seining. • Fish will be relocated to the channel of the stream outside the isolation area. • Any necessary electrofishing will follow NMFS guidelines (NMFS 2000).

1.3 Consultation History

Early coordination and pre-consultation with NMFS was conducted during a phone conversation on December 6, 2019, which included: Mr. Bob Ries (NMFS), Ms. Becky Johnson (Nez Perce Tribe, Director of Hatcheries), Mr. Bobby Hills (Nez Perce Tribe), Mr. Jerry Zumwalt (Idaho County Disaster Services), Duane Mitchell (COE), and Nick Gerhardt. Based on this discussion, COE sent a draft Biological Assessment to NMFS on January 8, 2020. Phone conversations and emails on January 8, 2020 answered all questions NMFS had for COE. However, due to concerns over unseasonal high precipitation and the possibility of high water, through subsequent emails and discussions with NFMS, COE on January 13, 2020 changed the proposed action to include BMPs for working in a wetted channel. At this point, NMFS reached finalization of the consultation package and considered January 13, 2020 to be the date of initiation of formal consultation.

Because this action has the potential to affect tribal trust resources, NMFS provided copies of the draft proposed action and terms and conditions for this Opinion to the Nez Perce Tribe (Tribe) on January 17, 2020. The Tribe responded on January 21, 2020 that all their concerns had been addressed and they had no further comments.

2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

2.1 Rangewide Status of the Species and Critical Habitat

This Opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The Opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the function of the essential physical and biological features (PBFs) that help to form that conservation value.

The Snake River Basin steelhead distinct population segment (DPS) is composed of 24 individual populations which spawn and rear in different watersheds across the Snake Basin. Having multiple viable populations makes a DPS less likely to become extinct from a single catastrophic event (ICBTRT 2007). NMFS expresses the status of a DPS in terms of the status and extinction risk of its individual populations, relying on McElhaney et al.'s (2000) description of a viable salmonid population. The four parameters of a viable salmonid population are abundance, productivity, spatial structure, and diversity. The recovery plan for Snake River spring/summer Chinook salmon and steelhead (NMFS 2017a) describes these four parameters in detail and the parameter values needed for persistence of individual populations and for recovery of the DPS.

Table 2 summarizes the status and available information on the Snake River Basin steelhead DPS, based on the detailed information on the status of individual populations, and the species as a whole provided by the *ESA Recovery Plan for Snake River Spring/Summer Chinook Salmon & Snake River Basin Steelhead* (NMFS 2017a) and *Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest* (NWFSC 2015). These two documents are incorporated by reference here.

Table 2. Listing classification and date, status summary (including recovery plan reference and most recent status review), and limiting factors for species considered in this Opinion.

Species	Listing Classification and Date	Status Summary	Limiting Factors
Snake River Basin steelhead	Threatened 1/5/06	This DPS comprises 24 populations organized into five MPGs. Currently, five populations are tentatively rated at high risk of extinction, 17 populations are rated at moderate risk of extinction, one population is viable, and one population is highly viable. Four out of the five MPGs are not meeting the population viability goals laid out in the recovery plan (NMFS 2017a). In order for the species to recover, more populations will need to reach viable status through increases in abundance and productivity. Additionally, the relative proportion of hatchery fish spawning in natural spawning areas near major hatchery release sites remains uncertain and may need to be reduced (NWFSC 2015, most recent species status review). Since 2015, abundance has declined steadily, with only 10,717 natural-origin adult returns counted in 2018 (ODFW & WDFW 2019).	Adverse effects related to the mainstem Columbia and Snake River hydropower system and modifications to the species' migration corridor. Genetic diversity effects from out-of-population hatchery releases. Potential effects from high proportion of hatchery fish on natural spawning grounds. Degraded fresh water habitat. Harvest-related effects, particularly on B-run steelhead. Predation in the migration corridor.

The proposed action will occur in the Clear Creek watershed, which is one of six major spawning areas for the Lower Clearwater Mainstem steelhead population. Recent abundance/productivity estimates for the Lower Clearwater Mainstem population exceed minimum thresholds for low risk status, but the population is assigned moderate risk for abundance/productivity due to the high uncertainty associated with the estimate (NWFSC 2015). Also, during 2017- 2019, abundance of this population is presumed to have declined substantially, as it has for the DPS as a whole.

Table 3 summarizes designated critical habitat for Snake River Basin steelhead based on the detailed information on the status of critical habitat throughout the designation area provided in the recovery plan for the species (NMFS 2017a), which is incorporated by reference here. NMFS describes critical habitat in terms of essential PBFs of that habitat to support one or more life stages (e.g., sites with conditions that support spawning, rearing, migration, and foraging). For Snake River Basin steelhead, PBFs include water quality, water quantity, spawning substrate, floodplain connectivity, forage, natural cover, and passage free of artificial obstructions. Across the designation, the current ability of PBFs to support the species varies from excellent in wilderness areas to poor in areas of intensive human land use.

Table 3. Critical habitat, designation date, Federal Register citation, and status summary for critical habitat considered in this Opinion.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Snake River Basin steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 25 subbasins in Oregon, Washington, and Idaho. Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (NMFS 2017). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migration corridor habitat quality has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.

