United States Department of the Interior

FISH AND WILDLIFE SERVICE

Washington Fish and Wildlife Office
510 Desmond Dr. SE, Suite 102
Lacey, Washington 98503

JUN - 1 2017

In Reply Refer To:
01EWFW00-2016-F-0643

Scott Smithline
Federal Highway Administration
Western Federal Lands Highway Division
610 E. Fifth Street
Vancouver, Washington 98661

Dear Mr. Smithline:

This letter transmits the U. S. Fish and Wildlife Service's (Service) Biological Opinion on the proposed Upper Hoh River Road Bank Stabilization Project located in Jefferson County, Washington, and its effects on bull trout (*Salvelinus confluentus*), marbled murrelet (*Brachyramphus marmoratus)*, and designated critical habitats for northern spotted owl (*Strix occidentalis caurina),* marbled murrelet, and bull trout. Formal consultation on the proposed action was conducted in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Your July 6, 2016, request for formal consultation was received on July 8, 2016.

The enclosed Biological Opinion is based on information provided in the July 6, 2016, Biological Assessment, telephone conversations, field investigations, and other sources of information cited in the Biological Opinion. A complete record of this consultation is on file at the Service's Washington Fish and Wildlife Office in Lacey, Washington.

The Biological Assessment also included a request for Service concurrence with (a) "not likely to adversely affect" determination for certain listed resources. The enclosed document includes a section separate from the Biological Opinion that addresses your concurrence request. We included a concurrence for northern spotted owl. The rationale for this concurrence is included in the concurrence section.

If you have any questions regarding the enclosed Biological Opinion, our response to your concurrence request(s), or our shared responsibilities under the Act, please contact Marty Acker at 360-753-9073, Jamie Hanson at 360-753-6044, or Carolyn Scafidi at 360-753-4068.

Sincerely,

for Eric V. Rickerson, State Supervisor
Washington Fish and Wildlife Office

Enclosure(s)

cc:
FHWA, Vancouver, WA (S. Morrow)

Endangered Species Act - Section 7 Consultation

BIOLOGICAL OPINION

U.S. Fish and Wildlife Service Reference:
01EWFW00-2016-F-0643

Upper Hoh River Road Bank Stabilization Project

Jefferson County, Washington

Federal Action Agency:

Federal Highway Administration

Consultation Conducted By:

U.S. Fish and Wildlife Service
Washington Fish and Wildlife Office
Lacey, Washington

Eric V. Rickerson, State Supervisor
Washington Fish and Wildlife Office

01 JUNE 2017
Date

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ACRONYMS AND ABBREVIATIONS

Act	Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*)
BA	Biological Assessment
CFR	Code of Federal Regulations
CHU	Critical Habitat Unit
CI	confidence interval
Corps	U.S. Army Corps of Engineers
dBA	A-weighted decibel level
dbh	Diameter-at-breast-height
FHWA	Federal Highway Administration
FMO	Foraging, Migration and Overwintering
FR	Federal Register
GIS	Geographic Information System
LSR	Late Successional Reserve
MP	milepost
murrelet	marbled murrelet
ONF	Olympic National Forest
Opinion	Biological Opinion
Park	Olympic National Park
PBF	Physical or Biological Features
PCE	Primary Constituent Element
PNT	Potential Nest Tree
RM	River mile
RPM	Reasonable and Prudent Measures
Service	U.S. Fish and Wildlife Service
spotted owl	northern spotted owl
WDFW	Washington Department of Fish and Wildlife
WFLHD	Western Federal Lands Highways Division
WSDNR	Washington State Department of Natural Resources
WSDOT	Washington State Department of Transportation

INTRODUCTION

This document represents the U. S. Fish and Wildlife Service's (Service) Biological Opinion (Opinion) based on our review of the proposed bank stabilization and bridge and culvert improvement projects in five locations along the Upper Hoh River Road located in Jefferson County, Washington (proposed action), and its effects on bull trout (*Salvelinus confluentus)*, northern spotted owl (*Strix occindentalis caurina)*, marbled murrelet (*Brachyramphus marmoratus)*, and critical habitats separately designated for each of the above-named species in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act). The Western Federal Lands Highways Division's (WFLHD) March 31, 2016, request for formal consultation was received on April 4, 2016.

This Opinion is based on information provided in the July, 2016, Revised Biological Assessment received on August 3, 2016, and information provided by WFLHD on August 12, 2016. A complete record of this consultation is on file at the Service's Washington Fish and Wildlife Office in Lacey, Washington.

CONSULTATION HISTORY

The following is a summary of important events associated with this consultation:

- A prior formal consultation between the Service and WFLHD was completed on December 9, 2014, for stream-crossing projects at milepost (MP) 4.38 and MP 6.95.

- The request for formal consultation and an initial Biological Assessment on an expanded project design with additional sites in addition to, and inclusive of, MP 4.38 were received on April 4, 2016.

- On July 5, 2016, WFLHD confirmed that the instream installation would be limited to engineered log jams and that rock barbs were eliminated from the project design.

- Additional information necessary to initiate consultation was received as a revised Biological Assessment (BA) on August 3, 2016. This BA is the only BA referenced in this Opinion. It included outdated engineering diagrams that still depicted rock armor installation, so the WFLHD provided updated engineering diagrams along with the BA on August 3, 2016 confirming that the only structures proposed for instream installation in the Hoh River mainstem are engineered log jams (ELJs).

- An August 12, 2016, email from WFLHD clarified the following project details:

    (1) The 30 percent design for ELJs includes 63 percent wood and 37 percent concrete by volume.

    (2) The project will likely make approximately 1.2 miles in Canyon Creek accessible to bull trout; Tower Creek will not be accessible to bull trout due to step pools at the confluence with the Hoh River.

(3) On-site evaluations of suitable habitat for northern spotted owls and for marbled murrelets (murrelet) estimated that up to 11.2 acres within 65 yards of project activities, 26.5 acres within 120 yards of project activities will be exposed to stressors generated by the proposed action. The information is phrased as "up to" because some habitat overlaps the disturbance zone for two sites, so these are conservative overestimates of the total area of suitable habitat for each species exposed to project activities. Notably, WFLHD confirmed that there is no suitable habitat for northern spotted owls or for murrelets within 120 yards of the worksite at Canyon Creek (site C5).

(4) Pile driving will occur for one week at each of the Tower Creek and Canyon Creek sites.

(5) Elevated noises beyond baseline levels will result from equipment operation over one full season of work at each project site. All work will take place between June 1 and October 31, 2018, within up to 90 days (See Table 1).

(6) WLFHD will require work to begin at least two hours after dawn and end at least two hours before dusk at all sites where work will occur during the murrelet nesting season (April 1 to September 23).

(7) WFLHD anticipates that bank stabilization at milepost 4.0 to 4.4 (site C2) will require more time than is available in the standard in-water work window for the Hoh River. Therefore, WFLHD will collaborate with appropriate permitting agencies (e.g., Washington Department of Fish and Wildlife (WDFW) and US Army Corps of Engineers (Corps)) to determine the project timing. The Corps standard work window for in-water work in the Hoh River is July 15 to August 15, whereas WDFW recommends August 1 to 15. The Service assumes that all proposed in-water work will be conducted during the months of July or August.

(8) WFLHD anticipates two weeks of work during the winter season to conduct certain upland portions of the bridge replacement and the culvert replacement work outside the nesting seasons of murrelets and northern spotted owls.

- On January 6, 2017, a phone conversation and subsequent email from WFLHD indicated an updated effect determination for northern spotted owls from Likely to Adversely Affect, to Not Likely to Adversely Affect. Additional project changes led to a new initiation date of January 6, 2017.

- On January 30, 2017, upon a request for clarification of duration of in-water work and dewatering/isolation area of project site C5, WFLHD provided an updated duration of project effects at each site, which differed from durations of on-site work provided within the BA.

CONCURRENCE

The WFLHD provided information in support of a "may affect, not likely to adversely affect" determination for the northern spotted owl (spotted owl).

Northern Spotted Owl

The proposed action will remove up to 287 trees across all project sites with construction-related noise and activity that will persist for the duration of construction from July 1 through October 31 during one calendar year. Most of these trees are in a narrow stand between the existing roadway and the Hoh River. The trees to be cut are primarily along the roadway and all cut trees will be replaced with greater numbers of planted native conifers and shrubs before project completion. The action agency will also implement best management practices to avoid impacts to other trees, including clearly marking the construction limits and minimizing the footprint of the project activities.

The proposed tree-removal areas are described by project site in the BA and therein totaled 5.21 acres (p. 13). WFLHD provided a quantification of the tree-removal areas using geographical information systems (GIS) to the Service on December 22, 2016. The Service's review of the GIS data provided by WFLHD yielded slightly larger areas of project site vegetation clearing equaling approximately 9.4 acres. This acreage is assumed to be the correct estimate for the remainder of this Opinion.

Also described in the BA, surveying was conducted by project partners on May 12 and 13, 2016, in each stand within 65 and 120 yards of all project sites to identify all conifer trees equal to or greater than 18 inches in diameter (pp. 33-34) because of the potential for nesting opportunities by both murrelets and northern spotted owls in trees in this size class. While it is stated in the BA that an inventory of cavities was not conducted due to time constraints, it was reported that "few" nest cavities were observed during the tree inventory and that "in general, cavities were only observed in the largest size class trees (>50 inches diameter at breast height [dbh])" (pp. 33-34). However, numerous large snags were present in all mature forest areas that could provide nest cavities for northern spotted owls, so the potential for suitable nesting cavities for spotted owls does occur in these stands.

A GIS analysis of potential suitable spotted owl habitat in the action area identified a patch of suitable nesting habitat in the vicinity of sites C1-C2. Furthermore, GIS analysis indicated site C4 is within the home range of a historic pair site approximately 1.10 miles from the site footprint that contains a small patch of suitable nesting habitat. However, these patches of suitable nesting habitat are relatively small, isolated from other patches, and highly fragmented, resulting in a high amount of edge effects and general disturbance from road-based activity. These factors make this area extremely unlikely to be used by nesting spotted owls. At the MP4 site, service representatives conducted a field visit during a previous consultation (USFWS 2014, p.6) to evaluate habitat conditions within 110 yards of project activities (see Table 1 in USFWS, 2013, p. 4). Based on a lack of large trees or snags with cavities, the Service determined that the area surveyed around site MP4 does not have the structural elements to meet the definition of nesting habitat and is extremely unlikely to support spotted owls.

Forested stands in the action area may provide suitable roosting, foraging and dispersal habitat for spotted owls. However, existing habitat conditions within 120 yards of project sites would not support roosting owls. Younger-aged stands present within this distance do provide adequate foraging and dispersal habitat. However, factors such as the young age of the stands, low canopy cover, dense mid-story conditions which limit flight space beneath the canopy, and other

attributes of the stand structure create low quality habitat. Ultimately, individual owls in these areas may forage in slightly different locations as a result of temporary noises generated by the project activities. These disruptions are not expected to measurably affect individuals given the large home ranges available for foraging activities and the single season of construction activity.

In summary, based on habitat conditions within the action area, it is extremely unlikely that nesting or roosting spotted owls will be exposed to project-generated noise and visual stressors. Foraging or dispersing spotted owls may be exposed to construction activities but are not expected to be measurably affected. The proposed action is not expected to result in any measurable effects to spotted owls through impacts to their prey base or habitat. For these reasons, the Service concurs with the WFLHD's determination of "may affect, not likely to adversely affect" for the spotted owl.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

A federal action means 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 (50 CFR 402.02).

The WFLHD of the Federal Highway Administration (FHWA), in partnership with Jefferson County, propose to re-construct stream crossing structures along the Upper Hoh River Road, crossing three tributaries to the Hoh River. The project partners also propose to construct ELJs in the mainstem Hoh River to deflect streamflow away from the banks along the Upper Hoh River Road, and to reduce road maintenance and repair frequency caused by river channel migration. The overall purpose of the proposed project is to prevent the road from washing away at these locations, and to provide safe and consistent access to residents, business, and Olympic National Park visitors via the Upper Hoh River Road (David Evans and Associates, Inc. 2016, p. 1; hereafter, cited as "BA, p. 1"). All project work will occur between MP 3.7 and 10.2 along the Upper Hoh River Road.

Stream Crossing Structures

The project will replace one bridge and two culverts along the Upper Hoh River Road with one box culvert and two bridges, each over three separate tributaries to the Hoh River. Each proposed stream-crossing structure is designed to provide improved fish passage, debris passage, and structural stability given the site-specific engineering considerations for each tributary. The BA identifies the three sites as milepost 4.38 (MP4), Tower Creek (C3), and Canyon Creek (C5). Engineering requirements for the new crossing structures are detailed in the BA (Chapter 2 and appended diagrams).

Pile driving will entail a vibratory hammer at the MP4, C3, and C5 sites. Impact proofing of 18-inch diameter hollow steel piles will require a total of 36,000 strikes at C3 and C5 (18,000 strikes at both sites). At MP4, vibratory sheet-pile driving and vibratory removal of the sheet-pile wall are anticipated to require less than one day of work each, scheduled for early July (installation) and late August (removal).

Work at each site will begin with the installation of erosion control materials, fish screens up- and down-stream of the project area, use of a screened pump meeting National Marine Fisheries Service standards to dewater the immediate work area, and sandbags and pipes to isolate the work zone and flowing water from each other. The Washington State Department of Transportation fish exclusion protocols will be implemented to handle and remove any fish that may be present.

The existing roadway and the corresponding section of the old culverts will be excavated in two phases at each site (one for each of two travel lanes). The same construction process will be used at both sites. New footings, poured in-place in temporary forms, will cure for approximately two weeks before wing walls and barriers are installed, grouted, and left to cure for approximately one week. Finally, the associated roadway approaches will be constructed. Construction is expected to take approximately 6 to 12 weeks for each project. Approximately half of this period will be devoted to curing concrete, during which project activities will be minimal.

During a final week of work at the end of October, workers will restore the stream beds and riparian areas by placing native cobbles in the streams; planting native riparian vegetation; and removing the stream bypasses, fish-exclusion screening, and erosion control materials. Some bridge or culvert work not requiring in-water operations will occur over 10 days in January or February (a time with less traffic on the roadway).

Excavators, dump trucks, chainsaws, a vibratory driver, impact driver, and an industrial auger drill are typical equipment that will be used to install the bridges and box culvert. Human activity at the project site will be common throughout the project, and may occur even when equipment operation is minimal.

Engineered Log Jams

"ELJs are collections of large woody debris that when placed in a river or other water body, redirect flow and increase stability to a bank or downstream gravel bar" (BA, pg 4). The project will install 29 ELJs along 2,900 linear ft of riverbank from mileposts 3.6 to 4.4 along the Upper Hoh River Rd, 1 ELJ at milepost 7.5, and 3 ELJs at milepost 7.9.

Each ELJ will be approximately 75 ft long, 20 ft high, and 20 ft wide, and will incorporate approximately 75 logs and 20 dolosse (plural of dolo), or concrete jack-like structures to which logs will be chained for stability. The BA describes the typical construction sequence for each ELJ (BA, pg 4-5), which includes staging in upland areas away from suitable habitat for any listed species, minimizing the extent of vegetation clearing, grading and excavating the bank to provide a stable equipment operating platform, excavating the streambed for placement of the ELJ, vibratory pile driving, and restoration of areas disturbed by project activities.

Pile driving for ELJ construction will employ a vibratory hammer to install approximately 170 12- to 18-inch log piles. Construction of ELJs will occur between June 1 and October 31 with in-water work generally limited to July 15 to August 31.

The Service has not identified any projects interrelated or interdependent to the proposed actions that are reasonably certain to occur.

Conservation Measures

A number of conservation measures were identified in the BA or were developed during consultation and confirmed by the WFHD in an email on August 12, 2016. The agreed-upon conservation measures include:

- The project will implement best management practices, summarized on page 12 of the BA, primarily pertaining to erosion and spill prevention.
- The project will avoid any blasting.
- Project work during the murrelet nesting season (April 1 to September 23) will begin at least two hours after dawn and cease at least two hours before dusk each day.
- All work below the ordinary high water mark will occur between July 15 and August 31. Work not requiring in-water operations will occur between July 1 and October 31.
- The project will install ELJs in lieu of the previously considered rock armoring and rock barbs.
- The project will maximize fish passage in the tributary streams.
- Temporary cofferdams, low-flow channels, and work timing will be used to minimize sedimentation of natural waters.

An additional conservation measure, agreed upon on December 22, 2016, includes the removal of potential nest trees (PNTs) outside of the murrelet nesting season.

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. The action area for this proposed federal action is based on the geographic extent of in-air sound, and is approximately the area depicted in Figure 2 of the BA and in Figure 1 of this Opinion.

The boundaries of the action area were defined based on the extent of temporary sound that will result from construction at each site. Pile driving is likely to generate the most extensive sounds from project activities. The Service previously conducted an independent analysis of in-air sound generation and attenuation using conservative assumptions. Incorporating that analysis by reference (see USFWS 2013), we can estimate the action area for the proposed project.

Recognizing that topography and a variety of environmental conditions influence in-air sound attenuation, the Service calculated that temporary increased sound levels associated with construction are likely to exceed ambient, background sound levels to a distance of approximately 5.9 miles from each project site, except where truncated by hillsides blocking any further sound transmission (Figure 1). The area affected by the other components of the proposed federal action is entirely contained within this action area. The area in which listed resources will be exposed to sound or other project stressors is discussed below in the effects section.

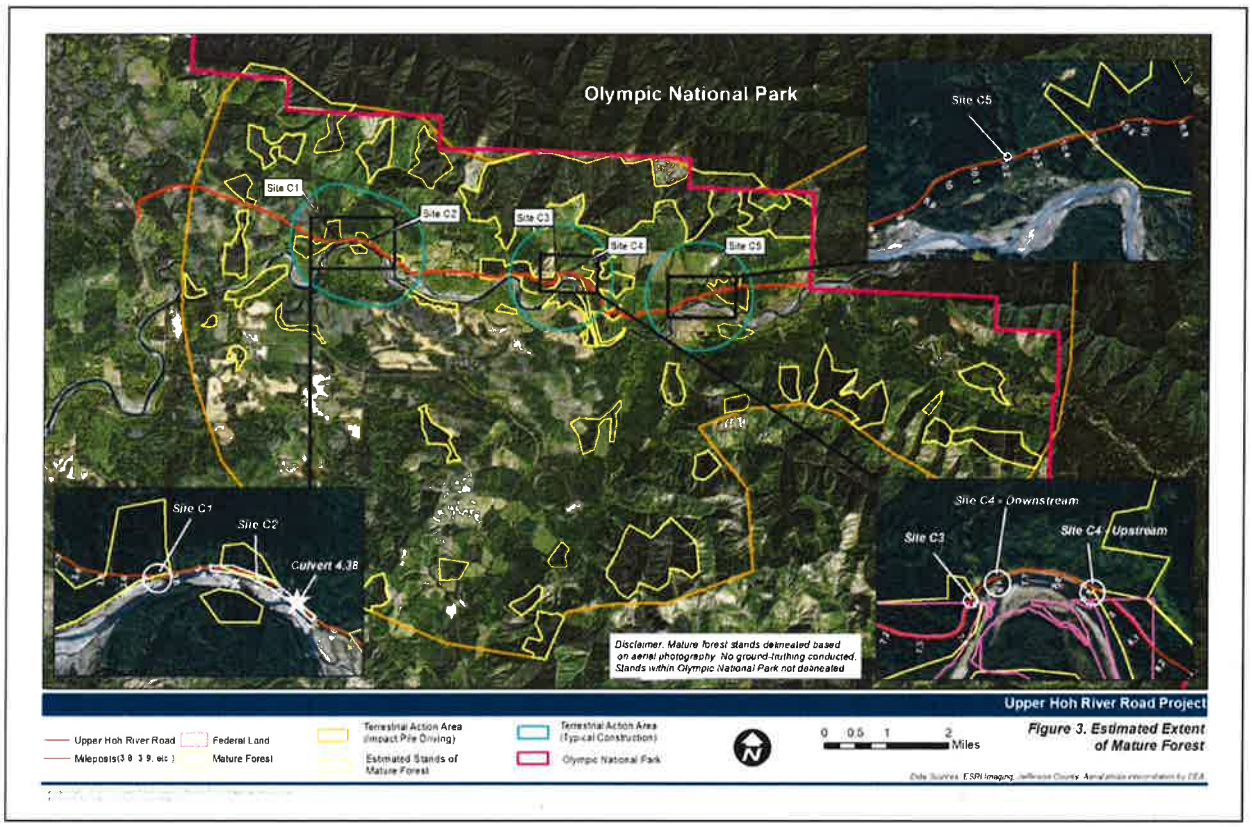

Figure 1. Action Area for the proposed federal action, and other spatial information including mile posts (MP), location of Upper Hoh River Road, boundary of Olympic National Park, federal lands, and mature forest stands.