2.1.1 Climate Change Implications for ESA-listed Species and their Critical Habitat

One factor affecting the status of the species and its critical habitat considered in this Opinion is climate change. Likely changes in temperature, precipitation, wind patterns, and sea-level height have implications for survival of Snake River Basin steelhead in both its freshwater and marine habitats. During the next century average temperatures in the Pacific Northwest are projected to increase 3 to 10°F, with the largest increases predicted to occur in the summer (Mote et al. 2014). Decreases in summer precipitation of as much as 30 percent by the end of the century are consistently predicted across climate models (Mote et al. 2014). Precipitation is more likely to occur during October through March, less during summer months, and more winter precipitation will be rain than snow (ISAB 2007; Mote et al. 2014). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007; Mote et al. 2014). Models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events) in the western United States (Dominguez et al. 2012). The largest increases in winter flood frequency and magnitude are predicted in mixed rain-snow watersheds (Mote et al. 2014). In general, these changes in air temperatures, river temperatures, and river flows are expected to cause changes in salmon and steelhead distribution, behavior, growth, and survival, although the magnitude of these changes remains unclear.

Climate change could affect the steelhead in the following ways (NMFS 2017a; NMFS 2017b):

- Warmer water temperatures during incubation may accelerate the rate of egg development and result in earlier fry emergence and dispersal, which could be either beneficial or detrimental, depending on location and prey availability.

- Reduced summer and fall flows may reduce the quality and quantity of juvenile rearing

habitat, strand fish, or make fish more susceptible to predation and disease.

- Reduced flows and higher temperatures in late summer and fall may decrease parr-to-smolt survival.

- Warmer temperatures will increase metabolism, which may increase or decrease juvenile growth rates and survival, depending on availability of food.

- Overwintering survival may be reduced if increased flooding reduces suitable habitat.

- Timing of smolt migration may be altered due to a modified timing of the spring freshet, and thus timing of smolts entering the ocean may shift to different, possibly detrimental conditions for the availability of forage and exposure to predators.

- Higher temperatures while adults are holding in tributaries and migrating to spawning grounds may lead to increased prespawning mortality or reduced spawning success as a result of delay or increased susceptibility to disease and pathogens.

- Increases in water temperatures in Snake and Columbia River reservoirs could increase consumption rates and growth rates of predators and, hence, predation-related mortality on juvenile steelhead.

- Lethal water temperatures (temperatures that kill fish) may occur in the mainstem migration corridor or in holding tributaries, resulting in higher mortality rates.

- If water temperatures in the lower Snake River (especially Lower Granite Dam and reservoir) warm during late summer and fall sufficiently that they cannot be maintained at a suitable level by cold-water releases from Dworshak Reservoir, then migrating adult Snake River steelhead could have higher rates of mortality and disease.

Both freshwater and marine productivity tend to be lower in warmer years for Snake River steelhead populations. Climate factors will likely make it more challenging to increase abundance and recover the species by reducing the suitable rearing areas and leading to a more limited run-timing under the warmer future conditions. This possibility reinforces the importance of achieving survival improvements throughout the species' entire life cycle, and across different populations since neighboring populations with different habitat may respond differently to climate change.

2.2 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area is located within the 50-year flood plain of Clear Creek. The project site is the eroded bank directly behind the Sellitti home. The action area consists of 85 linear feet of channel adjacent to the site, 50 feet upstream of the project site, and extending 600 feet downstream of the point bar to be excavated for the bank reconstruction. That distance below the work site is the likely extent of detectable

downstream sediment effects and includes the stream section where fish from fish salvage will be placed.

2.3 Environmental Baseline

The environmental baseline is defined at 50 CFR 402.02.

There has been extensive land disturbance in the action area associated with human uses such as logging, agriculture, grazing, and development. These activities, both within the action area and upstream from it, have caused the following impacts to stream habitat in the action area:

- High summer water temperatures occur annually in Clear Creek, primarily due to lack of riparian shade and extremely low summer base flow (SWS 2015; SWS 2016).

- The action area has very little mature riparian vegetation to provide shade or contribute wood to the stream. No significant large wood is present in the stream channel (SWS 2015; SWS 2016), and the banks are lined with riprap, especially within the lower developed areas of Clear Creek.

- Lower Clear Creek is generally impaired by erosion and sedimentation, most likely from runoff from logging and other land use practices and facilities (particularly roads) upstream from and within the action area. The action area portion of lower Clear Creek perennially experiences high energy stream flows (with stream energy increased by human-caused channel confinement); and percentages of surface fine sediment in the substrate are lower than in many other Idaho streams. The action area provides suitable, albeit presently simplified and low functioning, spawning and rearing habitat for steelhead (SWS 2015; SWS 2016; NMFS 2017a).

- The floodplain in the action area is constrained by roads and buildings and bank armoring.

These impacts to stream habitat in the action area contribute to habitat limiting factors for the Lower Clearwater Mainstem steelhead population, which include: high summer water temperatures, low summer flows, increased flood magnitude and frequency (i.e., increased "flashiness"), excess sediment accumulation in low-gradient stream reaches, reduced floodplain connectivity, degraded riparian conditions, reduced habitat complexity, and migration barriers (NMFS 2017a). Despite degraded habitat conditions, Stillwater Sciences (2015; 2016) has observed juvenile steelhead in the action area. Further, the Idaho Department of Environmental Quality Final 2016 §305(b) Integrated Report indicates that Clear Creek is fully supporting of applicable water quality standards.

2.4 Effects of the Action

"Effects of the action" is defined at 50 CFR 402.17(a) and (b).

2.4.1 Effects to Species

The in-water portion of the proposed action would take place in early February; adult steelhead are likely to be present early March through May. Some steelhead may be present in the latter part of February but they are more likely to be staging downstream in the Middle Fork Clearwater River. Therefore, if there are any in Clear Creek, their numbers are likely to be sparse. Juvenile steelhead are likely to be present throughout the entire year.

Steelhead in the action area could experience the following adverse effects from the proposed action:

- Fish salvage;
- exposure to short-term turbidity plumes downstream of the project site;
- exposure to construction noise;
- exposure to chemical contamination;
- exposure to increased sediment deposition;
- exposure to bank hardening; and
- altered stream flow pattern

The likelihood of exposure and the magnitude of response to these effects of the action are discussed below.

2.4.1.1 Fish Salvage

The work area will be isolated from the main stream channel with silt fencing or similar device. A seine net will then be pulled through the area to remove fish from the work area. The goal of the fish handling conservation measures is to capture fish using non-lethal methods, and then release or relocate them downstream with minimal handling. Following the conservation measures will minimize the risk of injury and mortality to listed fish to the extent possible. However, capturing and handling fish causes short-term stress for all individuals (Frisch and Anderson 2000; Hemre and Krogdahl 1996; Olla et al. 1995) and is likely to cause harm or death to some individuals, particularly those exposed to electrofishing (McMichael et al. 1998; Nielson 1998). Additionally, a small number of fish may not be found by the fish capture crew and could end up confined within the isolation area. Fish confined within the isolated area would be exposed to turbidity, noise, and possible impingement

Electrofishing can cause spinal injury to individual fish, which can lead to slower growth rates (Dalbey et al. 1996). Following the NMFS (2000) electrofishing guidelines will minimize the levels of stress and mortality related to electrofishing. McMichael et al. (1998) found a 5.1 percent injury rate for juvenile middle Columbia River steelhead captured by electrofishing in the Yakima River subbasin. A literature review by Nielson (1998), on the other hand, suggests that 25 percent of the total number of fish electrofished could be injured.

For this project, we make the following assumptions about injury and death rates during fish salvage activities.

- An area of up to 2,500 square feet of the channel of Clear Creek will be isolated from the rest of the stream for construction.

- Based on Stillwater Sciences (2015; 2016) fish surveys, in which the researchers found an average of 0.4 juvenile steelhead per square meter at sites within lower Clear Creek (SWS 2015; SWS 2016). Ninety three juvenile steelhead could be present in the isolated area and will therefore be captured or remain trapped within the isolation area.

These estimates are likely overestimates because the proposed walking of a seine net downstream through the isolated area (to disperse rather than capture fish) prior to electrofishing will cause most fish to leave the area without being caught or handled. Also, the steelhead density within the isolated area is most likely lower than the average density, because the point bar will be a very shallow riffle at the time of the work. Of the 93 juvenile steelhead in the isolated area, up to 25% (24 fish) could be injured or killed. Given mean smolt-to-adult return rates of 1.6 percent from 1997–2012 (Comparative Survival Study Oversight Committee and Fish Passage Center 2015), the injury or loss of 24 juvenile steelhead in the Lower Clearwater Mainstem population would mean a one-time loss of less than one adult returning to spawn.

2.4.1.2 Turbidity

The effects of increased suspended sediment on salmonids vary based on exposure time and concentration. These effects were reviewed by Newcombe and Jensen (1996) and range from avoidance response, to minor physiological stress from increased rate of coughing, to death. Salmonids are relatively tolerant of low to moderate levels of suspended sediment (Gregory and Northcote 1993). Salmon and steelhead tend to avoid suspended sediment above certain concentrations (Servizi and Martens 1992; McLeay et al. 1987). Avoidance behavior can mitigate adverse effects when fish are capable of moving to an area with lower concentrations of suspended sediment. Researchers have reported thresholds for salmonid avoidance behavior at turbidities ranging from 30 to 70 nephelometric turbidity units (NTU) (Lloyd 1987; Servizi and Martens 1992; Berg and Northcote 1985).

The proposed action incorporates the installation of silt fences around the isolated area of the construction site. This sediment fence will catch approximately 75% of the sediment produced by the construction activities (Chapman et al. 2014). The remaining sediment is not expected to persist in the stream channel for more than 600 feet downstream (A. Connor, NPCNF hydrologist, unpublished data 2014). Given the short distance and duration of the sediment

plume, steelhead within the area will be exposed to short-term harm due to the adverse effects caused by increased turbidity.

2.4.1.3 Noise and Disturbance

Construction noise or visual stimulus may disturb nearby juvenile steelhead cause them to move away from the area. If fish move, they are expected to move only short distances to an area where they feel more secure, and only for a few hours in any given day (Grant and Noakes 1987; Ries 1995; Olson 1996; SNF 2009). Because the stream habitat near the bank reconstruction site is a relatively shallow riffle, we expect that if fish are displaced they will move temporarily into nearby areas. They are unlikely to experience harm or harassment caused by those changes in location. Noise from construction equipment in this setting and as proposed will not rise to the decibel level known to physically harm fish (FHWA 2008; Wysocki et al. 2007).