ANALYTICAL FRAMEWORK FOR THE JEOPARDY AND ADVERSE MODIFICATION DETERMINATIONS

Jeopardy Determination

The following analysis relies on the following four components: (1) the *Status of the Species*, which evaluates the rangewide condition of the listed species addressed, the factors responsible for that condition, and the species' survival and recovery needs; (2) the *Environmental Baseline*, which evaluates the condition of the species in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the species; (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 species; and (4) *Cumulative Effects*, which evaluates the effects of future, non-federal activities in the action area on the species.

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 species' current status, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of listed species in the wild.

The jeopardy analysis in this Opinion emphasizes the rangewide survival and recovery needs of the listed species and the role of the action area in providing for those needs. It is within this context that we evaluate the significance of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

Adverse Modification Determination

Section 7(a)(2) of the Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to destroy or to adversely modify designated critical habitat (DCH). A final rule revising the regulatory definition of "destruction or adverse modification of critical habitat" was published on February 11, 2016 (USFWS and NMFS 2016). The final rule became effective on March 14, 2016. The revised definition states: "Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features."

Past designations of critical habitat have used the terms "primary constituent elements" (PCEs), "physical or biological features" (PBFs) or "essential features" to characterize the key components of critical habitat that provide for the conservation of the listed species. The new critical habitat regulations (81 FR 7214) discontinue use of the terms "PCEs" or "essential features," and rely exclusively on use of the term "PBFs" for that purpose because that term is contained in the statute. However, the shift in terminology does not change the approach used in conducting a ''destruction or adverse modification'' analysis, which is the same regardless of

whether the original designation identified PCEs, PBFs or essential features. For those reasons, in this Opinion, references to PCEs or essential features should be viewed as synonymous with PBFs. All of these terms characterize the key components of critical habitat that provide for the conservation of the listed species.

Our analysis for destruction or adverse modification of critical habitat relies on the following four components: (1) the Status of Critical Habitat, which evaluates the range-wide condition of DCH for the species. In terms of essential features, PCEs, or PBFs, depending on which of these terms was relied upon in the designation, are the factors responsible for that condition, and the intended recovery function of the critical habitat overall; (2) the Environmental Baseline, which evaluates the condition of the critical habitat in the action area, the factors responsible for that condition, and the recovery role of the critical habitat in the action area; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the essential features, PCEs, or PBFs and how those effects are likely to influence the recovery role of affected critical habitat units; and (4) Cumulative Effects, which evaluates the effects of future, non-Federal activities in the action area on the essential features, PCEs, or PBFs and how those effects are likely to influence the recovery role of affected critical habitat units.

For purposes of making the destruction or adverse modification finding, the effects of the proposed Federal action, together with any cumulative effects, are evaluated to determine if the critical habitat rangewide would remain functional (or retain the current ability for the PBFs to be functionally re-established in areas of currently unsuitable but capable habitat) to serve its intended conservation/recovery role for the species.

STATUS OF THE SPECIES AND DESIGNATED CRITICAL HABITAT: Bull Trout

Status of the Species

The bull trout was listed as a threatened species in the coterminous United States in 1999. Throughout its range, bull trout are threatened by the combined effects of habitat degradation, fragmentation, and alterations associated with dewatering, road construction and maintenance, mining, grazing, the blockage of migratory corridors by dams or other diversion structures, poor water quality, incidental angler harvest; entrainment and introduced non-native species (64 FR 58910 [Nov. 1, 1999]). Since the listing of bull trout, there has been very little change in the general distribution of bull trout in the coterminous United States, and we are not aware that any known, occupied bull trout core areas have been extirpated (USFWS 2014, p. iv).

Five segments of the coterminous population of the bull trout are considered essential to the survival and recovery of this species and are identified as interim recovery units: 1) Jarbidge River, 2) Klamath River, 3) Columbia River, 4) Coastal-Puget Sound, and 5) St. Mary-Belly River (U.S. Fish and Wildlife Service [USFWS] 2002a, pp. iv, 2, 7, 98; 2004a, Vol. 1 and 2, p. 1; 2004b, p. 1). Each of these interim recovery units is necessary to maintain the bull trout's distribution and its genetic and phenotypic diversity. Each of the interim recovery units are further organized into multiple bull trout core areas, which are mapped as non-overlapping watershed-based polygons, and each core area includes one or more local populations. On

September 4, 2014, the Service announced the availability of a revised draft recovery plan for the coterminous U.S. population of bull trout (79 FR:52741). This revised plan focuses on the identification and management of known threat factors in core areas in six proposed recovery units. The revised draft recovery plan updated the recovery criteria. The plan is not yet finalized.

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

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

Status of Designated Critical Habitat

On October 18, 2010, the Service issued a final revised critical habitat designation for the bull trout (70 FR 63898). The critical habitat designation includes 32 critical habitat units (CHUs) in six recovery units located throughout the coterminous range of the bull trout in Washington, Oregon, Idaho, Montana, and Nevada. Designated bull trout critical habitat is of two primary use types: 1) spawning and rearing, and 2) foraging, migration, and overwintering habitat. The conservation role of bull trout critical habitat is to support viable core area populations (75 FR 63943). CHUs generally encompass one or more core areas and may include FMO areas outside of core areas that are important to the survival and recovery of bull trout.

The final rule excludes some critical habitat segments. Critical habitat does not include: 1) waters adjacent to non-Federal lands covered by legally operative incidental take permits for habitat conservation plans (HCPs) issued under section 10(a)(1)(B) of the Act, in which bull trout is a covered species on or before the publication of this final rule; 2) waters within or adjacent to Tribal lands subject to certain commitments to conserve bull trout or a conservation program that provides aquatic resource protection and restoration through collaborative efforts, and where the Tribes indicated that inclusion would impair their relationship with the Service; or 3) waters where impacts to national security have been identified (75 FR 63898).

Within the DCH areas, nine PCEs have been described. These PCEs are those habitat components that are essential for the primary biological needs of foraging, reproducing, rearing of young, dispersal, genetic exchange, or sheltering.

For a detailed account of the status of the designated bull trout critical habitat, refer to Appendix B (Status of Designated Critical Habitat: Bull Trout).

ENVIRONMENTAL BASELINE: Bull Trout And Designated Bull Trout Critical Habitat

Regulations implementing the Act (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed federal projects in the action area that have undergone section 7 consultation, and the impacts of state and private actions which are contemporaneous with the consultation in progress.

The environmental baseline analysis for bull trout describes the relationship of the current condition and conservation role of the action area relative to bull trout core areas and established bull trout recovery units. The range of the bull trout is divided into 6 broad recovery units that reflect major watersheds, genetic relationships, and the physical and environmental factors that influence the biogeographical distribution of the bull trout (USFWS 2015, pg. 36). The action area for this project is located in the Coastal Recovery Unit for the bull trout, which encompasses the Olympic Peninsula, Puget Sound, and Lower Columbia River basins and 21 bull trout core areas (USFWS 2015, pg. 38). The action area for the project includes portions of the Hoh River core area on the Olympic Peninsula.

Status of Bull Trout in the Hoh River Core Area

The Hoh River core area comprises the Hoh and South Fork Hoh Rivers and associated tributaries. Active glaciers at the headwaters of the Hoh River watershed deliver both cold water and "glacial flour" to the mainstem.

Bull trout occur throughout the mainstem Hoh and South Fork Hoh Rivers. However, bull trout were not detected in 17 of 18 tributaries surveyed in the upper Hoh River. A series of cascades at river mile (RM) 48.5 in the upper Hoh River may be a barrier to upstream fish passage. There is a potential barrier to upstream fish passage in the South Fork Hoh River at RM 14.

Resident and migratory life history forms of bull trout, including anadromous forms, likely occur in the Hoh River core area. Genetic analysis has identified only bull trout (no Dolly Varden) in the Hoh core area (Spruell and Maxwell 2002).

The status of the bull trout core area population is based on four key elements necessary for long-term viability: 1) number and distribution of local populations, 2) adult abundance, 3) productivity, and 4) connectivity (USFWS 2004).

Number and Distribution of Local Populations

Two local populations have been identified: (1) Hoh River above the confluence with the South Fork Hoh River, and 2) South Fork Hoh River. With only two local populations, the bull trout in this core area is considered at increased risk of extirpation and adverse effects from random naturally occurring events (see "Life History").

Adult Abundance

Historically the Hoh core area likely comprised the largest population of bull trout on the Washington coast (Mongillo 1993). Currently there is insufficient information for a precise estimate of adult bull trout abundance, but the Hoh core area probably supports at least 500 but fewer than 1,000 adults. With fewer than 1,000 adults, this population is considered at increased risk of genetic drift.

Productivity

Bull trout in the Hoh core area are considered at risk of extirpation until sufficient information is collected to properly assess productivity.

Connectivity

Barriers to fish movement and migration in the Hoh core area include improperly sized or installed culverts in several locations. The mainstem is disconnected from off-channel habitats and adjacent riparian forest by riprap for bank armoring along the Upper Hoh Road. Holding and rearing areas for adult bull trout during spawning migration, and for juveniles during rearing movements among different stream reaches, are reduced due to reduction of instream large woody debris. Despite these habitat alterations, migratory bull trout persist in the Hoh River core area. Recent studies have shown that bull trout in the Hoh River core area move into adjacent independent coastal tributaries (Brenkman and Corbett 2003). Bull trout in this core area have diminished risk of extirpation from habitat isolation and fragmentation.

Changes in Environmental Conditions and Population Status

Since the bull trout listing, Federal actions occurring in the Hoh River core area have resulted in harm to, or harassment of, bull trout. These actions include statewide Federal restoration programs that include riparian restoration, replacement of fish passage barriers, and fish habitat improvement projects; federally funded transportation projects involving repair and protection of roads and bridges; and section 10(a)(1)(B) permits for HCPs addressing forest management practices. Capture and handling during implementation of section 6 (restoration projects) and section 10(a)(1)(A) permits (scientific collection) have directly affected bull trout in the Hoh core area. The number of non-Federal actions occurring in the Hoh River core area since the bull trout listing is unknown.

State forest practice regulations were significantly revised in 2000, following the Forest and Fish Agreement (FFR 1999; WFPB 2001). Revised regulations increased riparian forest retention, unstable-slope forest retention, and recruitment of large wood; road standards improved significantly over the old regulations. The updated regulations will significantly reduce the level of future timber harvest impacts to bull trout streams on private lands. However, most negative effects from past forest practices will likely continue to be a threat for decades. Because there is biological uncertainty associated with some of the riparian prescriptions and the methods to delineate fish habitat, the Forest and Fish Agreement relies on an adaptive management program for assurance that the new rules will meet the conservation needs of bull trout.

Reasons for Decline

Threats to bull trout in the Hoh River core area include:

- Timber harvest and harvest-related activities, such as roads, have degraded habitat conditions (e.g., fisheries, water quality, and connectivity) in the lower and middle watershed. Numerous steep slopes are susceptible to mass wasting and channelized landslides. The resulting substantial increase in the number of debris flows has reduced macroinvertebrate populations in the Hoh River. Riparian roads have increased fine sediments and peak flows.

- Other impacts from logging include reduced amounts of large woody debris, altered stream morphologies (especially reduced pool area and quality), and loss of riparian vegetation leading to increased water temperatures. Cedar spalts in several tributaries block fish passage, impede water flows, increase water temperature, leach tannins into the water, inhibit plant growth in the riparian area, and form dams that carve stream banks and increase fine sediments.

- Hard rock riprap for bank armoring along the Upper Hoh Road has prevented channel migration and formation of new habitats, created unnatural meander patterns, and disconnected the mainstem from off-channel habitats and adjacent riparian forest.

- Tribal and recreational fisheries cause incidental mortality of bull trout and are likely affecting the local populations.

- Black spot disease may be a factor in the decline of bull trout in the Hoh River.

Current Condition of the Species and Critical Habitat in the Action Area

The action is located in the Hoh River basin, a large glacially influenced river with an extensive floodplain. Regarding bull trout habitat, the action area includes part of the mainstem Hoh River and at least three tributary streams, all in an area of forestland cover and mixed intensities of historical and ongoing land management.

Conditions of both bull trout and aquatic habitat are described below for the Hoh River and each tributary in the action area:

Hoh River

The Hoh River flows westward for approximately 56 miles (90 km) from its headwaters in the Olympic National Park (elevation nearly 4,000 ft) to its confluence with the Pacific Ocean. The Hoh River drains approximately 250 square miles. Approximately 65 percent of the Hoh watershed is located in the national park and is managed as a natural area. The remaining lower watershed includes State, Tribal, and private lands (USFWS 2004, pg. 36). River discharge is strongly influenced by rainfall in autumn and winter and glacial runoff in spring and summer (Brenkmann and Corbett 2005, pg. 1074). The Hoh River ranges in width from 75 ft during summer low flow to more than 300 ft in winter and the channel migrates across more than a

thousand ft horizontal distance in some places within the action area. DCH for bull trout occurs in the mainstem Hoh River in the action area. The status of DCH in the action area is described at the end of this section.

The Hoh watershed provides habitat for a variety of salmon species (*Oncorhynchus spp.*), winter and summer steelhead trout (*O. mykiss*), and bull trout (Smith 2000, pg. 25; Salmonscape 2016). Bull trout spawn in the North and South Fork Hoh Rivers upstream of their confluence and use the lower segments of the Hoh River, including the project action area, as a migratory corridor and for rearing and foraging. Most bull trout in the action area are adults or subadults, though juveniles may also occur in the action area in low numbers.

The middle Hoh River and its tributaries in the action area have been heavily logged, and many riparian forests were once logged to the streambank. In some tributary streams in the watershed, large instream accumulations of cedar spalts (waste wood left over from timber salvage operations) block fish passage, impede water flows leading to warmer water temperatures, and degrade water quality by leaching tannins into the water (Smith 2000, pg. 81). In and around the action area, many miles of mature streambank forests were converted to younger stands. In the action area, the riparian areas remain conifer dominated, though increased hardwood communities degraded riparian functions for bull trout habitat in many local tributaries. The loss and degradation of significant riparian habitat has resulted in elevated stream temperatures and loss of large instream wood, including in the Hoh River mainstem in the action area.

Within the Hoh watershed, steep clear cut slopes resulted in landslides, scouring out and simplifying existing instream habitat. Debris flows resulting from landslides have become more common in the Hoh River tributaries, causing a reduction of macroinvertebrates, an important food item for bull trout and for the other fishes on which bull trout prey. The degree to which these debris flows affect the Hoh River mainstem is difficult to assess since the mainstem is already heavily influenced by glacial sediments from several active glaciers (USFWS 2004, pg. 80).

Channel migration in the Hoh River is a natural process regulated, in part, by the accumulation and distribution of large wood debris throughout the river. Instream large wood serves as an anchor for other wood and sediments, which together create instream bars and channel complexity that slows and distributes the braided channels of a meandering stream system. Loss of large wood inputs and alterations in watershed-scale hydrology from land management have reduced the abundance of natural logjams and river bars. The result is that the Hoh River streamflow is less braided than the historical condition. With a single dominant river channel draining water from this large watershed, the erosive forces of channel migration are compromising riverbanks and infrastructure located in the floodplains. To temporarily protect infrastructure, land managers have covered segments of the river banks in riprap (large angular rock). Riprap in rivers provides temporary stability but causes other problems like eliminating the undercut banks and side-channel features that provide complex slow-water habitat rich with diverse prey for bull trout.

Unnamed Tributary at MP4

The unnamed tributary in the project area is a seasonal intermittent stream that drains a 300-acre watershed and flows through the culvert at MP4. It is unlikely that bull trout are accessing the creek beyond the mouth of this tributary because of excessive the streamflow presents a velocity barrier. The existing culvert is perched several ft at the confluence with the Hoh River during most of the summer and fall. It is only accessible to fish during high water in the winter and spring. Stream substrate is mostly cobble and large boulders. Critical habitat for bull trout was not designated in this unnamed tributary.

Tower Creek (C3)

Tower Creek is a swift-flowing perennial tributary to the Hoh River at RM 23.3. WFLHD reports that temporary barriers are likely currently limiting bull trout to the lowest reach of the stream below the existing Tower Creek Bridge (BA, pg 23). This 2.5-mile long tributary to the mainstem Hoh River drains approximately 1,000 acres. Approximately half of the watershed was once logged. Site C3 is in a confined and steep-sided canyon, portions of which are vegetated. The west bank appears to be eroding upstream of the bridge, resulting in some un-vegetated slopes and sediment delivery to the stream. Bank erosion is extensive near the confluence of Tower Creek and the Hoh River. Salmonscape (2016) documents bull trout occurring in Tower Creek. Critical habitat for bull trout was not designated in Tower Creek.

Canyon Creek (C5)

Canyon Creek is accessible to bull trout. The stream is a swift-flowing perennial tributary to the Hoh River at RM 26.4. This 3-mile long tributary to the Hoh River drains approximately 1,000 acres and has a large alluvial fan at its mouth. Upstream of the undersized culvert on the Upper Hoh River Road, Canyon Creek is approximately 15 ft wide. Immediately downstream of the existing culvert, there is a 35-foot wide plunge pool, acting as a partial fish barrier (Salmonscape 2016). Three-quarters of the watershed was once logged. Bull trout distribution in Canyon Creek is currently limited downstream of Upper Hoh River Road due to the road crossing structure that is currently proposed for reconstruction. Critical habitat for bull trout was not designated in Canyon Creek.

Critical Habitat in the Action Area

The mainstem Hoh River is designated bull trout critical habitat (70 FR 56212), including (1) spawning and rearing habitat, and (2) foraging, migration, and overwintering (FMO) habitat.

The action area contains only designated FMO habitat. The status of each primary constituent element (PCE) of DCH relevant to the action area is briefly described below. PCE 6 does not occur in the action area.

PCE 1: Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia

Cool water delivered to the Hoh River is relatively abundant due to the largely intact floodplain maintaining watershed-scale groundwater connectivity with the river. In the action area, existing conditions include natural banks and riprap-covered banks where layers of rock armoring reduce hyporheic connectivity to the river. PCE 1 is slightly degraded in the action area due to riprap bank armoring and generally functional at broader scales.

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

Bull trout migration is unimpeded in the mainstem Hoh River within the action area. Access to tributaries in the action area is limited by existing roadway infrastructure, such as undersized culverts. While the historical extent of accessible habitat in these tributaries is not known and likely varied in response to tree fall and debris flows, it is reasonable to assume that accessible habitat frequently occurred upstream of the current limits at or near the Upper Hoh River Road.

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

Quantitative assessments of the bull trout food base at the scale of the action area are not available; however, studies in the action area show that short-term disturbances have measurable, temporary, and localized effects on the macroinvertebrate community and the localized food base (e.g., Kiffney et al. 2004) for bull trout. The food base is likely abundant because a large portion of the watershed is essentially undisturbed and the action area is in an area with extensive forest cover, which is important for production of the invertebrate prey base. At the scale of the action area, the armored streambanks that simplify habitat structure and the location of the Upper Hoh River Road in the riparian forest likely reduce overall productivity and access to food, but only marginally because connectivity with the upper watershed likely maintains adequate, if not high quality prey, throughout the watershed.

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

Complex river and stream environments occur in the action area. The Hoh River has complex instream structure with multiple channels, large wood, and suitable substrates. The Upper Hoh River Road is very near the river in the action area, and rock armoring to protect the road from erosion has simplified banks, eliminating many of the undercut banks that may have existed in the action area. Compared to the watershed as a whole, the action area has a relatively high concentration of armored riverbanks, but habitat complexity in the action area remains functional.

Accumulations of large wood occur in the Hoh River in the action area, and there is likely more wood embedded in the river bars. However, the source of large wood in the action area is being replenished below natural levels because bank armoring reduces recruitment of riparian trees into the stream and because the Upper Hoh River Road occupies a significant portion of the riparian area. Transport of wood out of the action area is likely elevated above the natural baseline because the channelized status of the Hoh River mainstem imposes higher energy flows on the action area than would be observed in a more complex and braided river. Fortunately, the action area also receives large wood from the upper watershed. Therefore, PCE 4 likely remains functional in the action area.

PCE 5: Water temperatures ranging from 2 to 15 degrees Celsius, with adequate thermal refugia available for temperatures that exceed the upper end of this range

The Washington State Department of Ecology manages two water quality monitoring stations in the Hoh River basin. One site is upstream of the action area in Twin Creek, a tributary to the Hoh River where overall water quality met or exceeded expectations and is of lowest concern (Ecology 2016). The other site is at RM 16.5, approximately 2 miles downstream of the project area, in the mainstem Hoh River, where overall water quality is of moderate concern. In four out of 22 years sampled, moderately high temperatures were recorded, including 2015, the most recent sampling year reported (Ecology 2016).

PCE 7: A natural hydrograph, including peak, high, low and seasonal ranges or, if flows are controlled, minimal flow departure from a natural hydrograph

The hydrograph in the Hoh River is not controlled (there are no significant dams). Alterations from the natural hydrograph result from land use, particularly timber harvest, in and around the action area, which are associated with elevated peak flows and shorter groundwater turnover rates (i.e., faster linkages between rainfall events and peak streamflow). A similar outcome is also resulting from climate change. Within DCH in the action area, the magnitude of any departure from a natural hydrograph is difficult to quantify. It is likely that elevated peak flows from land-use driven hydrograph changes are a factor in causing the streambank erosion and bank armoring described above in the status of PCE 4. Intact landscapes without timber harvest in the upper watershed are protected by Olympic National Park and likely minimize the intensity of land-use driven hydrography changes at scales broader than the action area.

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

Water quality and water quantity are functional in the action area, though this PCE does exhibit negative effects of land use and climate change. Monitoring results from 2009 and 2010 documented exceedance of temperature criterion in the Hoh River on 51 percent and 8 percent of days monitored, respectively (Ecology 2016). Most other water quality parameters met water quality criteria in most years sampled, such as 7 bacterial excursions recorded from 105 samples taken in the Hoh River between 2001 and 2009 (Ecology 2016).

Forty-four years of streamflow measurements in the Hoh River were collected downstream of the action area (Golder and Associates 2009, pp. 60, 71). These data show a trend of minimum flows decreasing by approximately 5 cubic ft per second per year. There is insufficient information to quantify instream flow and its effect on fish passage at the specific scale of the action area. The Watershed Management Plan for the Water Resource Inventory Area encompassing the Hoh River encourages more extensive monitoring of water quantity.

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

Nonnative species that prey on, interbreed with, or compete with bull trout are not known to occur in significant numbers in the Hoh River or South Fork Hoh River (Brenkman, S., pers. comm. 2016).

Conservation Role of the Action Area for Bull Trout and Bull Trout DCH

The action area includes a portion of the Hoh River core area for bull trout. The action area, including the DCH within the action area, provides essential foraging, migration, and overwintering habitat for bull trout. All waters accessible to fish within the bull trout core area provide a necessary contribution to the forage base that is important to the seasonal habitat needs, survival, and growth of individual migratory fish. Bull trout habitat in the action area is essential for maintaining the connectivity, distribution, and overall abundance of bull trout in the Hoh River core area.

Climate Change

Our analyses under the Act include consideration of ongoing and projected changes in climate. The terms "climate" and "climate change" are defined by the Intergovernmental Panel on Climate Change. "Climate" refers to the mean and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (IPCC 2014a, pp. 119-120). The term "climate change" thus refers to a change in the mean or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (IPCC 2014a, p. 119). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (IPCC 2014b, pp. 64, 67-69, 94, 299). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

All salmonids, including bull trout, are highly sensitive to changes in temperature. The current distribution of bull trout is linked to broad-scale stream temperature gradients, with spawning and rearing areas constrained to streams with appropriate temperature regimes (Dunham et al. 2003, p. 901). Maximum summer water temperatures in many low elevation rivers on the Olympic Peninsula are currently exceeding optimal levels for salmonids (Halofsky et al. 2011,

p.44), and recently developed stream temperature models for the Pacific Northwest indicate the warming trends on the western Olympic Peninsula will likely continue over the next 40 years (Isaak et al. 2015). Projected increases in winter peak flows, increases in summer stream temperatures, and lower summer streamflows suggest there will be declines in freshwater habitat quality and quantity for salmon, steelhead, bull trout, and resident fish on the Olympic Peninsula (Halofsky et al. 2011, p. 54). Increased stream temperature and reduced summer stream flows could particularly affect bull trout by reducing the quantity and quality of spawning and rearing habitat (Halofsky et al. 2011, p. 46).

Over a period of decades, climate change may directly threaten the integrity of the essential physical or biological features (PBF), formally known as PCE, described in Appendix B: Status of Designated Critical Habitat: Bull Trout. Protecting bull trout strongholds and cold water refugia from disturbance and ensuring connectivity among populations were important considerations in addressing this potential impact. Additionally, climate change may exacerbate habitat degradation impacts both physically (e.g., decreased base flows, increased water temperatures) and biologically (e.g., increased competition with non-native fishes).

The likely degradation of aquatic habitats due to predicted climate change impacts highlights the importance of maintaining and improving functional riparian zones to naturally regulate stream temperature, water quality, and provide for large wood recruitment to aquatic systems. The likely increase in frequency and intensity of floods highlights the need to manage transportation networks to have minimum impacts to aquatic habitat, including increasing culvert sizes to accommodate floods, and avoiding road construction in flood-prone areas, and moving existing roads out of floodplains (Halofsky et al. 2011, pp. 54-55).

EFFECTS OF THE ACTION: Bull Trout

The effects of the action refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

The proposed action includes several projects to be implemented along the Upper Hoh River Road. At three sites on the roadway, the proposed action is to replace two culverts and a bridge with two bridges and a culvert. Where the mainstem Hoh River flows immediately adjacent to the Upper Hoh River Road, the proposed action is to stabilize the riverbank by installing 33 engineered logjams comprised of large woody debris, wood pilings, and concrete dolosse. Estimates of construction duration, including number of days of in-water work, are shown in Table 1. The proposed action is located in foraging, migrating, and overwintering habitat for bull trout in the Hoh River and in Canyon Creek. All bull trout spawning areas are upstream of the action area in the Hoh River and South Fork Hoh River, so the proposed actions will avoid impacts to spawning bull trout and incubating bull trout eggs, alevins, and pre-emergent fry. Most bull trout in the action area are adults or subadults and a low number of juveniles.

Table 1. Estimated construction durations at all project sites

Location	In Water Work (days)	Total Construction (days) [1]
Site C1	45	60
Site C2	45	60
Site MP4 – Culvert	30	45
Site C3 – Tower Creek Bridge	10	90
Site C4	45	60
Site C5 – Canyon Creek Bridge	10	90

[1] All work will take place between June 1 and October 31, 2018, except C3 which may require an additional ten days of construction in January or February

These projects will result in the following effects to bull trout and their habitat. Some of these effects will be temporary, construction-related, and limited in both physical extent and duration. Other effects will be long-term, lasting for the functional life of the proposed action:

- Direct injury/mortality of juvenile bull trout from crushing during rock and large wood placement.
- Direct short-term effects (i.e., stress and/or injury) resulting from exposure to construction-related disturbance, turbidity and suspended sediments.
- Indirect effects to bull trout from impacts of sediment deposition that lead to reduced bull trout prey and their food sources, such as benthic macroinvertebrates.
- Long-term effects to instream habitat structure, function, and diversity.
    - The project will construct bank protections structures (ELJs) that will alter natural channel migration and recruitment of large wood in the affected areas. Structures will also result in local scouring and deposition of stream substrates and sediments, and improved habitat complexity.
    - The project would improve natural stream habitat function and connectivity over the long-term by replacing bridges and culverts on three tributary streams with channel-spanning bridges and an appropriately-sized culvert.

The proposed action will require in-water work (1) to isolate the bridge and culvert worksites from flowing waters in the three tributaries and (2) to install the ELJs in the Hoh River, requiring equipment operation to excavate stream and river beds and banks as detailed in the BA (Table 1, pg. 10). Project sites at the unnamed creek at MP4 and in Tower Creek (C3) are not currently accessible to bull trout, though bull trout are likely to occur in Canyon Creek (C5) and throughout the Hoh River in the action area. Construction activities have the potential to kill or injure a limited number of juvenile bull trout.

Temporary exposures to turbidity plumes are likely to significantly disrupt normal bull trout behaviors (including foraging, migration, and sheltering). These temporary exposures may cause bull trout to avoid the action area, may impede or discourage free movement through the action area, prevent individuals from exploiting preferred habitats, and/or expose individuals to less favorable habitat conditions in the short-term.

In the long-term, bridge and culvert improvements will have beneficial effects to bull trout: removing passage barriers for bull trout or their prey, and increasing stream habitat complexity via installation of ELJs for juveniles and subadults. These effects are detailed below.

Mortality from Crushing and/or Smothering Bull Trout

We expect that some juveniles will be injured or killed because these small individuals exhibit hiding behaviors during disturbance, which puts them at risk of being crushed. We anticipate that a small, but unquantifiable number of juvenile bull trout will be injured or killed within the footprint of in-water construction activities during the proposed project-specific in-water work window of July 15 to August 31. It is estimated that in-water work at C5 will be completed within ten days in this timeframe. All ELJ in-water work will be completed within 45 days.

Log Jam Installation

Construction will be conducted during a project-specific in-water work window when juveniles are most likely to be present in lower numbers. However, bull trout reside in the Hoh River system year-round. Therefore, juvenile, subadult, and adult bull trout are expected to be present in low numbers at the ELJ installation sites during project construction. Adult and subadult bull trout are highly mobile and are expected to move out of construction footprints while construction activities are underway. Juvenile bull trout (e.g., fish less than 100 mm in length) are less mobile and are closely associated with stream substrates. Therefore, a small number of juvenile bull trout are likely to be crushed and/or smothered during in-water equipment operation for ELJ installation. Worksite isolation is not proposed for work in the Hoh River because the work footprint and duration can be significantly minimized without this measure. To the maximum degree practical, equipment will operate from river banks, on dry river beds, or in the area where the subsequent ELJ will be installed to avoid unnecessary in-water work. Therefore, we use an estimate of the in-water work footprint and duration to describe the extent of impacts to individual juvenile bull trout that will be crushed in the mainstem Hoh River. The 33 ELJ/dolosse units would directly occupy approximately 49,500 square ft of substrate in the Hoh River (approximately 1,500 square ft per unit with ELJ units installed parallel to the river bank), and it is expected that all juvenile bull trout in this area will be crushed by equipment operation during 45 days of construction. Construction may occur on multiple ELJs concurrently, so this estimate represents the maximum extent and duration over which bull trout may be exposed to this effect. In summary, juvenile bull trout are reasonably certain to be crushed within the 1,500 square-foot in-water work area where equipment will operate for each of 33 ELJ installations. All of this work is expected to occur over a 45-day period during July and August.

Bridge and Culvert Replacement

Bridge and Culvert replacement along the Upper Hoh River Road will occur in small to medium tributaries to the Hoh River. Work on C5 will be conducted using dewatering and diversion techniques.

At site C3, Tower Creek, in-water work is limited to the approximately 150 lineal ft of the stream (approximately 1,800 square ft) that would be dewatered and isolated. As Tower Creek (C3) is not currently accessible to bull trout beyond the stream's mouth, bull trout are extremely unlikely to be crushed and/or smothered during in-water work and those effects are discountable.

The unnamed tributary at MP4 is a seasonally-flowing stream only accessible to bull trout during high-water conditions in winter and spring (BA, p. 22). Bull trout are likely to use this reach downstream of project activities during high-water conditions, but are not likely to remain and persist in the creek year-round. Because in-water work at MP4 will occur only during the drier conditions in July and August, it is extremely unlikely that bull trout will be present and directly affected by the project action. Direct effects to juvenile bull trout from being crushed and/or smothered at MP4 during in-water work are therefore considered discountable.

At site C5, Canyon Creek, dewatering and temporary work in the channel are planned to remove the old culvert, similarly to Tower Creek. Work area isolation and the attendant removal of fish within the project area are conservation measures designed to reduce the risk of fish stranding and other forms of injury (e.g., exposure to intense turbidity). However, isolation and removal techniques themselves can injure or kill fish. Low numbers of juvenile and small subadult bull trout to occur in Canyon Creek during the in-water work window. The subadult fish are likely to be detected and removed (see *Disturbance and Displacement of Bull Trout* below) because these fish are active and the work area is small. A small number of juvenile bull trout may avoid capture and relocation as they remain undetected in stream margins under vegetation or in gravels (Parsley et al. 1989). These juvenile fish can be stranded inside the isolated work area of the stream and, if not detected, will die from crushing by equipment operation in the small work space.

In-water work at site C5, Canyon Creek, is limited to the approximately 120 lineal ft of the stream (approximately 1,800 square ft) that will be dewatered and isolated at this site. While fish removal through the use of block nets, hand netting, and electrofishing will remove as many individual fish as possible in dewatered stream segments, it is expected that all juvenile bull trout remaining in this area during these activities will be subject to direct mortality from crushing and/or smothering.

In summary, direct crushing or smothering of individual juvenile bull trout is reasonably certain to result from in-water equipment operation in the following areas:

- 49,500-square foot area (1,500 square ft at each of 33 ELJs arranged along the northern river bank) where in-water equipment operation for ELJ installation will occur over 45 days in the in the Hoh River.

- An isolated work area along 120 linear ft of Canyon Creek (approximately 1,800 square ft) at site C5.

Effects of Project-Generated Turbidity and Suspended Sediment on Bull Trout

The in-water work to (1) to isolate the bridge and culvert worksites from flowing waters in the three tributaries and (2) install the ELJs in the Hoh River, requiring equipment operation to excavate stream and river beds and banks, will cause increased suspension and transport of sediment and turbidity at and downstream of each project site.

High levels of turbidity can adversely affect bull trout and cause lethal or sublethal effects depending on the sediment concentration and the duration of exposure (Newcombe and Jensen 1996). Foltz et al. (2008, p. 335) reported that the peak sediment concentrations below culvert removal sites ranged from 11 mg/L to 900 mg/L, with an average of 830 mg/L for projects that employed best management practices to minimize turbidity. Projects that did not employ erosion control measures had average sediment concentrations over 13,000 mg/L. These concentrations can be expected to last for several hours after construction to 1 day after construction. Based on minimization measures incorporated into the project, we expect that the stream channel excavation will generate relatively low-levels of suspended sediments that are less than or comparable to the mitigated values reported by Foltz et al. (2008, p. 335).

Exposure to suspended sediment concentrations of 830 mg/L for a period of 3 to 24 hours would be expected to cause sublethal effects to juvenile, subadult, and adult salmonids such as avoidance, abandonment of cover, short-term reductions in feeding rates, gill irritation, and increased respiration (Newcombe and Jensen 1996, p. 699). These sublethal effects are considered to be a significant disruption of normal behaviors which creates a likelihood of injury to exposed individuals. A similar exposure to salmonid eggs and alevins can result in delayed hatching, reduced growth, and a potential mortality rate of 0 to 20 percent.

Estimating the Extent of Downstream Sediment Effects

The concentration of suspended sediment in a turbidity plume and the distance downstream that the turbidity plume will carry a significant sediment concentration varies greatly based on site-specific characteristics such as stream substrate, stream gradient, and stream flow. As sediment enters a stream, it is transported downstream under normal fluvial processes and deposited in areas of low shear stress (MacDonald and Ritland 1989). These areas are usually behind obstructions, near banks (shallow water) or within interstitial spaces in the stream substrate. Estimating the extent of downstream suspended sediment effects is difficult because sediment conveyance and mixing characteristics are different for each stream.

Foltz et al. (2008, p. 329) monitored suspended sediment concentrations at 11 culvert removal projects in small streams in Idaho and Washington. They found that suspended sediment and turbidity was highest within 20 m (66 ft) of the project site, and decreased by an order of magnitude at a distance of 100 m (328 ft) downstream. At 810 m (2,657 ft, or 0.5 mile) downstream, suspended sediment concentrations had returned to near background levels. This study provides empirical evidence to indicate that significant sediment plumes are likely to occur at distances exceeding 100 m downstream from in-water construction sites, but all but the finest

sediments fall out of suspension within a distance of 810 m (0.5 mile). Based on the above information, we used the project footprint length plus 300 ft downstream to estimate the area where bull trout are most likely to be subjected to sublethal effects from turbidity plumes.

Log Jam Installation

Based on the location for in-water excavation work away from spawning habitat, bull trout eggs or alevins would not be exposed to construction-related turbidity plumes. Additionally, juvenile bull trout in the action area are expected to occur at low densities, so small numbers of individuals in this age class are likely to be exposed to turbidity plumes. Elevated turbidity and suspended sediment in the water are likely to be limited to the area within 300 ft downstream of the log-jam installation sites based on monitoring of similar projects. Using this assumption, the affected stream area, including the construction footprint was approximated in a GIS analysis from WFLHD-provided shapefiles and maps provided by WFLHD of project sites. This estimate was conservatively calculated to account for unexpected, but possible, high-water conditions (i.e., maximum potential affected area). During installation of the 33 ELJ/dolosse units in four groups along the northern bank of the Hoh River (total installation footprint of 49,500 square ft), the following areas are where the above-described sublethal effects to bull trout will result from temporarily increased turbidity:

- C1: 795 linear ft (0.15 mile) of Hoh River bed; approximately 3.5 acres.
- C2: 2,700 linear ft (0.51 mile) of Hoh River bed; approximately 12 acres.
- C4E: 535 linear ft (0.1 mile) of Hoh River bed; approximately 2.8 acres.
- C4W: 745 linear ft (0.14 mile) of Hoh River bed; approximately 2.9 acres.

The anticipated extent of elevated turbidity resulting from ELJ installation that will subject juvenile, subadult, and adult bull trout to the sublethal effects described above is the 4,775 linear ft (0.9 miles) of Hoh River bed, or approximately 21.2 acres. Turbidity is expected to return to baseline conditions shortly after completion of the 45 days of in-water work. The actual extent of elevated turbidity each day during construction will be more localized and of shorter duration, depending on the number of ELJs constructed at once.

Bridge and Culvert Replacement

As stated previously, construction in Tower Creek, Canyon Creek, and at MP4 will involve dewatering and diversion techniques, which will temporarily disturb stream beds and banks and result in increased turbidity and sediment plumes extending approximately 300 ft downstream during and immediately following installation and removal of flow diversions.