2.4.1.4 Chemical Contamination

Use of construction equipment and heavy machinery adjacent to stream channels poses the risk of an accidental spill of fuel, lubricants, hydraulic fluid, antifreeze, or similar contaminants into the riparian zone, or directly into the water. If these contaminants enter the water, the substances could adversely affect habitat, injure or kill aquatic food organisms, or directly impact ESA-listed species (e.g., Neff 1985; Staples et al. 2001). NMFS assumes that commonly implemented conservation measures will be implemented. Such as those listed below:

- All equipment working adjacent to the stream must be cleaned and leak free;
- Equipment will be 100 ft. or more from the stream edge when refueling;
- All fuel will be stored 150 ft. from the stream edge.

Based on the past success of these types of conservation measures in other projects, negative impacts to ESA-listed fish and fish habitat from fuel spills or leaks are unlikely.

2.4.1.5 Sediment Deposition

Turbidity plumes from construction work will deposit a small amount of sediment in Clear Creek downstream from the construction site. Effects to individual fish could include reduction of available cover for juveniles or changes to primary and secondary productivity, affecting food supply for the fish. As described above in the Turbidity section, only a small amount of sediment is expected to be mobilized, thus there will only be a small amount of sediment available for deposition. Because of the expected effectiveness of the proposed sediment control BMPs, NMFS does not expect that enough sediment deposition will take place to alter salmonid use of the habitat (including feeding and predator avoidance). Additionally, it is unlikely that primary or secondary production will be greatly affected. Habitat quality will likely recover as fine sediments are flushed downstream during the next season's high flows, which will occur within three months of the completion of the proposed work.

2.4.1.6 Bank Hardening

Installation of the rock barbs and riprap to the streambank could potentially reduce natural cover. The placement of riprap on stream banks can adversely affect stream morphology, fish habitat, and fish populations (Schmetterling et al. 2001; Garland et al. 2002). However, the existing streambank was already hardened prior to the erosion event in the spring of 2019. In addition, there is a back-yard deck patio adjacent to the site which extends to within a few feet of the stream bank. The concrete patio interferes with natural channel-forming process by preventing floodplain erosion and channel movement. Bank hardening will continue to alter channel-forming processes in the same manner and maintain nearly the same bank configuration as existed prior to the flooding. Installing the rock barbs and new riprap will not affect the existing natural cover at the project site since natural cover is largely absent due to previous/present alterations of the riparian area and streambank to accommodate a house, patio, and lawn. In the long term, the rock barbs could potentially create slack water that could provide a low velocity resting/refuge area for fish during high flows.

2.4.1.7 Altered streamflow patterns

The construction of two rock barbs and the reconstruction of one other, will force flows to the opposite bank (Radspinner 2010), and potentially cause incising of the stream channel (Odgraad and Kennedy 1983; Johnson et al. 2001). Further, there is the potential for scour pools to be created at the ends of each of the rock barbs (Odgraad and Kennedy 1983; Johnson et al. 2001). This impact should be short-term, as once spring runoff and high flows have subsided the substrate movement should reach a new equilibrium. Clear Creek within the action area, as well as upstream and downstream of the action area, is heavily impacted by development, bank armoring, and roads; which creates a channelized system. The altered streamflow patterns from the rock barb placement will not create substantial habitat change in this stream section and will not create velocities that are impassable to juvenile, or adult, steelhead. Therefore, project-caused changes to streamflow patterns and stream channel structure will have only minor impacts on steelhead.

2.4.2 Effects to Critical Habitat

Implementation of the proposed project is likely to affect freshwater spawning, rearing, and migration habitat for Snake River Basin steelhead. The PBFs that could be adversely affected by the proposed action are water quality, spawning substrate, and natural cover.

2.4.2.1 Water quality

The proposed action could negatively affect water quality through chemical contamination or short-term increases in turbidity. As described above in Section 2.5.1.4, we assume that commonly implemented conservation measures will be implemented, and those conservation measures will prevent leaks or spills from machinery from entering Clear Creek. We expect increases in turbidity to occur during construction activities to last several hours and extend no more than 600 feet downstream from the construction site. These increases in turbidity will be small enough to not reduce the conservation value of water quality in the action area more than minimally because the impacts will cover a small area and will be short-term.

2.4.2.2 Substrate

Turbidity plumes from construction work will deposit a small amount of sediment in Clear Creek. Because of the expected effectiveness of the proposed sediment control BMPs, NMFS does not expect that enough sediment deposition will take place to alter salmonid use of the habitat. Substrate will likely return to pre-project conditions as fine sediments are flushed downstream during high flows after project completion; and the project will not reduce the conservation value of the substrate PBF within the action area. The high flows that should flush out the sediment will occur within 3 months of the completion of the project.

The construction of two rock barbs, and the reconstruction of one rock barb will direct the flow to the center of the stream. This will help alleviate future bank erosion on or near the Sellitti property. However, the rock barbs will create scour pools directly downstream of the structure (Odgraad and Kennedy 1983; Johnson et al. 2001), possibly increase incising of the stream channel (Odgraad and Kennedy 1983; Johnson et al. 2001), and force the flow to the opposite bank (Radspinner 2010). The opposite bank in the action area is a natural rock bluff, which should not be susceptible to erosion due to the altered streamflow patterns. The stream channel in the area was previously armored and there is an existing rock barb. Any sediment movement or incision that occurs will most likely be minimal or return the area to conditions that existed prior to the spring 2019 flooding. Therefore, the effects of the rock barbs on future bank erosion or possible sediment from scour, is minimal and will have only short-term adverse effects on the conservation value of the substrate within the action area.

2.4.2.3 Natural Cover

As referenced above in the species effects section, the placement of the riprap and bank barbs will alter streamflow patterns which will consequently alter stream habitat such as scour pools. The effects from this are expected to be minor because it is likely that the loss of a pool in one section of the stream will be offset by the creation of a scour pool at the end of the barbs. Likewise, it is unlikely that the new structures will alter water velocities to the point where the habitat will become less usable than it is currently.

2.5 Cumulative Effects

"Cumulative effects" is defined at 50 CFR 402.02) and 402.17(a)).

The entire action area is adjacent to and on private property. The property directly downstream of the action area was impacted by the same high flows that caused the current erosion issues. It is anticipated that future bank stabilization projects in close proximity to the current project will continue in the future. Assuming that future bank stabilization projects will be similar in size, the future impacts will be similar to the ones described in this Opinion. Because of the existing infrastructure in the action area, NMFS anticipates that current private and state land use associated effects will continue into the future at their current rate. Given the substantial stream-adjacent land development/use that already exists in the action area, in the future this reach of Clear Creek will likely have limiting factors for steelhead (particularly channel confinement and very limited habitat complexity) that are essentially the same as those that presently occur. As noted above, effects from climate change (which may be factored in as baseline and/or

cumulative effects) are expected to increase stream temperatures and reduce the time period during summer/early fall when the action area provides suitable rearing habitat for steelhead.

2.6 Integration and Synthesis

In this section, we add the effects of the action (Section 2.4) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.5), taking into account the status of the species and critical habitat (Section 2.1), to formulate the agency's Opinion as to whether the proposed action is likely to: (1) Reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat for the conservation of the species.

Species. Many individual steelhead populations are not meeting recovery plan abundance and productivity targets, and the species remains threatened with extinction. Current abundance/productivity estimates for the Lower Clearwater Mainstem population—where the proposed action will take place—exceed minimum thresholds for low risk status, but the population is assigned moderate risk for abundance/productivity due to the high uncertainty associated with the estimate (NWFSC 2015). Also, abundance of the Snake River Basin steelhead DPS as whole (and likely for this population as well) has declined substantially during 2017 through 2019. Furthermore, climate factors will likely make it more challenging to increase abundance and recover the species (NMFS 2017a).

Regarding the effects of the proposed action, juvenile steelhead in the action area could potentially experience adverse effects associated with fish handling, noise, chemicals from construction equipment, turbidity, sediment deposition, bank hardening, and natural cover. The effects of noise and chemicals are expected to be negligible because of the proposed conservation measures and the ability of fish to move out of the action area during construction. The already existing degraded baseline conditions of habitat in the action area will not be altered more than minimally. The following adverse effects are expected:

- As many as 93 juvenile will be captured and relocated prior to construction activities; of these, possibly as many as 24 fish could be injured or killed.

- Exposure to sub-lethal impacts from short-term (no longer than two hours) increased turbidity levels up 600 feet downstream.

Given mean smolt-to-adult return rates of 1.6 percent from 1997–2012 (Comparative Survival Study Oversight Committee and Fish Passage Center 2015). Ninety-three juvenile steelhead will be subjected to one-time sub-lethal or lethal impacts from fish handling. This would translate to an impact of less than one adult equivalent returning to spawn. Further impacts would be from the short duration turbidity plume that is expected to flow 600 feet downstream. Effects such as these would not likely reduce the abundance and productivity of the population. Because we do not anticipate a change in the viability of the Lower Clearwater Mainstem steelhead population, the proposed action will not likely affect the survival of the DPS or the species' probability of recovery.

Critical habitat. Critical habitat for Snake River Basin steelhead is present in the action area, and exhibits many of the Lower Clearwater Mainstem population's habitat limiting factors: high summer water temperature, low amounts of large wood, elevated fine sediments, and a constrained floodplain. The proposed action will cause small, short-term adverse effects to the substrate, natural cover, and water quality PBFs. However, due to the small and short-lived nature of these effects, the conservation value of critical habitat in the action area would not likely be greatly reduced. Since the conservation value of critical habitat in the action area would not likely be greatly reduced, the conservation value of critical habitat at the designation scale would also not likely be affected to more than a minimal amount.

2.7 Conclusion

After reviewing the current status of the listed species and their designated critical habitat, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS' opinion that the proposed action is not likely to jeopardize the continued existence of Snake River Basin steelhead, or destroy or adversely modify its designated critical habitat.

2.8 Incidental Take Statement

Section 7(b)(4) and section 7(o)(2) of the ESA provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this incidental take statement.

2.8.1 Amount or Extent of Take

In the Opinion, NMFS determined that incidental take is reasonably certain to occur as follows:

- **Area Isolation/Fish handling**. We anticipate that up to 93 juvenile steelhead could be present in the isolated in-water work area. Most, if not all of the fish, would be either herded out of the work area when the seine is moved through it or captured, handled, and relocated out of the work area. A subset of the fish would be injured or killed in the capture/handling process. It is possible that a few of the up to 93 fish may elude herding and capture, become confined in the isolated work area, and be injured or killed from exposure to sustained turbidity during work or impingement on/crushing by work equipment. The amount of take will be exceeded if more than 93 juvenile steelhead are captured, injured, or killed during fish salvage.