Though Tower Creek (C3) is not currently accessible to bull trout, sediment plumes from this will barely reach the mainstem Hoh River. The distance from the mainstem Hoh River to the construction site at C3 varies depending on the water level of the Hoh River. A GIS analysis of aerial imagery representative of the construction season shows the site is more than 200 ft upstream from the convergence of Tower Creek with the mainstem Hoh, so only the downstream

end of the turbidity plume will reach the Hoh River. The turbidity will dissipate almost immediately as suspended sediment is diluted by mixture of the slight flow from Tower Creek with the massive flows of the Hoh River. Therefore, the intensity of turbidity and suspended sediment in the Hoh River, resulting from construction at C3 will be insignificant to bull trout.

The unnamed tributary at MP4 is a seasonally-flowing stream only accessible to bull trout during high-water conditions in winter and spring (BA, p. 22). Bull trout are likely to use this reach downstream of project activities during high-water conditions, and individuals do not persist in the creek. Because in-water work at MP4 will occur only during the drier conditions in July and August, it is considered extremely unlikely that the project will deliver disturbed sediments to flowing waters or that bull trout will be present and directly affected by the project action. Effects to bull trout from exposure to turbidity and suspended sediments from construction at MP4 are, therefore, considered discountable.

At site C5, Canyon Creek, dewatering and temporary work in the channel are required to replace the culvert. Because bull trout may occur in Canyon Creek, individual bull trout will be exposed to suspended sediments in this tributary. As described above, exposure to suspended sediment is likely to result in significant behavioral alteration within 300 ft downstream of this project site (approximately 6,000 square ft). It is expected that all bull trout in this area during these activities will be subject to sublethal effects from increased turbidity, as detailed above. The distance from site C5 in Canyon Creek to the Hoh River is greater than 300 ft and thus all significant exposure of bull trout to temporarily elevated turbidity from construction at C5 will occur within Canyon Creek.

Project-generated turbidity and sediment plumes from construction at C5 will be of short duration during and immediately following diversion installation and removal. Minimization measures that address negative impacts of in-water work on turbidity include worksite isolation, construction timing during an in-water work window with relatively low streamflow, and manual installation of diversion materials (BA, Table 12, p. 41). Additionally, erosion control during and following the project will minimize the potential for sediments to reach flowing waters. Recontouring and replanting of riparian vegetation on disturbed banks will avoid long-term effects on bank stability and the related sediment delivery to streams as a result of construction.

Following construction at site C5, fine sediments that were temporarily suspended in the water column will deposit downstream, which can degrade downstream habitat. Sedimentation is expected to be temporary (one season) due to the short-term nature of construction activities and the measures described in the BA ensuring replanting of disturbed banks. Bull trout prey on certain groups of benthic macroinvertebrates, such as mayflies, caddisflies, and stoneflies, as well as on other fish species, such as Chinook salmon and steelhead trout. While sediment deposition is likely to reduce abundance of each of these prey species, (Everest et al. 1987; Waters 1995; Birtwell 1999), we anticipate this effect will be extremely localized and short-term (up to a season). Therefore, streambed sedimentation will result in fine-scale, short-term changes in the location where individual bull trout forage in the action area. This proposed action is likely to reduce macroinvertebrate prey production in the project footprint and 300 ft downstream (approximately 400 linear ft), or approximately 6,000 square ft. Because prey

resources also include other sources, such as riparian and upstream sources, we anticipate foraging will proceed throughout bull trout-occupied areas of Canyon Creek during the 10 days of work in the isolated portion of the stream.

In summary, project-generated turbidity and suspended sediments will result in sublethal effects on juvenile, subadult, and adult bull trout in the following locations:

- 4,775 linear ft (0.9 miles) along the northern bank of the Hoh River (approximately 21.2 acres) during 45 days of in-water work in the mainstem Hoh River from ELJ installation
- 6,000 square foot portion of Canyon Creek at the start of and shortly after 10 days of worksite isolation (this is the reach within 300 ft downstream of the project site).

Disturbance and/or Displacement of Bull Trout

In-water construction activities at each ELJ-installation site in the mainstem Hoh River will disturb individual bull trout. Although we anticipate that much of the disturbance will be related to activities that occur directly within the wetted width of the stream, such as placement of wood and other materials for ELJs, the accompanying vibrations created by the heavy equipment operating just outside the waters to place the substantial materials into the Hoh River may also contribute to bull trout disturbance. Disturbance of juvenile and subadult bull trout results in their temporary displacement from the project sites during these activities. In such cases, most bull trout are expected to leave the area in which the disturbance occurred until the disturbance subsides, sometimes moving into the area of suspended sediments described above, and other times moving out of the project area. An unknown number of individuals may remain in the vicinity of the work.

Whether individual bull trout leave the project area as a result or disturbance or remain in the project area during project activities, they will experience significant temporary disruptions to normal foraging behaviors through reduced feeding efficiency or displacement from productive feeding areas. While reduced feeding efficiency creates a likelihood of injury, we anticipate that these effects will be temporary and that feeding will still occur at a rate that will support continued growth and maturation. The disturbance will persist longer for individuals that remain in the project area, resulting in potential for reduced feeding efficiency for up to 45 days during in-water work along 4,775 linear ft of the Hoh River, and at the start and finish of 10 days of in-water work in 400 linear ft of Canyon Creek. Exposure to disturbance will be much shorter for individuals that move away from project activities. Although we expect displaced individuals will make short, localized movements into other portions of the Hoh River or its tributaries where individuals will forage effectively, this is considered to be significant because those movements can be energetically costly.

We anticipate that all streambank stabilization projects that include in-water work will result in significant disruptions to normal rearing, foraging, migrating, or overwintering behaviors for subadult and adult bull trout. For this analysis, we used the project footprint length plus 300 ft downstream to estimate the area where bull trout are most likely to be subjected to sub-lethal

effects associated with disturbance. We anticipate that these effects will be temporary, and based on the low densities of bull trout within the action area, very few bull trout are likely to be affected. Bull trout will likely resume their normal behavior once project actions are completed.

Effects to Instream Habitat Structure, Function, and Diversity

Some effects of the project will benefit bull trout through improved habitat complexity in and around the ELJs, and restored access to over one mile of suitable habitat in Canyon Creek. The effects of altered hydrology on the hydrodynamics in the action area are difficult to quantify. Qualitatively, we anticipate ELJs to function beneficially for bull trout, similarly to natural logjams. Slower streamflow resulting from the localized diversion of waterflow increases in-channel bar formation from increased sediment deposition and promotes channel complexity. It is expected that the project will maintain streambank stability and riparian functions, in the long-term. Additionally, the project would improve natural stream habitat function and connectivity over the long-term by replacing bridges and culverts on three tributary streams with channel-spanning bridges and an appropriately-sized culvert. These effects are expected to last for the functional life of the proposed streambank stabilization measures.

Effects of Interrelated and Interdependent Actions

It is likely that sections of the Upper Hoh River Road will be subjected to frequent flood damage and delivery of the road fill materials to stream channels, resulting in local sedimentation or aggradation effects. Depending on the severity of the flood damage, some road sections may be damaged and rebuilt several times over subsequent years. Future reconstruction of any failed bank protection structures is not a covered action under this Biological Opinion and will require separate analysis and consultation under section 7 of the Act.

Summary of Effects to Bull Trout

The WFLHD, in partnership with Jefferson County, proposes to re-construct stream crossing structures along the Upper Hoh River Road, over three tributaries to the Hoh River. The project partners also propose to construct engineered log jams in the mainstem Hoh River to deflect streamflow away from the banks, and to reduce maintenance and repair frequency on the Upper Hoh River Road caused by river channel migration. The projects are designed primarily to protect roadway infrastructure by accommodating natural river hydrology.

Some effects of the project will benefit bull trout through improved habitat complexity in and around the ELJs, and restored access to over one mile of suitable habitat in Canyon Creek. These effects are expected to last for the functional life of the proposed streambank stabilization measures.

These projects will also result in negative effects to individual bull trout and their habitat. Some of these effects will be temporary, construction-related and limited in both physical extent and duration. Temporary construction impacts associated with equipment operation, turbidity, and suspended sediment will occur during July and August in the year the project is implemented, and highly localized reduction in prey production will persist through the following autumn as a result of project-generated habitat disturbance:

- Direct mortality of very low numbers of juvenile bull trout resulting from crushing and/or smothering associated with in-water equipment operation in:
    - 49,500-square foot area (1.1 acres) (1,500 square ft at each of 33 ELJs arranged along the northern river bank) where ELJ installation will occur over 45 days in the in the Hoh River.
    - An isolated work area along 120 linear ft of Canyon Creek (approximately 1,800 square ft) at site C5 at within 10 days of initiation of worksite isolation.

- A likelihood of injury (i.e., physiological stress and/or sub-lethal injury) resulting from short-term exposures to construction-related turbidity and sediment plumes within a distance of 300 ft downstream from construction sites. Project-generated turbidity and suspended sediments will result in sublethal effects on juvenile, subadult, and adult bull trout in:
    - 4,775 linear ft (0.9 miles) along the northern bank of the Hoh River (approximately 21.2 acres) during 45 days of in-water work in the mainstem Hoh River from ELJ installation.
    - 6,000 square foot portion of Canyon Creek at the start of and shortly after 10 days of worksite isolation (this is the reach within 300 ft downstream of the project site),

- Reduced prey production associated with sediment deposition that results from changes in channel configuration following placement of ELJ structures. The extent of reduced prey production in the Hoh River is defined by the extent of project-generated turbidity and suspended sediment because we expect the deposition areas from these effects to promote sediment aggradation, covering the stream bed. The duration is expected to persist through the autumn after construction across 4,775 linear ft (0.9 mile) along the northern bank of the Hoh River (approximately 21.2 acres) in the mainstem Hoh River from installation of 33 ELJs.

EFFECTS OF THE ACTION: Designated Bull Trout Critical Habitat

The bull trout critical habitat designation includes 32 CHUs in six recovery units located throughout the coterminous range of the bull trout in Washington, Oregon, Idaho, Montana, and Nevada. The action area is located within the Olympic Peninsula Unit, which is one of eight CHUs located within the coastal recovery unit (FR 75 63935). The Olympic Peninsula CHU is located in northwestern Washington. Bull trout populations inhabiting the Olympic Peninsula

comprise the coastal component of the Coastal–Puget Sound population. The unit includes approximately 465 miles of streams, 7,572 acres of lake surface area, and 329 miles of marine shoreline designated as critical habitat (75 FR 63938). The Olympic Peninsula CHU is divided into 10 critical habitat subunits, which encompass individual bull trout core areas (e.g. Hoh River core areas) as well as FMO habitats located outside of core areas. The subunits within this unit provide spawning, rearing, foraging, migratory, and overwintering habitats for bull trout that are essential for maintaining distribution of the amphidromous life history form within the Coastal Recovery Unit (USFWS 2010, p. 17). Foraging, migratory, and overwintering habitats for bull trout occur in the action area.

Effects to the Hoh River Critical Habitat Subunit and Core Area

The Hoh River core area comprises the Hoh and South Fork Hoh Rivers, associated tributaries, and the estuary. The Hoh River core area includes expanses of National Forest, National Park, and industrial timberlands, encompassing over 191,000 acres, and including over 100 miles of mapped bull trout streams. About 20.7 miles of bull trout critical habitat are designated in the action area, supporting one local population of bull trout of unknown size (abundance), though overall in the Hoh River core area, adult bull trout abundance was estimated to be 250 to 1000 adults (USFWS 2008, pg. 23). Bull trout abundance in the Hoh River core area was recently estimated to be stable (USFWS 2008, Figure 3). The upper Hoh Road provides the primary access to Olympic National Park, but its location in the floodplain constricts the river and is vulnerable to washouts. Repair and reconstruction efforts both in and outside of the park have armored significant portions of the river's banks and reduced channel complexity. This project utilizes more natural and complex stream bank protection measures to stabilize the Upper Hoh River Road and increases fish passage under the Hoh Road to allow juvenile bull trout use of rearing and refugia habitats in Canyon Creek, a tributary not designated as critical habitat.

The proposed action will result in short-term negative effects to critical habitat PCEs from in-stream sediment disturbance, and temporary turbidity plumes, and long-term beneficial effects of increased habitat complexity from ELJ structures that mimic natural wood accumulation. The negative effects associated with sediment disturbance and turbidity will occur along approximately 4,775 linear ft (0.9 mile) along the north bank of the Hoh River. Although this action will temporarily degrade the condition of bull trout critical habitat associated with the Upper Hoh River Road, these effects are localized and limited in scale, and described in detail below.

Because the effects of the action are localized and temporary, we do not expect the effects of the action to reduce the function of critical habitat PCE at the scale of the action area during the project, or at any scale within the Hoh River core area in the long-term.

Effects to the Designated Critical Habitat PCEs

PCEs are the physical and biological features of critical habitat essential to a species' conservation. Effects analyses for bull trout critical habitat evaluate how a proposed action will affect the capability of the PCEs to support the life-history needs of the species and provide for its conservation (75 FR 63943). There are nine PCEs of bull trout critical habitat listed in the final rule that address the specific habitat requirements essential for bull trout conservation. The

nine PCEs relate to (1) water quality; (2) migration habitat; (3) food availability; (4) instream habitat; (5) water temperature; (6) substrate characteristics; (7) stream flow; (8) water quantity; and (9) nonnative species (75 FR 63931). We do not anticipate negative effects on PCE 1, 6, 7, 8, or 9. Measurable or significant adverse effects to PCE 2, 3, 4, and 5 are described below:

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

During construction, this PCE is likely negatively affected through localized adverse impacts to the migration habitat as a result of short-term disturbance from in-water equipment operation or from temporary water-quality impairments through increased sound, vibrations, visual disturbance, and/or increased turbidity levels. Daily and seasonal movements of bull trout in the mainstem Hoh River may change during in-water construction, though we expect this PCE to remain functional throughout the majority of the action area during the entire action. The restriction of in-water work to the work window in July and August limits the effects to temporary and localized impairment of the PCE in the 4,775 linear-foot area along the north bank of the Hoh River (approximately 21.2 acres) during in-water work. Over the long-term, PCE 2 will return to baseline levels of function or will be slightly enhanced as a result of improved instream complexity from ELJ installation.

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

The proposed actions will result in a short-term, localized degradation of the food base for bull trout through sedimentation in and downstream of the ELJ construction sites where production of fish and macroinvertebrates will be temporarily reduced. This effect is described in detail above in the effects analysis for bull trout. Temporary reductions in prey production will occur in 4,775 linear ft of the north bank of the Hoh River (approximately 21.2 acres during construction and lasting through autumn after the project). Even with temporary reductions in the food base, we anticipate the entire action area will continue to contain an adequate food base because prey resources also come from riparian and upstream sources. PCE 3 will remain functional.

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

Complex habitats would be temporarily degraded sediment disturbances, altered substrate embeddedness, as well as enhanced over the long-term through large woody debris installation, improved streambank stability, and floodplain connectivity. Though the project will remove some riparian trees that would naturally recruit to the river, those trees will be used in construction of ELJs. Therefore, we do not consider the riparian removal to be a reduction in large woody debris recruitment. The project will not alter the arrangement or accessibility of

off-channel habitats, such as wetlands or side channels. The installation of 33 ELJs will improve in-stream habitat complexity for juvenile, subadult, and adult bull trout over the long-term throughout the 49,500 square foot area (1.1 acres) along the north bank of the Hoh River.

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

Riparian vegetation is one of the most important factors controlling water temperature in streams, especially during summer months (Everest and Reeves 2007, p. 10). The water temperature of large rivers is less affected by riparian vegetation. Most available solar radiation reaches the surface of large streams, but diel temperature variations are minimized by stream depth and volume of flow (Everest and Reeves 2007, p. 11). Because the areas affected by the these projects are limited in scope, and are adjacent to major river channels, effects to water temperature are considered to be insignificant.

Summary of the Effects to Bull Trout Critical Habitat

In the preceding section, we determined the proposed actions will result in localized and temporary degradation of PCEs (2) migration habitat; (3) food availability; (4) instream habitat; and (8) water quality. These effects will occur throughout the 4,775 linear ft along the north bank of the Hoh River (approximately 21.2 acres), and the duration of the effect is limited to the construction period at each site.

CUMULATIVE EFFECTS: Bull Trout and Designated Bull Trout Critical Habitat

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 Opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

The Service is not aware of non-federal actions that are reasonably certain to occur in the action area. Because the action area for the proposed actions is primarily located on federally-managed forestlands (Olympic National Park and Olympic National Forest [ONF]) and non-federal forestlands covered by Service-approved HCPs, cumulative effects, as defined under the Act, are not anticipated. The Service completed formal consultation on these HCPs, and anticipated that there would be significant adverse effects to bull trout and bull trout critical habitat from the covered forestry activities, but concluded that these effects are not likely to jeopardize the continued existence of bull trout, or adversely modify designated bull trout critical habitat (USFWS 2006, pp. 783, 809). Because these effects have already been addressed through section 7 consultation, they are not considered cumulative effects.

INTEGRATION AND SYNTHESIS OF EFFECTS: Bull Trout

The Integration and Synthesis section is the final step in assessing the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we evaluate the effects of the action, the status of the species and critical habitat, the environmental baseline, and cumulative effects, to formulate our biological opinion as to whether the proposed action is likely to: (1) appreciably reduce the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of DCH for the conservation of the species.

The proposed action involves bank stabilization and bridge and culvert improvement projects in five locations along the Upper Hoh River Road in the Hoh River Core Area for bull trout.

Historic habitat loss and fragmentation, interaction with nonnative species, and fish passage issues are widely regarded as the most significant threat factors affecting bull trout rangewide. The primary strategy for the recovery of bull trout is to conserve the species so it is geographically widespread across representative habitats and demographically stable in six recovery units; and to effectively manage and ameliorate the primary threats at the core area scale such that bull trout are not likely to become endangered in the foreseeable future (USFWS 2015, p. v).

The primary threats identified for the Hoh River core area include impaired fish passage at former dam sites outside the action area, threats to instream flows associated with municipal water rights, forage fish availability, and competition/hybridization with brook trout. Other threats include impacts associated with roads that parallel the river, loss of channel complexity, and fisheries bycatch (USFWS 2015a, p. 22). Considering the predicted effects of climate change to hydrology and stream temperature on the Olympic Peninsula, these primary threats are likely to be exacerbated by increased summer temperatures and increased frequency and intensity of winter floods, which will likely lead to more road failures and increased sediment loading to streams.

In the Environmental Baseline section, we established that that action area supports foraging, migratory and overwintering habitat for adult, subadult and low numbers of juvenile bull trout. The conservation role of the action area, including DCH within the action area, provides essential foraging, migration, and overwintering habitat for bull trout.

Effects of the Action on Bull Trout Numbers, Reproduction, and Distribution

Population viability analysis has been applied to assess the long-term persistence of bull trout populations (Rieman and McIntyre 1993, Post et al. 2003, Staples et al. 2005). Sensitivity analyses in these models have pointed to the importance of survival of older age classes to population persistence. Post et al. (2003) found that populations of migratory bull trout may be highly susceptible to declines from increased mortality of larger, older fish due to angling. Bull trout generally do not attain first maturity until at least 5 years of age. Thus, in bull trout populations, survival of older juveniles and adults appears to be a critical factor influencing population persistence (Dunham et al. 2008, p.544).

These population viability analyses have provided important perspectives on the dynamics of individual populations of bull trout. Within the context of a stream network, connectivity among populations (dispersal) and access between habitats used for spawning and foraging are critical for sustaining populations. Bull trout populations within core areas exhibit complex dynamics and structuring that represent a composite of different metapopulation, landscape, and historical processes (Dunham et al. 2008, p.544). Studies of large scale patterns of habitat or "patch" occupancy by bull trout show that local population persistence in stream networks is strongly tied to patch size (stream or watershed size), connectivity, and habitat quality (Dunham and Rieman 1999). The importance of habitat size and connectivity to the persistence of bull trout is supported by several lines of evidence that examine temporal processes driving these patterns (e.g., dispersal, demographic variation, and environmental variability) (Dunham et al. 2008, p.544).

The Pacific coast core areas on the Olympic Peninsula (Hoh, Queets, and Quinault) do not have any physical barriers to migration that limit the movement of bull trout within or between core areas. Radio-telemetry studies have demonstrated that migratory bull trout in these coastal core areas seasonally use habitat in multiple drainages, including waters in neighboring core areas (Brenkman and Corbett 2005, p. 1078). Populations that have the potential to exchange individuals through dispersal are much more likely to persist than populations that are totally isolated (Rieman and McIntyre 1993, p. 16). Based on the metapopulation theory forwarded by Reiman and McIntyre (1993), we expect that the coastal core areas on the Olympic Peninsula (Hoh, Queets, and Quinault) have a high level of connectivity and are resilient to minor disturbance-related habitat perturbations.

In the Hoh core area, the proposed action will result in 1) low levels of bull trout mortality; 2) short-term, sublethal effects associated with turbidity plumes and riverbed sedimentation; and 3) localized temporary degradation of designated critical habitat PCEs. Although this action will result in temporary degradation of bull trout habitat, the magnitude of these effects are limited in scale. Because the effects of the action are highly localized, and occur in areas previously degraded by the presence of the Upper Hoh Road, we do not expect the effects of the action to influence bull trout distribution or habitat use within the Hoh core area after project construction is completed.

We expect direct mortality of very low numbers of juvenile bull trout resulting from crushing and/or smothering associated with in-water equipment operation in:

- 49,500-square foot area (1.1 acres) (1,500 square ft at each of 33 ELJs arranged along the northern river bank) where ELJ installation will occur over 45 days in the Hoh River.

- An isolated work area along 120 linear ft of Canyon Creek (approximately 1,800 square ft) at site C5.

Bull trout demography is most sensitive to adult mortality and habitat connectivity within and between core areas. The anticipated mortality of low numbers of juvenile bull trout is not likely to measurable reduce the likelihood of persistence of the Hoh River local population, which is distributed over 56 miles of river habitat within the basin.

Additionally, the project will result in a likelihood of injury (i.e., physiological stress and/or sub-lethal injury) from short-term exposures to construction-related turbidity and sediment plumes within a distance of 300 ft downstream from construction sites. Project-generated turbidity and suspended sediments will result in sublethal effects on juvenile, subadult, and adult bull trout in the following areas:

- 4,775 linear ft (0.9 miles) along the northern bank of the Hoh River (approximately 21.2 acres) during 45 days of in-water work in the mainstem Hoh River from ELJ installation.

- 6,000 square foot portion of Canyon Creek at the start of and shortly after 10 days of worksite isolation (this is the reach 300 ft downstream of the project site)

Finally, reduced prey production is expected to persist through the autumn after construction across 4,775 linear ft (0.9 miles) of the northern bank of the Hoh River (approximately 21.2 acres) from installation of 33 ELJs.

Effects to Designated Critical Habitat

In the action area, bull trout critical habitat was designated in the mainstem Hoh River. Negative effects to DCH are likely to be localized to the area within the project footprint (cumulatively, 4,775 linear ft, or approximately 21.2 acres) in the Hoh River and limited to the period of active construction and through the following autumn as a result of project-generated habitat disturbance. It is anticipated that, following completion of in-water work, designated critical habitat conditions will return to baseline or be slightly improved as a result of ELJ installation within a year after construction.

Although we anticipate localized adverse effects to individual bull trout and DCH will occur from implementation of the proposed action, these effects are not anticipated to appreciably reduce the likelihood of persistence through a reduction in the numbers, distribution, or reproduction of bull trout in the affected core areas, the coastal recovery unit, or within the listed range of the species.

Additionally, the proposed action will not permanently reduce the function of DCH in the action area to provide for the conservation of the species. The recovery objectives outlined in the Service's recovery plan for bull trout are to conserve bull trout and to effectively manage and ameliorate the primary threats at the core area scale (USFWS 2015, p. v). Considering the localized nature of the effects of the proposed actions, we conclude that the conservation role of the action area, and the function of designated bull trout critical habitat to provide for the connectivity, distribution and overall abundance of bull trout, will be maintained at the scale of the action area, the Hoh core area, DCH subunits and units, the coastal recovery unit, and range-wide.

CONCLUSION: Bull Trout and Designated Bull Trout Critical Habitat

After reviewing the current status of bull trout, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's Opinion that the action, as proposed, is not likely to jeopardize the continued existence of bull trout and is not likely to destroy or adversely modify DCH for the bull trout.

STATUS OF THE SPECIES AND CRITICAL HABITAT: Marbled Murrelet

Status of the Species

The murrelet was listed as a threatened species in Washington, Oregon, and northern California in 1992. The primary reasons for listing included extensive loss and fragmentation of old-growth forests which serve as nesting habitat for murrelets and human-induced mortality in the marine environment from gillnets and oil spills (57 FR 45328 [Oct. 1, 1992]). Although some threats such as gillnet mortality and loss of nesting habitat on Federal lands have been reduced since the 1992 listing, the primary threats to species persistence continue (75 FR 3424 [Jan. 21, 2010]).

Murrelet populations have declined at an average rate of 1.2 percent per year since 2001. The most recent annual population estimate for the entire Northwest Forest Plan area ranged from about 16,600 to 22,800 murrelets during the 14-year period, with a 2013 estimate of 19,700 murrelets (95 percent confidence interval [CI]: 15,400 to 23,900 birds) (Falxa and Raphael 2015, p.7). While the overall trend estimate was negative (-1.2 percent per year), this trend was not conclusive because the confidence intervals for the estimated trend overlap zero (95 percent CI:-2.9 to 0.5 percent), indicating the murrelet population may be declining, stable, or increasing at the range-wide scale (Falxa and Raphael 2015, pp. 7-8).

Murrelet population size and marine distribution during the summer breeding season is strongly correlated with the amount and pattern (large contiguous patches) of suitable nesting habitat in adjacent terrestrial landscapes (Falxa and Raphael 2015, p. 156). The loss of nesting habitat was a major cause of murrelet decline over the past century and may still be contributing as nesting habitat continues to be lost to fires, logging, and wind storms (Miller et al. 2012, p. 778). Monitoring of murrelet nesting habitat within the NWFP area indicates nesting habitat has declined from an estimated 2.53 million acres in 1993 to an estimated 2.23 million acres in 2012, a total decline of about 12.1 percent (Falxa and Raphael 2015, p. 89). The largest and most stable murrelet subpopulations now occur off the coast of Oregon and northern California, while subpopulations in Washington have experienced the greatest rates of decline (-5.1 percent per year; 95 percent CI: -7.7 to -2.5 percent) (Falxa and Raphael 2015, p. 8-11). Rates of nesting habitat loss have also been highest in Washington, primarily due to timber harvest on non-Federal lands (Falxa and Raphael 2015, p. 124), which suggests that the loss of nesting habitat continues to be an important limiting factor for the recovery of murrelets.

Factors affecting murrelet fitness and survival in the marine environment include: reductions in the quality and abundance of murrelet forage fish species through overfishing and marine habitat degradation; murrelet by-catch in gillnet fisheries; murrelet entanglement in derelict fishing gear;

oil spills; and high levels of underwater sound pressure generated by pile-driving and underwater detonations (USFWS 2009, pp. 27-67). While all of these factors are recognized as stressors to murrelets in the marine environment, the extent that these stressors affect murrelet populations is unknown. As with nesting habitat loss, marine habitat degradation is most prevalent in the Puget Sound area where anthropogenic activities (e.g., shipping lanes, boat traffic, shoreline development) are an important factor influencing the marine distribution and abundance of murrelets in Conservation Zone 1 (Falxa and Raphael 2015, p. 163).

For a more detailed account of murrelet biology, life history, threats, demography, and conservation needs, refer to Appendix C: Status of the Species: Marbled Murrelet.

Status of Designated Critical Habitat

The revised critical habitat designation for murrelets encompasses over 3.69 million acres in Washington, Oregon, and California (76 FR 61599 [Oct. 5, 2011]). In Washington, the critical habitat designation includes over 1.2 million acres, located primarily in Late-Successional Reserves (LSRs) on National Forests. The primary constituent elements (PCEs) of critical habitat represent specific physical and biological features that are essential to the conservation of the species and may require special management considerations or protection. The PCEs of murrelet critical habitat include (1) individual trees with potential nesting platforms and (2) forested areas within 0.8 kilometer (0.5 mile) of individual trees with potential nesting platforms that have a canopy height of at least one-half the site potential tree height. This includes all such forest, regardless of contiguity (76 FR 61604).

The conservation role of critical habitat is to support successful nesting and reproduction of murrelets, and to maintain viable murrelet populations that are well distributed across the listed range of the species (76 FR 61609). Much of the area included in the critical habitat designation in Washington includes young forest and previously-logged areas within LSRs that are expected to provide buffer habitat to existing old-forest stands, and future recruitment habitat to create large, contiguous blocks of suitable murrelet nesting habitat. Due to a combination of past timber harvest, wildfire history, and natural topography (e.g., subalpine, wetlands, etc.), currently only about 26 percent (310,956) of the total area within designated murrelet critical habitat in Washington is mapped as potential nesting habitat for murrelets.

For a more detailed account of murrelet critical habitat, refer to Appendix D: Status of Designated Critical Habitat: Marbled Murrelet.

ENVIRONMENTAL BASELINE: Marbled Murrelet and Designated Marbled Murrelet Critical Habitat

Regulations implementing the Act (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area that have undergone section 7 consultation, and the impacts of State and private actions which are contemporaneous with the consultation in progress.

The environmental baseline analysis for the murrelet also describes the relationship of the current condition and conservation role of the action area to murrelet recovery units. The *Recovery Plan for the Marbled Murrelet* identifies six broad "Marbled Murrelet Conservation Zones" across the listed range of the species to geographically define recovery goals and objectives. In Washington, there are two Conservation Zones: Puget Sound (Conservation Zone 1) and Western Washington Coast Range (Conservation Zone 2) (USFWS 1997, p. 114). Murrelet potential nesting habitat and population estimates for the Conservation Zones in Washington are summarized in Table 2.

The action area for this project is located in the northwestern portion of Conservation Zone 2. Conservation Zone 2 includes marine waters within 1.2 miles of the Pacific Ocean shoreline south of the U.S.-Canadian border off Cape Flattery and extends south to the mouth of the Columbia River, and extends inland to the midpoint of the Olympic Peninsula and 55 miles inland in southwestern Washington. Most of the forested lands in the northwestern portion of Conservation Zone 2 occur on public (Federal and state) lands, while most of the forested lands in the southwestern portion are privately owned. Extensive timber harvest has occurred throughout Conservation Zone 2 in the last century, but the greatest losses of suitable nesting habitat occurred in the southwest portion (USFWS 1997, p. 127).

Table 2. Summary of murrelet nesting habitat distribution and populations in Washington

Murrelet Conservation Zone	**Murrelet habitat on federal lands (acres)**	**Murrelet habitat on non-federal lands (acres)**	**Total murrelet habitat in Conservation Zone (acres)**	**Estimated murrelet population (2015) and 95 % confidence intervals**	**Estimated annual population trend (2001-2015)**
Zone 1 – Puget Sound and Strait of Juan de Fuca	532,285	207,112	739,407	4,290 (2,783 – 6,492)	-5.3 %
Zone 2 – Washington Coast	353,800	256,783	610,583	3,204 (1,883 – 5,609)	-2.8 %
Totals	886,085	463,905	1,349,990	7,494	-4.4 %

Note: All habitat figures are approximate values derived from GIS data. Totals were computed prior to rounding. Marbled murrelet habitat estimates represent approximate conditions in 2012, as depicted by Falxa and Raphael. (2015) map data, moderate (class 3) and highest (class 4) suitability. Murrelet population and trend estimates for the year 2015 are from Lance and Pearson (2016, p. i).

Habitat Requirements and Use

Murrelets depend on old forests, or forests with an older tree component, for nesting habitat (Hamer and Nelson 1995, p. 69; Ralph et al. 1995, p. 4; McShane et al. 2004, p. 2-5). Specifically, murrelets prefer high and broad platforms for landing and take-off, and surfaces which will support a nest cup (Hamer and Nelson 1995, entire). The physical condition of a tree appears to be the important factor in determining the tree's suitability for nesting (Ralph et al. 1995, p. 7); but it is also influenced by the surrounding forest.

Radar and audio-visual studies have shown murrelet habitat use is positively associated with the presence and abundance of mature and old-growth forests, large core areas of old-growth, low amounts of edge and fragmentation, proximity to the marine environment, total watershed area, and increasing forest age and height (McShane et al. 2004, pp. 4-39 to 4-42). Murrelets nest preferentially in larger, more-contiguous patches of habitat (Meyer 1999 as cited in Meyer and Miller 2002, p. 760; Nelson et al. 2006, p. 15-16, 20; Raphael et al. 2006, p. 108; Raphael et al. 1995, p. 177). In California and southern Oregon, areas with abundant numbers of murrelets were farther from roads, occurred more often in parks protected from logging, and were less likely to occupy old-growth habitat if it was isolated (e.g., greater than 3 miles) from other nesting murrelets (Meyer et al. 2002, p. 103). Murrelet nests documented in small remnant habitat patches as well as in places that would not typically be considered habitat make it difficult to ascribe a minimum size of habitat required. Murrelet occupancy was documented in remnant habitat patches ranging from 24 acres (Zharikov et al. 2006, p. 113) down to 5 acres in size (Nelson K., pers. comm. 2005). Miller and Ralph (1995, p. 211) found no significant effect of stand size on the status of murrelets in the stands they examined. The smallest category of stands they examined included stands from 5 acres to 50 acres in size; they found nearly a 20 percent occupancy rate in this category.

Estimates of murrelet nest densities vary depending upon the method of data collection. For example, nest densities estimated using radar range from 59 to 824 acres per nest (Nelson 2005, p. 10), and 21 to 77 acres per nest from a study by Nelson (2005a, p. 8). Conroy et al. (2002) found one active nest per 22 acres.

Murrelets detected in the same nesting stands for many years suggests that murrelets have a high fidelity to nesting areas (Nelson 1997, p. 17). Use of the same nest platform in successive years and use of multiple nests in the same tree have been documented, although it is not clear whether the repeated use involved the same birds (Hebert and Golightly 2003, p. 51; Nelson 1997, p. 17). Nelson and Peck (1995, p. 46) found that none of the platforms in their study were reused in subsequent years; however, two of the nest trees were used in more than 1 year. Although based on limited observations, fidelity to the same nest site in consecutive years appears to be lower than for other alcids (members of the family Alcidae), but this may be an adaptive behavior in response to high predation rates (Divoky and Horton 1995, p. 83-84). Repeated use of a specific or neighboring nesting platform may be more common in areas where predation is limited or where the number of suitable nest sites is few because suitable nesting trees are rare.

Ralph et al. (1995, p. 14) speculated the annual use of nest sites or stands by breeding murrelets may be influenced by the nesting success of previous rearing attempts. Although murrelet nesting behavior in response to failed nest attempts is unknown, nest failures could lead to

prospecting for new nest sites or mates. However, Nelson and Peck (1995, p. 52) report two cases of murrelets returning to the same tree in the year following suspected nest failure. Other alcids have shown an increased likelihood to relocate to a new nest in response to breeding failure (Divoky and Horton 1995, p. 83). However, murrelets likely remain in the same stand over time as long as the stand is not significantly modified (Ralph et al. 1995, p. 14). Meyer et al. (2002, p. 97) also found at least a few years passed before birds abandoned fragmented forests.

It is unknown whether juveniles disperse from natal breeding habitat (natal dispersal) or return to their natal breeding habitat after reaching breeding age (natal philopatry). Divoky and Horton (1995, p. 85) predicted that juvenile dispersal is likely to be high because murrelets are non-colonial and nest in widely dispersed nest sites. Conversely, Swartzman et al. (1997 [as cited in McShane et al. 2004]) suggested juvenile dispersal is likely to be low, as it is for other alcid species. Therefore, the presence of unoccupied suitable nesting habitat on the landscape may be important for first-time nesters if they disperse away from their natal breeding habitat.

Habitat Conditions in the Action Area

The projects occur within forests immediately adjacent to the Upper Hoh River Road. The Upper Hoh River Road provides the main access point on the west side of the Olympic Peninsula into the Olympic National Park (Park), creating year-round traffic through the action area with substantial peaks in traffic during the summer, which overlaps with the murrelet nesting season and project schedules. In addition to traffic passing the project sites, the road shoulder provides room to park, so Park visitors often explore the roadside forest or walk out to the mainstem Hoh River at each of the project sites, creating noise and visual disturbance from human activity. Consequently, baseline conditions include traffic-generated noise and visual disturbance along the Upper Hoh Road during the nesting season. Baseline conditions also include predation risks that are likely higher than those observed in pristine habitat as a result of human activity and fragmented forest habitats along the Upper Hoh River Road.

The action area consists primarily of a mix of public and private open forest land, with a few scattered rural residences located near MP 6.0 (BA, p.21). Primary land uses include commercial forest lands owned and managed for timber or wildlife habitat by various private and governmental entities. The result is a complex mix of mature forests suitable for murrelet nesting, maturing forest that may grow into suitable murrelet nesting habitat in the near term, intensively managed timber plantations where habitat development is not likely in the near term, and open space that currently does not provide murrelet habitat. The Hoh River Trust, a private non-profit organization devoted to conservation, manages some habitat along the Hoh River in the action area for long-term conservation objectives consistent with the growth or protection of murrelet habitat. Active logging is more common across the Hoh River on the south side of the valley, where private land is more abundant.

The Hoh River has an active channel migration zone and floodplain. The active hydraulic nature of the river has led to a wide range of seral riparian forest conditions along the river.

Elevation in the action area ranges from about 500 ft above sea level adjacent to the Hoh River, to about 3,200 above sea level at the ridgetops on the north side of the Hoh River valley.

The project is located in the Westside Lowland Conifer-Hardwood Forest habitat type (Johnson and O'Neil 2000, pp. 24-26). The BA states that most of the action area is occupied by native upland and wetland forest vegetation, except for the ditches and cleared areas adjacent to the roadside, which often were characterized by non-native species. These low-elevation forests include a mix of mature conifer-dominated and mixed-species stands, young stands comprised variably of hardwoods or conifers, and developed parcels. Forest stands along the Upper Hoh River Road are generally mid-seral, but several fragmented areas of old growth are present, particularly near the Tower Creek project site, C3.

Numerous large trees greater than 18-inches dbh occur in the action area, including Sitka spruce, western red cedar (*Thuja plicata*), Douglas-fir (*Pseudotsuga menziesii*), and western hemlock (*Tsuga heterophylla*). Many of these trees have large-diameter branches with moss accumulation and cover provided by branches of neighboring trees. Because trees with large diameter branches provide suitable nesting structures for murrelets, these trees are considered PNTs. During a previous consultation site visit on March 25, 2014, the Service observed that PNTs were located near and between MP4 to MP 6.0, being distributed throughout the adjacent stands (USFWS 2014, p. 17).

As described in the BA (pp. 33-34), surveying for PNTs was subsequently conducted on May 12 and 13, 2016, within 120 yards of all project sites. All conifer trees equal to or greater than 18 inches in diameter were identified, and numbers of potential nest platforms (limbs at least 4 inches in diameter with moss) were estimated. Trees were identified using a combination of total tree counts and sampling plots. Where sample plots were used, results were extrapolated to the rest of the sampled stand. Appendix H of the BA provides maps showing the survey zones around each site.