- **Short-term water quality impacts from turbidity**. Because it is not possible to observe the number of fish exposed to the turbidity plumes, NMFS will use the extent and duration of the turbidity plumes as a surrogate for take. This is a rational surrogate for take because the bigger the size and the longer the duration of turbidity plumes, the greater the likelihood of take. NMFS will consider the extent of take exceeded if turbidity plumes extend downriver further than 600 feet and persist for longer than two hours.

2.8.2 Effect of the Take

In the Opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

2.8.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures to minimize the amount or extent of incidental take (50 CFR 402.02).

The COE shall:

1. Minimize incidental take from construction activities and implement all of the proposed conservation measures.

2. Ensure completion of a monitoring and reporting program to confirm that the terms and conditions in this ITS were effective in avoiding and minimizing incidental take from permitted activities and that the extent of take was not exceeded.

2.8.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the COE must comply with them in order to implement the reasonable and prudent measures (RPMs) (50 CFR 402.14). The COE has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. To implement RPM 1, minimize take from construction activities, the COE shall ensure the following by imposing permitting conditions:

    a) The proposed action, including all described conservation measures and BMPs, will be implemented as described in the BA and Proposed Federal Action section of this Opinion

    b) Ensure fish salvage is managed by a qualified fish biologist.

    c) Ensure that all stockpiled material is placed above the ordinary high water mark.

    d) Ensure all equipment remains above the ordinary high water mark.

    e) Ensure that all equipment to be used for construction activities shall be cleaned, inspected for leaks, and have leaks fixed prior to arriving at the project site.

    f) All equipment must be refueled a minimum of 100 feet from perennial surface waters in areas such as the landowner's driveway in front of the house.

g) Ensure that equipment will be 100 feet or more from the stream edge when refueling.

h) Ensure that all fuel will be stored l00 feet from the stream edge.

2 To implement RPM 2 (monitoring and reporting), the COE shall:

a. Ensure that the landowner, or contractor, monitors turbidity plumes created by the action. If turbidity plumes extend more than a 600 feet downstream for more than two hours, cease activities immediately and take actions to reduce turbidity and prevent reoccurrence. If the turbidity plume is visible more than 600 feet downstream for more than two hours (Idaho state standards), the landowner shall cease operation and notify NMFS immediately (extent of take).

b. Report to NMFS the number of steelhead that are handled, injured, or killed during fish salvage (amount of take). COE shall direct the landowner, or contractor, to immediately cease activities and contact NMFS if more than 93 juvenile steelhead are handled during fish salvage. Also, immediately cease operations and contact NMFS if more than 24 juvenile steelhead are killed.

Submit a monitoring report (with information on turbidity plumes and fish salvage) by April 15, following project completion to: nmfswcr.srbo@noaa.gov

2.9 Conservation Recommendations

Conservation recommendations are defined at 50 CFR 402.02, and, for this consultation, are as follows:

1. Wash all fill and riprap material collected from the upland location.

2. To the extent possible, perform work when water levels are low and the area is dry.

2.10 Reinitiation of Consultation

This concludes formal consultation for the Clear Creek Bank Stabilization Project.

As 50 CFR 402.16 states, 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 taking specified in the ITS 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 on 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.

3. Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Adverse effect means any impact that reduces quality or quantity of EFH, and may include physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based, in part, on the EFH assessment provided by the COE and descriptions of EFH for Pacific Coast salmon contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

The PFMC designates the freshwater habitat of Pacific salmon species by subbasin (i.e., HUC 4). EFH includes all streams and other water bodies occupied or historically accessible to these species, but does not otherwise distinguish individual streams within the subbasins. The Action will be implemented in the Clearwater subbasin (17060306), Chinook and coho (*O. kisutch*) salmon have (as of December 2014, 79 FR 75449) EFH designated habitat. Analysis was completed for Chinook and coho salmon due to the possibility, in the future and during the project, of each of these species utilizing the action area for spawning and rearing.

- HAPCs for salmon are: complex channel and floodplain habitat, spawning habitat, thermal refugia, estuaries, and submerged aquatic vegetation (see descriptions of salmon HAPCs in Appendix A to the Pacific Coast Salmon FMP.

3.2 Adverse Effects on Essential Fish Habitat

Based on the information provided in the BA and the analysis of effects presented in the ESA portion of this document, NMFS concludes that the proposed action will have the following adverse effects on EFH designated for Chinook and coho salmon: (1) Increased sediment from construction activities temporarily affecting water quality and substrate in some areas.

3.3 Essential Fish Habitat Conservation Recommendations

NMFS believes that the following Conservation Recommendations are necessary to avoid, mitigate, or offset the impact that the proposed action has on EFH. These Conservation Recommendations are similar but not identical to the ESA Terms and Conditions.

a) Turbidity monitoring shall be conducted during excavation of gravel from the point bar. After a turbidity plume begins at the work site, visual turbidity shall be noted and recorded after two hours at 600 feet downstream. If a plume is visible, the downstream extent of the plume will also be recorded. Results of this monitoring will be reported in the project annual report. If a visible plume is visible at 600 feet downstream after two hours, NMFS will be called to discuss reinitiation of consultation.

b) Ensure that all stockpiled material is placed above the ordinary high water mark.

c) Ensure all equipment remains above the ordinary high water mark.

d) Ensure that all equipment to be used for construction activities shall be cleaned, inspected for leaks, and have leaks fixed prior to arriving at the project site.

e) All equipment must be refueled a minimum of 100 feet from perennial surface waters in areas such as the landowner's driveway in front of the house.

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in section 3.2.

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-554) (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this Opinion are US Army Corps of Engineers. Other interested users could include Mr. Ted Sellitti, and Nez Perce Tribe. Individual copies of this Opinion were provided to the COE. The document will be available within 2 weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adheres to conventional standards for style.

4.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

4.3 Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01, et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this Opinion/EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

5. REFERENCES

Berg, L. and T.G. Northcote. 1985. Changes in territorial, gill-flaring, and feeding behavior in juvenile coho salmon (*Oncorhynchus kisutch*) following short-term pulses of suspended sediment. Canadian Journal of Fisheries and Aquatic Science 42: 1410-1417.

Chapman, J M, C L. Proulx, M A N. Veilleux, C. Levert, S. Bliss, M E. Andre, N W R. Lapointe, S J. Cooke. 2014. Clear as mud: A Meta-Analysis on the Effects of Sedimentation on Freshwater Fish and the Effectiveness of Sediment-Control Measures. Water Research (56) 190-202

Comparative Survival Study Oversight Committee and Fish Passage Center. 2015. Comparative Survival Study of PIT-tagged Spring/Summer/Fall Chinook, Summer Steelhead, and Sockeye, 2015 Annual Report. 496 p. http://www.fpc.org/documents/CSS/CSS_2105AnnualReport.pdf

Connor, Annie. Forest Service, Nez Perce Clearwater National Forest. Kamiah, ID. 2014. A summary analysis turbidity at the onset of dewatering and rewatering at monitoring sites from 20 culvert, diversion, and road replacement or removal projects from the Nez Perce Clearwater National Forest. Unpublished data. 2014.

Dalbey, S.R., T.E. McMahon, and W. Fredenberg. 1996. Effect of electrofishing pulse shape and electrofishing-induced spinal injury to long-term growth and survival of wild rainbow trout. North American Journal of Fisheries Management 16:560-569.

Dominquez, F. E Rivera, D P. Lettenmaier, C L. Catro. 2012. Changes in Winter Precipitation Extremes for the Western United States Under Warmer Climates as Simulated by Regional Climate Models. Geophysical Research Letters (39) L05803 https://doi.org/10.1029/2011GL050762

Federal Highway Administration (FHWA). 2008. Effective Noise Control During Nighttime Construction, updated July 15, 2008. http://ops.fhwa.dot.gov/wz/workshops/accessible/Schexnayder_paper.htm

Frisch, A.J. and T.A. Anderson. 2000. The response of coral trout (*Plectropomus leopardus*) to capture, handling and transport and shallow water stress. Fish Physiology and Biochemistry 23(1):23–34.

Foltz, R B. K A. Yanosek, T M. Brown. 2008. Sediment Concentration and Turbidity Changes During Culvert Removals. Journal of Environmental Management (87) 329-340

Garland, R.D., K.F. Tiffan, D.W. Rondorf, and L.O. Clark. 2002. Comparison of subyearling fall Chinook salmon's use of riprap revetments and unaltered habitats in Lake Wallula of the Columbia River. North American Journal of Fisheries Management. 22 (4): 1283-1289.

Grant, J.W.A and D.L.G Noakes. 1987. Movers and stayers: Foraging tactics of young-of-the-year brook charr, *Salvelinus fontinalis*. Journal of Animal Ecology 56: 1001–1013.

Gregory, R.S. and T.S. Northcote. 1993. Surface, planktonic, and benthic foraging by juvenile Chinook salmon (*Oncorhynchus tshawytscha*) in turbid laboratory conditions. Canadian Journal of Fisheries and Aquatic Sciences 50: 223-240.

Hemre, G.I. and A. Krogdahl. 1996. Effect of handling and fish size on secondary changes in carbohydrate metabolism in Atlantic salmon, *Salmo salar*. Aquaculture Nutrition 2:249–252.

Interior Columbia Basin Technical Recovery Team (ICBTRT). 2007. Viability Criteria for Application to Interior Columbia Basin Salmonid ESUs, Review Draft March 2007. Interior Columbia Basin Technical Recovery Team: Portland, Oregon. 261 pp. http://www.nwfsc.noaa.gov/trt/col/trt_viability.cfm

Johnson, A P. R D. Hey, M. Tessier, D L. Rosgen. 2001. Use of Vanes for Control of Scour at Vertical Wall Abutments. Journal of Hydraulic Engineering 127(9) 772-778

Lloyd D. 1987. Turbidity as a Water Quality Standard for Salmonid Habitats in Alaska. North American Journal of Fisheries management 7:34-45.

McElhany, P., M.H. Ruckelshaus, M.J. Ford, T.C. Wainwright, and E.P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evolutionarily significant units. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-42, Seattle, Washington, 156 p.

McLeay, D.J., I.K. Birtwell, G.F. Hartman, and G.L. Ennis. 1987. Responses of Arctic Grayling (Thymallus arcticus) to acute and prolonged expose to Yukon Placer Mining Sediment. Can. J. Fish. Aquat. Sci. 44: 658-673.