The habitat survey identified 702 potentially suitable habitat trees within 120 yards of the project sites. Table 9 and 10 of the BA (p. 34), provide additional detail regarding the number and size class distribution of these trees within both 65 and 120 yards of each individual project site (these distances are significant because they approximately correspond to the zones of significant effects related to murrelet response to sound). In brief summary, sites C2 and C3 have the most potential nest trees within a 120 yard zone. Site C3 also has a large mature forest stand on the west side of the survey zones, which contributes to a large number of mature trees in the 120 yard survey zone. Based on the PNT survey, WFLHD provided estimates of suitable habitat area within 120 yards of project sites, as summarized in Table 3 (Morrow, S. in litt. 2016). Site C1 has the most suitable habitat (9.8 acres), followed by C2 (8.5 acres), C4 East (4.5 acres), and C3 (3.7 acres). There was no measurable difference in the amount of suitable habitat within 110 yards and 120 yards of project sites.

Table 3. Suitable habitat for marbled murrelets (in acres) near project sites

Project Site	Suitable Habitat (Acres) within 120 yards
C1	9.8
C2	8.5
MP4	0
C3 – Tower Creek	3.7
C4 West	0
C4 East	4.5
C5	0
Totals	26.5

Status of the Marbled Murrelet in the Action Area

The action area is located just north of the Hoh River, which murrelets likely use as a flyway to access nesting habitat higher in the watershed. Survey data for presence of potential murrelet nesting trees in the action area was not collected beyond 120 yards from project sites. However, WDFW Priority Habitats and Species data documented over 100 "occupied" detections of murrelet within the zone where noise would be above ambient levels due to the action. Detection data included three levels of audio-visual survey records: (1) confirmed nest locations, (2) observations of eggshells or grounded nestlings, and (3) sub-canopy behavior of adults, including circling within canopy height (WDFW 2005, pp. 42-48). Two of the sub-canopy behavior detections are within the portion of the action area that would be exposed to elevated noise from pneumatic power tools used during construction (calculated as a 0.86 mile buffer from project sites)(BA 2016, p.17). The closest detection to one of the project sites is a single detection made on July 25, 2000, approximately 2,000 ft southeast of the upstream end of site C4 (BA 2016, p. 29).

There are no reliable data from which to estimate the number of murrelets in nesting habitat at the scale of an individual project site or an individual stand of suitable nesting habitat. Raphael et al. (2002, p. 331) used radar to count numbers of murrelets flying inland within 10 river drainages on the Olympic Peninsula. Murrelets were detected in each of the drainages monitored, and the total number of murrelets counted was strongly correlated with the total amount of nesting habitat in the watershed. Raphael et al. (2002, p. 340) calculated an average density of more than 370 acres of nesting habitat per murrelet detected in their study on the Olympic Peninsula (each bird detected represents a potential nesting pair) but acknowledged that murrelets likely occur at higher densities in some locations. Simultaneously active nests have been documented within a distance of 32 to 110 yd from each other (Nelson 1997, p. 13).

Some studies suggest that murrelet densities are generally lower where habitat quality is less optimal, but Burger and Waterhouse (2009, p. 108) found that murrelet nests can occur within lower quality habitats. However, one rigorous study in Clayoquot Sound, British Columbia, estimated that there were no nests in habitats classified as 'good and sub-optimal' and 0.11 nests

per ha in 'excellent' habitat (Conroy et al. 2002, p. 121)[1]. Given the past data for murrelet occupancy in the action area and the quality of suitable habitat, it is reasonable to expect that suitable habitat in the action area is likely to be occupied.

Surveys for murrelets were conducted on the west side of the Olympic Peninsula outside of the action area, but the resulting information is useful in understanding the status of murrelets that may occur within the action area. In a radio-telemetry study conducted for nesting murrelets on the Olympic Peninsula, Bloxton and Raphael (2005, p. 5) documented a nest success rate of 0.2 (2 chicks fledging from 10 nest starts). From 2004 to 2008, in the Puget Sound and outer coast of Washington, Bloxton and Raphael (2009, p. 2 and 5-6, 8) captured and banded 162 murrelets, placed radio transmitters on 157 adult murrelets, monitored 20 nests, and observed only three successful nests (an additional nest was presumed to be successful) (p. 8). Within Conservation Zones 1 and 2, the 2015 monitoring results from the Northwest Forest Plan Effectiveness Monitoring Program for the Marbled Murrelet found that murrelets were declining by 4.4 percent per year at the state scale during the 2001 to 2015 period (Lynch et al. 2016, p. 3). This information indicates that murrelets in the action area likely exhibit extremely low rates of reproductive success. A number of stressors in the action area contribute to low overall productivity, including noise and visual disturbance, increased risk of nest predation, and habitat removal and displacement. Below are discussions of these stressors related to the proposed action.

The Hoh River Valley serves as a flight corridor from marine foraging habitat to upland habitat either within the action area or beyond. Nelson and Peck (1995, p 49), Peery et al (2004, p 348), and others have documented strong fidelity to flight corridors and routine use of roads and rivers as corridors. Nelson and Peck (1995, pp. 47-48), Naslund and O'Donnell (1995, pp. 129-130), Stumpf et al. (2011, p 126), and Bigger et al. (2006) documented adult breeding and non-breeding murrelets transiting during daylight and evening hours more than 120 minutes outside of sunrise or sunset. Naslund (1993) found murrelets visit nesting habitat throughout the year. Information from these studies suggests both non-breeding and breeding adults are transiting through the project area at all times throughout the year.

Noise and Visual Disturbance

We previously analyzed the effects of noise and visual disturbance to murrelets (e.g. Appendix E; and USFWS 2013, p. 101-111) and concluded that noise and visual disturbance can disrupt normal murrelet nesting behaviors in some situations. Significant disturbance occurs when human-generated noise or activity causes a murrelet to avoid or delay nest establishment, flush away from an active nest site during incubation or brooding, abort a feeding attempt to nestlings, or maintain increased vigilance (USFWS 2006a, p. 123). A flush from a nest site includes movement out of an actual nest, off of the nest branch, and away from a branch of a tree within suitable habitat during the nesting season. Such events are considered significant because they are reasonably certain to reduce hatching success, fitness, or survival of juveniles and adults.

[1] ha - hectre

Noise and visual disturbances associated with vehicle traffic are common in the action area, with increased frequency during the nesting season from summer visitors to the Park. The analysis in Appendix E: Revised Disturbance Analysis for Marbled Murrelets, distinguishes the effects of noise and visual disturbance resulting from consistent traffic from the effects of noise and visual disturbance resulting from road maintenance, forest management (e.g., timber harvest or hazard tree removal), and impulsive noises (e.g., impact pile driving). Although at least one murrelet nest was located near an existing roadway, which may suggest that acclimation to routine noise and visual disturbance can occur, additional disturbances near that nest site caused adults to flush from the nest or abort a nest visit (Hamer and Nelson 1998, p. 17). Aborted feedings and changes in flight direction in response to vehicle traffic have also been observed in murrelets (Hebert and Golightly 2006).

Murrelets in the action area routinely experience noise and visual disturbance from vehicle traffic and human activity along the roadway during the nesting season. Such traffic-generated noise and visual stressors likely result in some delayed or aborted feedings currently. In turn, this likely leads to greater energetic demands on adults carrying food to chicks and on chicks maturing to fledging size, particularly for any murrelets nesting within approximately 110 yards of the Upper Hoh Road. Existing noise and visual disturbance from vehicle traffic would not effectively mask other types of noise and visual disturbance (Hamer and Nelson 1998, p. 17).

Nest Predation

Nest predation was cited as a cause of murrelet nest failure and may be a limiting influence on the reproductive success of the murrelet population. Murrelets are believed to be highly vulnerable to nest predation compared to other alcids and forest-nesting birds (Nelson and Hamer 1995, p. 97; USFWS 1997, p. 47). Small increases in murrelet predation can have deleterious effects on murrelet population viability due to their low reproductive rate (one-egg clutches) and current low level of recruitment.

A broad suite of animals are likely predators of murrelet eggs and young, including at least 10 mammalian and avian species (Raphael et al. 2002, p. 221). Nest failure and predation were highest within 50 m (55 yards) from edges of clearcuts, especially in areas close to human activity (Raphael et al. 2002, pp. 229–230). Steller's jays (*Cyanocitta stelleri*) and common ravens (*Corvus corvax*) are known predators of murrelet nests (Nelson and Hamer 1995a, p. 65; Peery et al. 2004, p. 1095; Hebert and Golightly 2007, p. 221), and gray jays (*Perisoreus canadensis*) are suspected predators (Nelson 1997, p. 14). Other suspected nest predators include northwestern crows (*Corvus caurinus*) and American or common crows (*Corvus brachyrhynchos*) (Nelson and Hamer 1995, p. 93; Nelson 1997, p. 14; Manley 1999, p. 36). Collectively, we refer to the above birds as corvids. Predation by squirrels and mice has been documented at artificial nests (Luginbuhl et al. 2001, p. 562-563) and these animals cannot be discounted as potential predators on murrelet eggs and chicks (Raphael et al. 2002, p. 228; Bradley and Marzluff 2003, p. 1181, 1184; Malt and Lank 2009, p. 1284).

Steller's jays were found in abundance at "hard-edged sites" (edges of clearcuts 5 to 11 years old) and "soft-edged sites" (next to regenerating stands 17 to 39 years old), but they were rare at "natural-edged sites" (next to rivers and avalanche chutes) (Malt and Lank 2009, p. 1284).

Simulated murrelet nests placed in stands along hard edges had 2.5 times the probability of disturbance by avian predators relative to nests placed in adjacent interiors, whereas nests in soft edges were only one-third as likely to be disturbed as nests in adjacent interiors (Malt and Lank 2009, p. 1278). Nests in natural-edged sites showed little difference in risk of avian disturbance between edges and interiors (Malt and Lank 2009, p. 1278).

The relationship between predation and habitat edges is more complex than reflected in earlier studies. Marzluff et al. (2000) found predation on murrelet nests may be reduced by buffering stands near (less than 0.6 miles) human activity, but stands far (more than 3 miles) from human activity have equal rates of nest predation from their edge to their interior (Marzluff et al. 2000, Figure 5, p. 1136). Buffers far from human activity would, therefore, be ineffective. Moreover, increasing the contiguity of mature, complex, and especially old-growth forests near humans by buffering may actually reduce the productivity of nesting murrelets because many avian nest predators are most abundant in such settings (Marzluff et al. 2000, Figure 6, p. 1137). Increased predator abundance in such settings is correlated positively and significantly with the rate of nest predation. Accordingly, nests in contiguous forests near humans are depredated an average of 3 to 5 days faster if they are in stands of complex to very complex structure than if they are in stands of simple structure. The habitat feature measured that was most significantly associated with the rate of nest predation was stand structure. In contrast to expectations, stands of mature forest with uniform (simple) structure had significantly lower rates of predation than stands of complex or very complex (old-growth) structure (Marzluff et al. 2000, Figure 7, p. 1137). The relationship between human activities and predators, and their potential impact on murrelet nesting success, has been identified as a significant threat to murrelets (Peery and Henry 2010, p. 2414). The risk of predation on murrelet nests by avian predators (especially corvids) appears to be highest in close proximity to forest edges (including roads), campgrounds, and settlements (Raphael et al. 2002, Marzluff and Neatherlin 2006). Raphael et al. (2002, p. 226) reviewed the few available studies and records of predation at murrelet nest sites and observed that predation caused most nest failures within 50 m (55 yards) of forest edges. Human activity concentrated on the Upper Hoh Road likely subjects murrelets nesting within 55 yards of the roadway to elevated predation risks.

Habitat Removal and Displacement

Murrelets have demonstrated high site fidelity to nesting stands and, in some cases, fidelity to individual nest trees (McShane et al. 2004, p. 2-14). Fidelity to nest sites imparts potential benefits to a long-lived species related to increasing breeding success and lifetime fitness. Nest site fidelity can reduce reproductive effort by increasing the chances of breeding with the previous year's mate, eliminating or reducing the need to locate a new suitable nest site each year, and developing a familiarity with the surrounding environment (Divoky and Horton 1995, p. 83).

Privately-managed forests in the action area have largely been subject to historical and recent timber harvest, so near-term timber harvesting on those parcels would occur in young, densely stocked forests that lack the structure to support murrelet nesting. Historical timber harvests and natural disturbances in the action area have likely forced murrelets returning to previously used nesting areas to relocate to an alternate nest tree or to a different site altogether. Locating

alternate nest sites is likely to disrupt normal murrelet nesting behaviors. The potential effects of this disruption may include a delay in the onset of breeding, nest-site abandonment, or failed breeding due to increased predation risk at a marginal nesting location (Divoky and Horton 1995, p. 83; Raphael et al. 2002, p. 232). Several authors report nest site fidelity in murrelets, consistent with that of other alcids where birds return to previously occupied, but recently destroyed nest sites, for two or more years after the destruction of the nest location (Divoky and Horton 1995, p. 86). Each of these outcomes has the potential to reduce the nesting success for individual breeding pairs, and could ultimately reduce recruitment of juvenile birds into the local population (Raphael et al. 2002, pp. 231-233).

Research in Oregon (Meyer et al. 2002., p. 110) and in British Columbia (Zharikov et al. 2006, p. 117) indicates that murrelets do not immediately abandon fragmented or degraded habitats. Murrelets are likely to maintain fidelity to their nesting sites as long as the habitat stands retain some suitable nesting structures and the birds are able to successfully nest at the site (Divoky and Horton 1995, pp. 83-84). However, murrelet populations eventually decline in fragmented habitats, most likely as a consequence of increased predation at nest sites along clear-cut edges (Raphael et al. 2002, p. 232, Meyer et al. 2002., p. 110, McShane et al. 2004, p. 4-108).

Most of the action area is covered by the Washington Department of Natural Resources State Trust Lands Habitat Conservation Plan or the U.S. Forest Service's Northwest Forest Plan. Other nearby lands are managed for conservation interests by the Hoh River Trust and forests adjacent to the channel migration zone of the Hoh River are within riparian buffers per the Washington State Forest Practices rules. Thus, beyond the habitat area removed for this project, we do not anticipate further removal of habitat from the project sites due to harvest or separate projects unless another Federal action were to be initiated in the future. Due to the existing conservation plans, suitable habitat on Federal and State lands in the surrounding landscape will be protected from timber harvest except under unusual circumstances (such as responding to emergency situations).

Windthrow

Past timber harvests and natural disturbances increased the exposure of remaining habitat suitable for murrelet nesting to windthrow. Forest stands and individual trees vary in their susceptibility to windthrow. Washington State Forest Practices Rules currently require a 300-foot buffer around murrelet-occupied stands, but within that buffer, the rules only require 75 trees per acres over 6 inches in diameter with some larger trees where available. This prescription is often applied to harvesting densely stocked hemlock stands where it is unlikely to provide for the wind-firm integrity of the buffer itself, so the level of protection provided for the adjacent habitat stands is not well understood. Densely stocked trees often are relatively unstable due to excessive height-to-diameter ratios and small rooting diameters (as indicated by vertically and horizontally narrow tree crowns). Hemlocks have characteristically shallow roots making them particularly vulnerable to windthrow. Little high- or moderate-quality habitat remains on private lands in the surrounding landscape. Habitat remaining on State or Federal lands is often adjacent to other Federal or State lands providing better buffers than those required under Forest Practices regulations. Chronic windthrow is normally most intense along sharply contrasting stand edges (e.g. cleared areas next to older forests), but severe weather events can

also have profound effects throughout a stand. Severe storms may be more frequent due to global climate change (Salathé 2006; Warner et al. 2012). Substantial amounts of murrelet habitat have been lost or degraded in the past decade from such windstorms. There is no information to suggest that this trend will change. However, in this case, the complex canopies indicate a lower risk for catastrophic windthrow (that is, historical storms resulted in fine-scale within-stand heterogeneity and not a recent stand-replacing event). Windthrow risks are typically greatest in the few years after adjacent timber is clear-cut harvested due to the sudden change in wind exposure (Mitchell 2013, p. 150). Given the long-term exposure of these sites to long-fetch winds along the Hoh River, the stands as a whole are likely to be extremely wind-tolerant (Mitchell 2013, p. 149). Therefore, windthrow maintains changes within the murrelet habitat, but is not considered to be a major issue threatening habitat suitability in the action area.

Status of Critical Habitat in the Action Area

Critical habitat for the murrelet was designated originally on May 24, 1996. It was subsequently revised on October 5, 2011. In the action area, designated critical habitat occurs only on Federal forestland. Critical habitat designated for murrelets contains two PCEs: 1) individual trees with potential nesting platforms, and 2) forested areas within 0.5 mile of individual trees with potential nesting platforms, and with a canopy height of at least one-half the site-potential tree heights. Federal lands with one or both PCEs are considered to be critical habitat by definition.

Areas with platform-bearing trees (PCE 1) are found in close proximity to the project sites and throughout ONF lands in the action area and areas serving as PCE 2 are adjacent to the project area and throughout the ONF lands in the action area. PCE 2 in the action area is fragmented by the Upper Hoh Road and by neighboring younger forests lacking the structural elements of suitable murrelet habitat. As described above in the *Status of the Species*, trees with potential platforms (PCE 1) occur in the action area but habitat quality within stands (PCE 2) in which PCE1 occurs are degraded by noise and visual disturbance, windthrow, nest predation, climate change, and fragmentation.

Tree removal for the project will extend into DCH. Specifically, project sites C3 and C4 West are immediately adjacent to, and partially overlapping, federal forest in DCH (Figure 2). The BA effect determination for murrelet critical habitat at sites C1 and C2 is based on the location within Washington Department of Natural Resources (WSDNR) lands that were designated as critical habitat in 1996 (FR 61:26256 [May 24, 1996]). However, these lands were excluded from designation in 1997 with the approval of the WSDNR Habitat Conservation Plan for state trust lands (FR 61:26256, [May 24, 1996]), (FR 81:51365 [Aug. 4, 2016]).

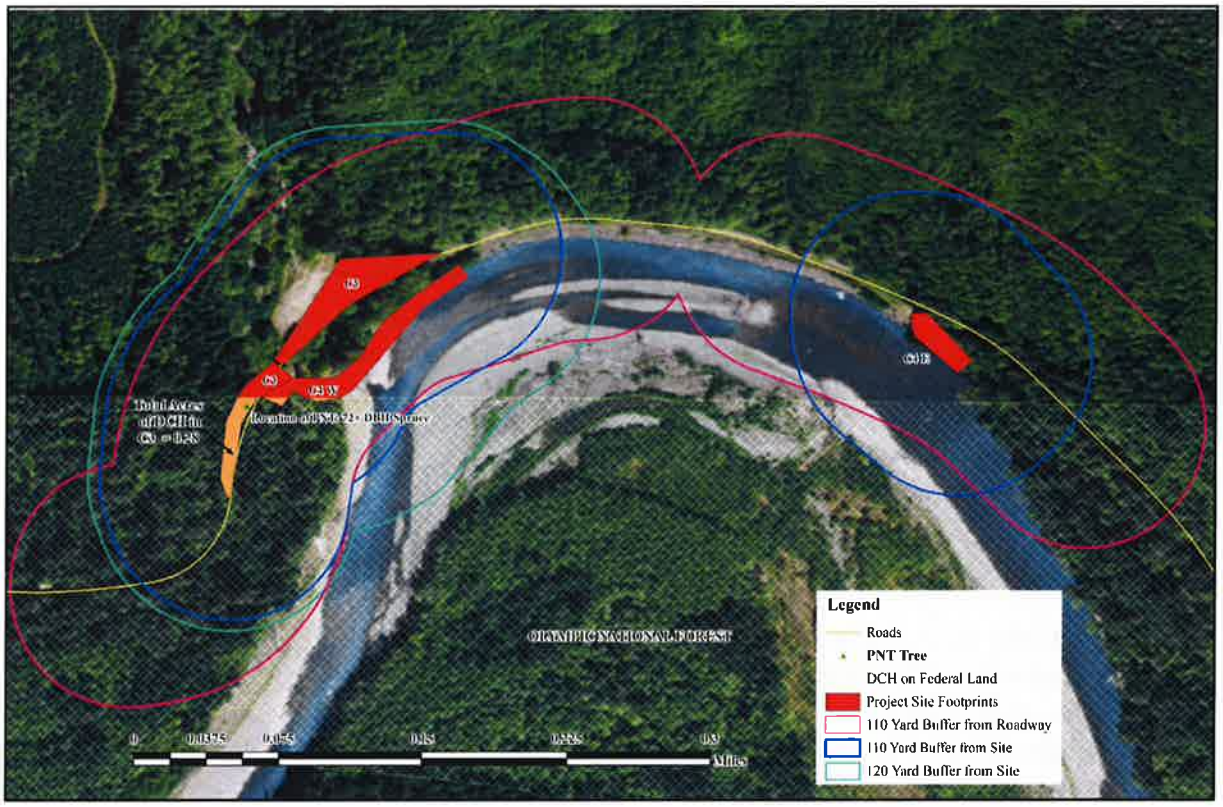

Figure 2. Project Sites C3 and C4 in proximity to DCH in Olympic National Forest land.

Conservation Role of the Action Area for Marbled Murrelets and Marbled Murrelet DCH

The action area is located within Conservation Zone 2, as defined in the Marbled Murrelet Recovery Plan (USFWS 1997, p. 114). The action area contains suitable nesting habitat between 14 (C1) and 16 miles (C4) from foraging habitat in the Pacific Ocean.

Generally, the following lands are considered essential for the recovery of the murrelet: 1) any suitable habitat in a LSR; 2) large areas of suitable nesting habitat outside of LSRs on federal lands; 3) suitable habitat on State lands within 40 miles off the coast; and 4) habitat within occupied murrelet sites on private lands (USFWS 1997, pp. 131-132). The conservation role of the action area is the same as it is rangewide on NWFP lands, namely 1) to support nesting habitat by maintaining and protecting occupied habitat, and 2) to minimize the loss of unoccupied but suitable habitat (USFWS 1997, p. 119). More specifically, the short-term actions necessary to stabilize populations include maintaining occupied habitat, maintaining and enhancing buffer habitat, and minimizing nest disturbances to increase reproductive success (USFWS 1997, pp. 138-142).

Lands considered essential to the recovery of the murrelet within Conservation Zone 2 include all nesting habitat located within the range of the murrelet on Federal lands; nesting habitat on State lands within 40 miles of the coast; and nesting habitat within occupied murrelet sites on private lands (USFWS 1997, pp. 132-133). Murrelet habitat use during the breeding season is positively associated with the presence and abundance of mature and old-growth forests that

contain platforms (large branches or deformities) used for nesting, large core areas of old growth, low amounts of edge habitat, reduced habitat fragmentation, and proximity to the marine environment.

The proposed action is located in a low-elevation floodplain forest adjacent to the Hoh River and its tributaries. The action area includes DCH in ONF lands classified as LSR under the NWFP. It is reasonably certain that suitable habitat in the action area is occupied, as WDFW Priority Habitats and Species data documented over 100 "occupied" detections of murrelet within the action area. Overall, the action area represents an area that contains suitable nesting habitat for the murrelet. The Service recognizes that not all suitable murrelet nesting habitat will be occupied each year and that not all suitable habitat is currently occupied by murrelets. Unoccupied habitats can also be important for murrelet conservation to provide potential nesting opportunities for displaced breeders and/or first-time breeding adults if they disperse away from their natal breeding habitat seeking nesting habitat to colonize.

Climate Change

Our analyses under the Act include consideration of ongoing and projected changes in climate. Climate change is an earth-system response to greenhouse gas emissions caused by Federal and non-Federal actions. Climate change has significant implications on weather that will likely influence the condition of species and alter (lessen or magnify) the effects of human proposed actions on species. During the next 20 to 40 years, the climate of the Pacific Northwest is projected to change significantly with associated changes to forested ecosystems. Predicted changes include warmer, drier summers and warmer, wetter autumns and winters, resulting in a diminished snowpack, earlier snowmelt, and an increase in extreme heat waves and precipitation events (Salathé et al. 2010). Initially, the Pacific Northwest is likely to see increased forest growth region-wide over the next few decades due to increased winter precipitation and longer growing seasons; however, forest growth is expected to decrease as temperatures increase and trees can no longer benefit from the increased winter precipitation and longer growing seasons (Littell et al. 2009, p. 15). Additionally, the changing climate will likely alter the species composition of forest ecosystems.

In summary, climate change is likely to further exacerbate some existing threats such as the projected potential for increased habitat loss from drought-related fire, mortality, insects and disease, and increases in extreme flooding, landslides and windthrow events in the short-term (10 to 30 years). However, while it appears likely that the murrelet will be adversely affected to some degree, we lack adequate information to quantify the magnitude of effects to the species from climate change (USFWS 2009, p. 34). Refer to Appendix C: Status of the Species: Marbled Murrelet for more information.

EFFECTS OF THE ACTION: Marbled Murrelet

The effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

Overview of the Proposed Action

The proposed action involves a number of projects, as presented in Table 4. These projects include ELJ installation in the Hoh River and replacing undersized culverts on tributaries to the Hoh River to improve fish passage, streamflow under flood conditions, and downstream wood transport. Construction activities in the tributaries include stream diversion, worksite isolation, excavation, temporary traffic by-pass lane construction and removal, box-culvert or bridge installation, and site remediation. Site remediation includes restoring the contour of disturbed stream banks, planting natural woody vegetation in disturbed areas, and installing site-appropriate streambed materials. Logjam construction activities include cutting trees for short access routes between the road and the river, construction of worksite platforms on the river bank, bed excavation, driving of wood piles, and placement of wood and dolosse.

Table 4. Overview of projects and use of pile driving

Project Type	Site	General Description	Pile Driving?
Stabilize Bank	C1	Install 6 ELJ/dolosse clusters	Yes: 170 Log piles, vibratory hammer
	C2	Install 23 ELJ/dolosse clusters	No
	C4 East and C4 West	Install 4 ELJ units: 1 ELJ unit at MP 7.5; 3 ELJ units at MP 7.9	No
Replace Culvert	MP4	Replace 72-inch culvert with 16-foot x 16-foot concrete box culvert	Yes: Sheet pile, vibratory hammer
Replace Bridge	C3	Replace 70-foot x 30-foot bridge with 130-foot x 44-foot bridge	Yes: Six 18-inch-diameter hollow steel piles, 18,000 strikes of an impact pile driver
Replace Culvert	C5	Replace culvert with 160-foot x 180-foot bridge	Yes: Six 18-inch-diameter hollow steel piles, 18,000 strikes of an impact pile driver

The proposed action will generate noise and visual disturbance associated with the operation of heavy equipment during the murrelet nesting season in habitat that is considered suitable for murrelet nesting and has not been surveyed for murrelets. For the purposes of our 7(a)(2) analysis, we consider unsurveyed suitable habitat that would be exposed to stressors by the action is reasonably certain to be occupied. The proposed action also includes removal of a few small patches of trees described in detail below and in the August 12, 2016, information response from WFLHD.

The proposed action may affect murrelets through 1) noise and visual disturbance and 2) habitat alteration, both of which increase predation risks to nesting adults and chicks.

Disturbance Effects to Marbled Murrelets

Potential murrelet responses to disturbance include delay or avoidance of nest establishment, flushing of an adult from a nest or branch within nesting habitat, aborted or delayed feeding of juveniles, or increased vigilance/alert behaviors of adults and chicks at nest sites with implications for reduced individual fitness and reduced nesting success. These behavioral disruptions create a likelihood of injury by increasing the risk of predation to adults and chicks, and by reducing the fitness of nestlings as a result of missed feedings. We do not expect that noise and visual disturbance will always result in direct nest failure, but such disturbance creates a likelihood of injury due to an increased risk of predation or reduced fitness of both adults and young.

Evaluation Criteria

As stated in Appendix E, a significant disruption of normal murrelet nesting behaviors due to noise and visual disturbance is reasonably certain to occur when:

- Aircraft noise exceeds 92 dBA sound exposure level at a nest site;
- Ground-based activity occurs during the nesting season within 110 yards of a nest site;
- Impulsive noise from blasting occurs within 0.25 mile of a nest site; or
- Impulsive noise from pile driving occurs within 120 yards of a nest site.

The intensity, frequency, duration, and magnitude of a disturbance event are all important factors the Service considers in the evaluation of disturbance effects. In general, we consider low intensity, short-duration actions (e.g., less than 1 day at a site) to be of much lower risk for disrupting murrelet nesting when compared to prolonged actions that require several days or weeks at a site to complete.

Noise and project activities that occur beyond the disruption distance thresholds listed above are likely to expose murrelets to low-level above-ambient sounds out to distances of 0.25 mile or more. Low-level project sounds that are detectable to murrelets at a distance may affect murrelets by triggering minor behavioral responses, such as scanning or head-turning behaviors, or increased vigilance for short periods. Such minor behavioral responses are considered to have

insignificant effects to nesting murrelets. Exposure to noise and visual disturbance is reasonably certain to result in a significant disruption of murrelet nesting behavior when the activities (e.g., heavy equipment operation and pile driving) occur in close proximity to murrelet nest sites during the nesting season.

Exposure of Murrelets to Noise and Visual Disturbance

Murrelets have not been documented in or directly adjacent to the project sites; however, formal surveys have not been conducted here and past murrelet surveys elsewhere in the action area have detected murrelets (BA 2016, p. 33). Additionally, platform density in the disturbance zone exceeds the minimum density of 10 platforms per acre documented at most known murrelet nest sites in the Pacific Northwest, as can be seen in Table 9 of the BA (Nelson and Wilson 2002, p. 57; BA 2016, p. 34). As we established in the Environmental Baseline, it is reasonably certain that murrelets are nesting in the action area and would be exposed to project effects within 110 yards of ground-based activity and within 120 yards of pile driving.

As previously described, the number of murrelets that will be exposed to noise and visual disturbance is unknown. Acres of suitable habitat is used here as a surrogate for the purposes of this analysis.

As shown in Table 3, murrelet suitable habitat totals 26.5 acres within 120 yards[2] of project sites. Ground-based activity associated with bank stabilization, culvert replacement, bridge replacement, and site restoration, requiring the use of power tools and heavy equipment, will generate noise and visual disturbance for up to 107 days of the nesting season within these 26.5 acres of suitable habitat. Approximately a quarter of the nesting season will pass before project activities begin, but these activities will continue through the remaining 75 percent of the nesting season.

Additional noise disturbance from pile driving may occur at three sites (C1, C3, and C5) using either a vibratory hammer or impact pile driver for up to seven days during the same nesting season. However, suitable habitat does not exist within 120 yards of site C5. Thus, nesting murrelets in the 13.5 acres of suitable habitat that exists within 120 yards of C1 and C3 will be exposed to noise and visual disturbance resulting from impact pile driving for up to seven days within the overall construction period. Although our analysis is structured to consider the effects of pile driving separately from the effects of ground-based activities, these effects will occur concurrently and are not significantly distinguishable.

Nesting murrelets would only be exposed to elevated sound pressure levels that could cause direct injury (i.e., hearing damage) at an extremely close distance (e.g. less than or equal to 5 yards). No suitable habitat occurs within this distance of anticipated impact pile driving activities for the project; therefore, we do not expect nesting murrelets to be injured by impact pile driving activities.

[2] WFLHD's habitat surveys did not find a measurable difference in the amount of suitable murrelet nesting habitat between 110 and 120 yards from the project sites, so this analysis uses the same estimates of habitat area to describe the area where murrelets may be exposed to effects of noise and visual disturbance (110 yards) and effects from impact pile driving (120 yards).

While the Hoh River Valley serves as a flight corridor from marine foraging habitat to upland habitat either within the action area or beyond and we expect that both non-breeding and breeding adults will be transiting through the project area at all times throughout the year, we do not expect transiting murrelets to occur close enough to project activities (i.e., within 110 yards of equipment operation and within 120 yards of impact pile driving) for a long enough duration to experience significant levels of disturbance. Transiting murrelets would be flying higher and in a more direct flight path than murrelets that may be nesting in the action area. If transiting murrelets had any response to construction noise and activity, it would be brief and extremely unlikely to elicit a significant response such as dropping prey or altering a flight path.

Response of Murrelets to Noise and Visual Disturbance

Ground equipment, use of vibratory and impact pile hammers, motorized vehicle activity, increased human presence, and other increased activity in the project area will occur over a five month period (152 days) from June 1 to October 31 and will overlap a large portion of the murrelet nesting season (April 1 to September 23). Work that will generate noise and visual disturbance to nesting murrelets may occur seven days a week during daytime hours outside of the dawn and dusk restriction. Elevated noise levels from pile-driving would last approximately 1 week at C3-Tower Creek Bridge. Though C3-Tower Creek Bridge may require an additional ten days of construction in January or February, this would be outside the nesting season and is not expected to measurably affect murrelets.

The WFLHD has included a Conservation Measure that no project activity will occur two hours after official sunrise and the two hours prior to official sunset during the murrelet nesting season (April 1 to September 23). This timing restriction reduces the potential to expose murrelets to impulsive noise that could disrupt adults and chicks during their daily peak activity periods for nest establishment, feeding, and incubation exchanges. However, even with this restriction, murrelets will be exposed to all project activities during the remainder of daylight hours. Exposure to any activity adjacent to nesting habitat that is beyond the normal activity experienced by murrelets has the potential to cause disturbance. Project activities will likely disrupt some adult nesting behaviors including nest establishment, incubation exchanges, and feeding of nestlings, and will increase the time that individual murrelets spend vigilant. Such events are considered a significant disruption of normal behavior that creates a likelihood of injury because they are reasonably certain to result in reduced productivity (e.g., if nest establishment was avoided or delayed), fitness, or survival of juveniles and adults. Noise and visual disturbance creates a likelihood of injury in the following ways: delaying nest establishment; increasing the risk of predation of exposed eggs, nestlings, and adults; and reduced feeding of chicks. We address these outcomes below.

Delayed Nest Establishment

Because murrelets exhibit high nest site fidelity, increased disturbance around PNTs can adversely affect murrelets. The murrelets returning to that tree in a subsequent season may be forced to locate an alternate nest site. In areas where nesting habitat is highly fragmented or otherwise limited, relocating to a new nest site could result in a delay in the onset of breeding, nest site abandonment, or failed breeding due to higher predation risk at a marginal nesting location (Divoky and Horton 1995, p. 83; Raphael et al. 2002, p. 232).

Prospecting for nest sites is a well-documented murrelet behavior. Prospecting involves individuals or pairs flying near and landing on tree limbs in the early spring and mid-summer. Murrelets also visit nesting areas during the winter and may select nest sites during this time (Nelson 1997, p. 7). Research in Oregon (Meyer et al. 2002, p. 110) and in British Columbia (Zharikov et al. 2006, p. 117) indicates that murrelets do not immediately abandon degraded habitats. Murrelets are likely to maintain fidelity to their nesting sites as long as the habitat stand retains some suitable nesting structures and the birds are able to successfully nest at the site (Divoky and Horton 1995, p. 83-84). Increased disturbance will reduce the overall quality of suitable nest platforms at the stand scale, but is not expected to result in the loss of nesting habitat functions, nor substantially reduce nesting opportunities for murrelets in the action area.

We typically expect that when noise and visual disturbance extends into a murrelet-occupied area, murrelets that have not already initated nesting may elect to nest in a different part of the stand or may delay nesting. The proposed action involves projects scheduled to begin, and thereby produce project-generated noise and visual disturbances, eight to twelve weeks after the start of the nesting season. Based on this timing, any murrelets that haven't already initiated nesting would delay nesting in response to project-generated disturbance and would be unlikely to nest at all (refer to Appendix C).

For these reasons, murrelets exposed to project-related noise and visual disturbance in 26.5 acres of suitable nesting habitat are expected to experience a significant disruption of normal nesting behaviors.

Increased Predation Risk to Adults and Nestlings

Murrelets evolved several mechanisms to avoid predation: they have cryptic coloration, are silent around the nest, minimize movement at the nest, and limit incubation exchanges and chick feeding to occur primarily during twilight hours (Nelson 1997, p. 14). The relationship between human activities and predators poses a significant threat to murrelets through potential impacts on murrelet nesting success (Peery and Henry 2010, p. 2414). Consumption of eggs and chicks by avian predators is a particularly important cause of nest failure due to the frequency of its occurrence (McShane et al. 2004, p. 4-109). The murrelet nests at the highest risk of predation by avian predators are near both forest edges and human activities, where many corvid species (e.g., jays, crows, ravens) are in highest abundance (McShane et al. 2004, p. 4-109).

Murrelets appear to be most sensitive to noise and visual disturbances when they are approaching a nest site or delivering fish to a nestling. There are several documented instances where ground-based activities caused adult murrelets to abort or delay feedings of nestlings, caused adults to divert their flight paths into nesting habitat, or caused murrelets to vacate suitable habitat (Hamer and Nelson 1998, p. 8-17; Appendix E: Revised Disturbance Analysis for Marbled Murrelets). Disturbance that causes a murrelet to flush can advertise the nest's location, thereby creating a likelihood of predation of the eggs or nestlings (USFWS 2006, p. 27).

Noise and visual disturbance are likely to significantly disrupt the murrelets' normal nesting behaviors. Potential murrelet responses to disturbance include flushing from a nest or branch within nesting habitat, aborted or delayed feeding of juveniles, or increased vigilance/alert behaviors at nest sites with implications for reduced individual fitness and reduced nesting

success. These behavioral disruptions create a likelihood of injury by increasing the risk of failed nesting attempts due to predation of nestlings, or through reduced fitness of nestlings caused by missed feedings.

Noise and visual disturbance that causes an adult murrelet to abort a prey delivery also creates a likelihood of injury for the adult through an increased risk of predation (Kuletz 2005, pp. 43-45). Ralph et al. (1995, p. 16) state, "Predation on adult murrelets by raptors occurs in transit to nest sites... Given the small number of nest sites that have been monitored, observations of the taking of adult murrelets by predators raise the possibility that this is not a rare event." They proceed to list several observations of raptors killing adult murrelets and of murrelet wings and bones being found in peregrine falcon nests. The significantly increased time airborne due to an aborted feeding creates a likelihood of injury from predation to the adult. Given the persistence of daily disturbance throughout one nesting season, we believe the project is reasonably certain to increase predation risk throughout the 26.5 acres of suitable habitat exposed to elevated noise and visual disturbance from June 1 to September 23 because this is the period during which construction will overlap with the nesting season.

Reduced Feedings to Nestlings

Murrelets are most sensitive to noise and visual disturbances when they are approaching a nest site or delivering fish to a nestling. Murrelet nestlings are fed primarily during dawn and dusk periods, but also may be fed throughout the day (Nelson 1997, p.18). Even with morning and evening timing restrictions in place, murrelets exposed to noise or visual disturbances are susceptible to missed feedings during the day. Nelson and Hamer (1995a, p. 62) reported that relatively few feedings take place during the daytime. However, in some areas, 31 to 46 percent of feedings take place during the mid-day hours (USFWS 2012, p. 3).