McMichael, G.A., L. Fritts, and T.N. Pearsons. 1998. Electrofishing Injury to Stream Salmonids; Injury Assessment at the Sample, Reach, and Stream Scales. North American Journal of Fisheries Management 18:894-904.

Mote, P. W. and E. P. Salathé. 2009. Future climate in the Pacific Northwest. Climate Impacts Group, University of Washington, Seattle, Washington.

NMFS. 2017a. ESA Recovery Plan for Snake River Spring/Summer Chinook & Steelhead. NMFS. http://www.westcoast.fisheries.noaa.gov/publications/recovery_planning/salmon_steelhead/domains/interior_columbia/snake/Final%20Snake%20Recovery%20Plan%20Docs/final_snake_river_spring-summer_chinook_salmon_and_snake_river_basin_steelhead_recovery_plan.pdf

NMFS. 2017b. ESA Recovery Plan for Snake River Fall Chinook Salmon (*Oncorhynchus tshawytscha*).

http://www.westcoast.fisheries.noaa.gov/publications/recovery_planning/salmon_steelhead/domains/interior_columbia/snake/Final%20Snake%20Recovery%20Plan%20Docs/final_snake_river_fall_chinook_salmon_recovery_plan.pdf

National Marine Fisheries Service (NMFS). 2000. Guidelines for Electrofishing Waters Containing Salmonids Listed Under the ESA. *http://www.westcoast.fisheries.noaa.gov/publications/reference_documents/esa_refs/section4d/electro2000.pdf*.

Neff, J.M. 1985. Polycyclic aromatic hydrocarbons. *In*: Fundamentals of aquatic toxicology, G.M. Rand, and S.R. Petrocelli (eds.), pp. 416-454. Hemisphere Publishing, Washington, D.C.

Newcombe, C. and J. Jensen. 1996. Cannel Suspended Sediment and Fisheries: A Synthesis for Quantitative Assessment of Risk and Impact. North American Journal of Fisheries Management 16: 693-727.

Nielson, J. 1998. Electrofishing California's Endangered Fish Populations. Fisheries 23(12): 6-12.

Northwest Fisheries Science Center (NWFSC). 2015. Status review update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest. 356 p.

Odgaard, J A. J F. Kennedy, Members ASCE. 1983. River-Bend Bank Protection by Submerged Vanes. Journal of Hydraulic Engineering 109 (8) 1161-1173

Olla, B.L., M.W. Davis, C.B. Schreck. 1995. Stress-induced impairment of predator evasion and non-predator mortality in Pacific salmon. Aquaculture Research 26(6): 393-398.

Olson, D. 1996. Monitoring Report Associated with the Implementation of the Incidental Take Statement for Snake River Spring/summer Chinook salmon (Oncorhynchus tshawytscha) for the 1995 Recreational Floating on the main Salmon River. USDA Forest Service, Sawtooth National Forest, SNRA, Custer County, Idaho.

Rapdspinner, R. P. Diplas, F. Anne, A F. Lightbody, F. Sotiropoulos. 2010. River Training and Ecological Enhancement Potential Using In-Stream Structures. Journal of Hydraulic Engineering 136(12) 967-980

Ries, P. 1995. May 23, 1995 letter to National Marine Fisheries Service documenting: Field notes collected during the 1992 floatboating season on the Sawtooth National Recreation Area. USDA Forest Service, Sawtooth National Forest, SNRA, Custer County, Idaho.

Sawtooth National Forest (SNF). 2009. Calendar Year 2008 monitoring report for Sawtooth National Recreation Area Permitted Commercial Floatboating and Walk/Wade Angling and Non-Outfitted Floatboating and Walk/Wade Angling on the Upper Main Salmon River. USDA Forest Service Sawtooth National Forest Sawtooth National Recreation Area Custer County, Idaho. January 30, 2009.

Schmetterling, D.A., C.G. Clancy, and T.M. Brandt. 2001. Effects of riprap bank reinforcement on stream salmonids in the western United States. Fisheries 26(7): 6-13.

Servizi, J.A. and D.W. Martens. 1992. Sublethal responses of coho salmon (*Oncorhynchus kisutch*) to suspended sediments. Canadian Journal of Fisheries and Aquatic Sciences 49: 1389-1395.

Staples C.A, J.B. Williams, G.R. Craig, and K.M. Roberts. 2001. Fate, effects and potential environmental risks of ethylene glycol: a review. Chemosphere. 43(3): 377-383.

SWS (Stillwater Sciences). 2015. Clear Creek Aquatic Habitat Condition Assessment and Fish Population Monitoring. Prepared by Stillwater Sciences, Portland, Oregon for Clearwater Basin Collaborative, Moscow, Idaho.

SWS (Stillwater Sciences). 2016. Clear Creek Aquatic Habitat Condition Assessment and Fish Population Monitoring 2016 Report. Prepared by Stillwater Sciences, Portland, Oregon for Clearwater Basin Collaborative, Moscow, Idaho

Wysocki, L.E., J.W. Davidson III, M.E. Smith, S.S. Frankel, W.T. Ellison, P.M. Mazik, A.N. Popper, and J. Bebak. 2007. Effects of aquaculture production noise on hearing, growth, and disease resistance of rainbow trout Oncorhynchus mykiss. Aquaculture 272: 687-697.