Missed feedings can reduce the fitness of nestlings. During chick rearing, adults feed the young 1 to 8 times per day (mean = 3.2 ±1.3 SD) (Nelson and Hamer 1995a, p. 61). If we assume an average of 4 feedings per day, a single aborted feeding would constitute a loss of 25 percent of that day's food and water intake for the nestling. Such a loss is considered to be a significant disruption of normal behavior given that, "murrelet chicks grow rapidly compared to most alcids, gaining 5 to 15 g/day during the first 9 days after hatching" (Nelson and Hamer 1995a, p. 60). With such a fast growth rate and a low average number of daily feedings, it is reasonable to assume a single missed feeding may disrupt normal growth and create the likelihood of injury by presenting a developmental risk to the chick. Young murrelets that receive multiple daily feedings grow faster and fledge earlier than those receiving prey at lower rates. Early fledging helps minimize nest mortality (Nelson and Hamer 1995a, p. 66).

Fish-eating alcids (e.g., murrelets, *Brachyramphus spp.*; and puffins, *Fratercula spp.*) exhibit wide variations in nestling growth rates. The nestling stage of murrelet development can vary from 27 to 40 days before fledging (De Santo and Nelson 1995, p. 45). The variations in alcid development are attributed to constraints on feeding ecology, such as specialized foraging behaviors, unpredictable and patchy food distributions, and great distances between feeding and nesting sites (Oyan and Anker-Nilssen 1996, p. 830). Food limitation often results in poor growth, delayed fledging, increased mortality of chicks, and nest abandonment by adults (Oyan and Anker-Nilssen 1996, p. 836). Growth rates of body mass and skeletal elements in alcids are

strongly affected by rates of food intake; and low rates of daily food intake result in a significant increase in the duration of chick development time (Kitaysky 1999, p. 466). Some alcids respond to reduced provisioning by slowing their metabolic rates and allocating growth to the head and wings to facilitate successful fledging (Oyan and Anker-Nilssen 1996, p. 830, Kitaysky 1999, p. 470). Murrelets also exhibit this adaptive behavior by prioritizing wing and bill growth in the nest and delaying the development of fat stores to post-fledging development (Janssen et al. 2011, p. 859). This is believed to be an adaptive strategy to reduce the length of the nestling period while maintaining a high probability of successful fledging and survival immediately after fledging (Janssen et al. 2011, p. 866).

Contemporary studies of murrelet diets in the Puget Sound–Georgia Basin region indicate that Pacific sand lance (*Ammodytes hexapterus*) (sand lance) now comprise the majority of the murrelet diet (Gutowsky et al. 2009, p. 251). Historically, energy-rich fishes such as herring and northern anchovy *(Engraulis mordax)* comprised the majority of the murrelet diet (Becker and Beissinger 2006, p. 470, Gutowsky et al. 2009, p. 247). This is significant because sand lance have the lowest energetic value of the fishes that murrelets commonly feed on. For example, a single northern anchovy has nearly six times the energetic value of a sand lance of the same size (Gutowsky et al. 2009, p. 251), so a chick eating sand lance would have to eat six fish to match the energy obtained by eating a single anchovy. This illustrates the significance that a single feeding can represent for a murrelet nestling. Assuming nestlings receive an average of three single-fish feedings per day (Nelson and Hamer 1995a, p. 61), a nestling being fed a low-quality diet comprised primarily of sand lance may be on the edge of its energetic needs for successful development. Nestlings have minimum daily energetic demands to sustain life and development, and mortality from starvation occurs when nestlings do not receive sufficient food (Kitasky 2009, p. 471). A recent study of 158 radio-tagged murrelets in Washington found that of 20 confirmed nesting attempts, only 4 were successful. This is reflective of a very low nesting rate and low nesting success (Bloxton and Raphael 2009, p. 8). The majority of the nest failures were attributed to nestling starvation or adults abandoning eggs during incubation (Bloxton and Raphael 2009, p. 11).

The findings from Bloxton and Raphael (2009, entire) indicate that murrelets in Washington are not initiating nesting or are abandoning their nests during incubation or chick rearing, most likely in response to poor foraging conditions. For those murrelets that do initiate nesting and begin chick rearing, the implications of missed feedings due to noise and visual disturbance could be significant, because each missed feeding represents a delay in the development of the chick, prolonging the time to fledging and increasing the risk of predation, accidental death from falling off the nest, or abandonment by the adults. If the disturbance at a nest site is prolonged, each successive day of disturbance represents an increasing risk that multiple missed feedings will trigger a significant delay in their growth and development processes, cause permanent stunting, or result in the mortality of a nestling due to malnourishment.

Typical patterns of existing vehicle traffic (concentrated around mid-day) and the conservation measure that restricts project activities to mid-day hours mean that murrelet nestlings are likely to receive a minimum of one or more feedings during the dawn or dusk hours. As previously established in the status of the species section, we know that the majority of daily feedings occur during dawn and dusk hours. Depending on the quality of prey delivered, as discussed above, these feedings may or may not be sufficient to sustain chick development. Murrelet chicks suffer from reduced fitness and low fledging weight when prey quality is low and more mid-day feedings are missed (Kuletz 2005, p. 85). Based on a model describing the relationship between energy requirements of murrelet chicks and the number of daily feedings required for fledging, the minimum daily feedings needed by growing chicks range from approximately two herring to eight sand lance per day (Kuletz 2005, p. 85). Over the course of the 27 to 40 day nestling period, the estimated feedings required for successful fledging range from 38, age 1+, herring to 204 sand lance (Kuletz 2005, p. 85). We assume that murrelet nestlings that experience missed mid-day feedings due to noise and visual disturbance will still fledge, but fledgling weights may be low and the development time to fledging may be increased significantly. Such situations create a likelihood of injury through reduced survival and fledging success.

Although we recognize that prolonged disturbance at a site (multiple missed feedings over days or weeks) has the potential to result in the death of a nestling due to malnourishment, we conclude that this outcome is not reasonably certain to occur within the single nesting season over which the projects will occur. This is due to the fact that the peak feeding period is during dawn/dusk hours when project activities are not permitted and existing traffic is less common. Further, the proximity of the action area to foraging habitat enables murrelets to forage at relatively low energy costs compared to murrelets nesting further inland. Due to the variable nature of the murrelet diet, we cannot currently predict with reasonable certainty the number of missed feedings that are likely to result in injury or death of a nestling, or the duration of increased risk before an injury or death is reasonably certain to occur. However, given the persistence of effects throughout the nesting season, the projects are reasonably certain to increase the likelihood of injury through reduced fledging weights of an unknown number of individuals. Although we cannot quantify the number of individuals that may be affected, a reasonable approximation of the extent of effects can be described as the area contained within 110 yards surrounding project sites during ground-based construction and 120 yards during periods of pile driving. Thus, we expect that all murrelet chicks within the 26.5 acres of suitable habitat will be exposed to disturbances that result in an increased risk of missed feedings between June 1 and September 23 (114 days). The project-generated noise and visual disturbance to murrelets will cease at the end of the nesting season (September 23), but the remaining construction and site restoration activities are not expected to impact nesting murrelets. Future operation and maintenance activities in the action area will not significantly differ from baseline conditions.

Summary of Noise and Visual Disturbance Effects

Disturbances that cause a murrelet to flush are expected to increase the likelihood of predation of eggs or nestlings. We expect that noise and visual disturbance is reasonably certain to cause adult murrelets to alter their flight behavior (i.e., abort or delay feedings), creating a likelihood of injury for the adult through increased exposure to predation. Noise and visual disturbance are expected to cause adults to abort or delay feedings to chicks, creating a likelihood of injury to the

chick. The exposure areas have routine disturbances generated by existing vehicle traffic and habitat structure. All of the 26.5 acres of suitable habitat exposed to significantly elevated predation risks as a result of noise and visual disturbance are routinely exposed to noise and disturbance from daily vehicle traffic, given the location of project activities on and along the Upper Hoh River Road. If murrelet adults are exposed to noise and activity levels proposed by the project, it will place murrelet chicks at risk of missing multiple feedings. We expect that multiple missed feedings over days or weeks is reasonably certain to result in nestling injury or death due to malnourishment. However, the limiting operating period described in the Conservation Measures section will allow for feedings to occur each day during the peak prey delivery time without risk of disruption. Therefore, we expect that murrelet nestlings will still fledge, although fledgling weights may be lower, and/or the development time to fledging may be significantly increased.

In summary, murrelets nesting within 26.5 acres of suitable habitat will be exposed to noise and visual disturbance from project activities for 114 days (between June 1 and September 23). This exposure will result in an increased likelihood of injury to the following life history forms:

- Adult murrelets through a significant disruption of normal nesting behaviors will preclude or delay nesting in response to habitat removal;
- Adult murrelets and murrelet chicks through an increased risk of predation over the same time and space; and
- Murrelet chicks through an increased risk of missed mid-day feedings over the same time and space.

Habitat Alteration

Tree removal will occur in potential murrelet habitat adjacent to an existing transportation corridor. In effect, this will temporarily widen a narrow but existing gap in the canopy of a stand providing potential murrelet habitat. The project will involve the removal of 287 small trees and 20 large conifers (>18 inches dbh) total, across 9.4 acres in approximately six patches ranging from a 0.3-acre equipment operation area to a long, narrow 4.5-acre patch along the roadway.

Tree removal will be necessary for access roads and benches constructed on the stream bank to provide equipment access for logjam installation (See Table 5, below). In terms of forest structure, all but 20 of the trees being removed are small hardwoods or conifers in suppressed or intermediate conditions, which indicates a low potential for developing into suitable habitat in the near term.

As stated previously, the proposed project will remove up to 287 trees. The BA provided estimates of proposed clearance areas (p. 13). The maximum area to be cleared is expected to be approximately 9.4 acres in approximately 6 patches. The largest individual patch of tree removal is a long, narrow strip of trees totaling 4.5 acres at site C2.

Most of the 20 large conifers to be removed are 18 to 32 inches dbh and do not currently have significant platforms for murrelets. However, three conifers that will be removed are greater than 50 inches dbh and have suitable platforms for murrelet nesting. This includes one greater than 72-inch spruce located close to the northwest corner of the existing Tower Creek Bridge at site C3, and two large spruce located along the top of the existing streambank at site C4 East.

Suitable nest trees are conifers with live crowns containing suitable nesting platforms. Platforms are often defined as a flat surface greater than or equal to 4 inches in diameter located greater than or equal to 33 ft above ground, with adequate cover. Platforms used for nesting are usually moss-covered branches. For purposes of section 7 consultation, the Washington Fish and Wildlife Office considers potential nest trees to be coniferous trees within 55 miles (88.5 km) of marine waters that support at least one 4-inch (10.2-cm) diameter platform, with horizontal and vertical cover. If a tree or forested area does not support these habitat features, it is our determination that it is "extremely unlikely" to support a murrelet nest.

Table 5. Maximum number and size of trees removed and associated acreage.

Site	Number of Total Trees Removed	Number of Large Conifer Trees to be Removed[1]	Tree Removal Area (Acres)
C1	30	3	1.96
C2/MP4	175	3	4.48
C3 – Tower Creek	30	10[2]	1.29
C4 West	2	0	0.70
C4 East	10	4[3]	0.27
C5 – Canyon Creek	40	0	0.68
Total	**287**	**20**	**9.4**

[1] Large conifer trees defined as greater than 18 inches in diameter

[2] Includes one 72+ inch dbh spruce located close to the northwest corner of the existing Tower Creek bridge.

[3] Includes two 50+ inch dbh spruce located along the top of the existing streambank at site C4 East

In order to reduce impacts to nesting murrelets, all tree removal will occur prior to the nesting season to avoid removing an active nest site. Tree removal associated with the proposed actions will expand the narrow gap in the forest originally created by the construction of the Upper Hoh Road, slightly increasing the overall level of habitat fragmentation at the project sites. Research in Oregon (Meyer et al. 2002, p. 110) and in British Columbia (Zharikov et al. 2006, p. 117) indicates that murrelets do not immediately abandon fragmented or degraded habitats. Murrelets are likely to maintain fidelity to their nesting sites as long as the habitat stand retains some suitable nesting structures and the birds are able to successfully nest at the site (Divoky and Horton 1995, p. 83-84). Other conservation measures for the tree-removal component of the proposed action include minimizing the footprint of project activities, clearly marking the limits

of clearing, and briefing the on-site crews to ensure accurate project implementation. The construction footprints are designed to minimize the number of trees removed and to avoid removing any additional PNTs or trees providing cover to PNTs.

The project will slightly reduce the total number of PNTs and cover available to PNTs. Thus, tree removal will reduce nesting opportunities for murrelets in the action area now and in the future. Given the high site-fidelity that murrelets have demonstrated for individual nest trees and WFLHD's plans to remove three PNTs in the action area, we consider the proposed tree removals to be an adverse effect to murrelets.

Because PNTs will be cut outside the nesting season, the analysis below focuses on the indirect effects of tree removal, most notably effects on avian predators. Habitat alteration, including marginally opening the forest edges, may increase predation risks above those found in interior forest baseline conditions.

Based on the findings of Malt and Lank (2009) and Raphael et al. (2002, p 221), we assume that nesting habitat along roads and trails in the action area has a high level of predation risk. Project effects on forest structure would occur along existing edge habitats and would not affect the majority of the stand, only marginally changing the location of forest-edge effects.

Tree removal will directly alter habitat conditions in the construction footprint: Refer to Table 5 for site-specific acreage of tree removal by site. This analysis was simplified through the appropriately conservative assumption that construction activities will alter habitat throughout the construction footprints by increasing the extent of edge effect. Tree removal in suitable nesting habitat or in close proximity will increase predation risks within 110 yards of the construction footprint (140 acres) for approximately 10 years in the case of small tree removal and 30 to 50 years in the case of large conifer removal. Reducing the amount of interior forest could increase predation risk to murrelet eggs and chicks in the 26.5 acres of suitable nesting habitat estimated to occur within the 140 acres affected by tree removal. Because additional nesting habitat would remain intact in immediately adjacent areas not exposed to project-generated disturbance, and the species' site fidelity, it is likely that a displaced breeding pair would nest in other trees within the remaining habitat or continue to nest in the affected habitat.

Replanting trees and shrubs in impacted project areas at completion will reduce the extent of impacts to forested areas over the long-term. Damage to residual trees will be minimized through directional felling. Additionally, using removed trees for the logjams will minimize the amount of equipment operation needed to load and haul trees away.

Summary of Habitat Alteration Effects

Murrelet adults, chicks, and eggs are expected to experience an increased risk of predation related to an increase in corvid presence following tree removal in 26.5 acres of suitable nesting habitat. The duration of this effect is approximately 10 years for small tree removal and 30 to 50 years for large conifer removal. The removal of 3 PNTs outside the nesting season will reduce future nesting opportunities for murrelets and significantly disrupt nesting of one to three murrelet pairs for at least one nesting season.

CUMULATIVE EFFECTS: Marbled Murrelet

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

Forest-landownership in the action area is a mixture of Federal, State, private, and local municipalities. The suitable murrelet habitat in the action area is primarily located on Federal or State-owned lands, where the respective agencies intend to identify and protect existing murrelet habitat from timber harvest.

Privately-owned land in the action area is sufficiently degraded from historical timber harvests, and from agricultural, residential, and municipal developments that murrelet habitat is not likely to exist in those areas and is unlikely to develop over time. Therefore, future actions on private or municipally-owned lands are not expected to reduce the amount or quality of suitable habitat available for murrelets. It is also likely that commercial forestlands in the action area would be harvested on a 40- to 60-year rotation, preventing substantial increases in murrelet habitat. The exceptions to this are in riparian areas immediately surrounding the project sites and the Hoh River mainstem, and on unstable slopes where state laws regulating forest practices generally prohibit clear-cut timber harvest. These areas may gradually develop into murrelet habitat over the long-term, within a landscape of commercial timber operations. We do not know the extent to which murrelets will nest in riparian buffers and on unstable slopes in commercial landscapes once suitable habitat structures are available. A non-profit conservation organization operating along the Hoh River is likely to identify and protect existing murrelet habitat while also implementing appropriate forest management treatments to restore degraded habitats in a manner that may increase the amount of available habitat in the action area.

Conversion of forestland to developed land uses is reasonably certain to occur in some areas containing young, immature forest stands. Where forests are converted to developed land uses, forests may not be retained in riparian areas and on unstable slopes as described above. Continued development in the action area will perpetuate the conditions that promote large populations of avian predators at the landscape level.

In summary, cumulative effects of non-Federal actions that are reasonably certain to occur in the action area will impact the degree to which murrelet habitat expands over the long-term, and will likely result in large populations of avian predators. We do not know of other activities in the action area that would affect existing habitat.

INTEGRATION AND SYNTHESIS OF EFFECTS: Marbled Murrelet

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed Federal actions in the context of the species' current status, taking into account any cumulative effects, to determine if implementation of the proposed actions is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the species in the wild. The jeopardy analysis in this Opinion emphasizes consideration of the

range-wide survival and recovery needs of the species and the role of the action area in the survival and recovery of the species. It is within this context that we evaluate the significance of the effects of the proposed Federal action, taken together with cumulative effects, for purposes of making the jeopardy determination.

The significant effects to murrelets are associated with 1) noise and visual disturbance during the nesting season, 2) increased areas of elevated predation risk, and 3) altered nesting behavior due to PNT removal. Noise and visual disturbance is reasonably certain to result in a delay in or avoidance of nest establishment, flushing from a nest or branch, aborted or delayed feeding of nestlings, and/or increased vigilance and alert behaviors at nest sites with implications for reduced individual fitness and reduced nesting success. These behavioral disruptions create a likelihood of injury by increasing the risk of predation, reducing the fitness of nestlings as a result of missed feedings, and/or increasing energetic costs to adults that must make additional foraging or nest establishment trips.

We do not expect that noise and visual disturbance will result in nest failure, but acknowledge that disturbance creates a likelihood of injury that can indirectly result in nest failure due to predation or reduced fitness of individuals. Many murrelets exposed to disturbance are likely to nest successfully because the duration of most discrete disturbance events is generally brief (e.g., each project schedule incorporates numerous periods for concrete curing during which project activity is minimal, if ongoing at all).

Temporary exposure of adult murrelets to sound and visual disturbance is not expected to result in nest abandonment and/or nest failure, nor is it reasonably certain to lead to actual injury or death of an adult murrelet. Although missed feedings may lead to delayed or slowed growth of chicks, we do not expect the exposure to result in injury or death of any individual chick.

We expect an increase in predation risk and reduced nesting opportunities following tree removal. Increased predation risks to murrelet chicks and eggs are reasonably certain to occur due to increased corvid presence following tree removal, and subsequent increased edge effect, within 26.5 acres of suitable nesting habitat. The duration of these effects is approximately 10 years for small tree removal and 30 to 50 years for large conifer removal.

The removal of 3 PNTs outside the nesting season is expected to reduce nesting opportunities for one to three murrelet pairs. This disruption of normal nesting behavior is expected to occur for an at least one nesting season.

The action agency incorporated a daily operating restriction that will avoid operations during the daily dawn and dusk peak murrelet activity periods. Strict trash management measures will also be required during construction. These restrictions reduce, but do not eliminate, the likelihood of adverse effects and disrupted feeding attempts. Because we anticipate that murrelets exposed to the project's effects will successfully feed and raise nestlings, and are not reasonably certain to be injured or killed due to predation, we do not anticipate a fitness consequence.

Effects to Murrelet Numbers, Reproduction, and Distribution

We assessed project effects on murrelet numbers, reproduction, and distribution. Increased areas of noise and visual disturbance in 26.5 acres for 114 days of the nesting period will adversely affect murrelets by significantly disrupting normal behavior.

Due to the murrelet's high site fidelity and the fact that major portions of the suitable habitat would remain intact, we do not anticipate murrelets would be extirpated from the action area as a result of the proposed action.

The effects of disturbance throughout one nesting season (after June 1) and increased predation risk over approximately 30 to 50 years would be limited to small areas near the project site locations. Current reproductive success within the action area is expected to be low, and the background probability of predation is high, so the stressors imposed by the projects are not new to the action area.

Overall, we do not expect the probability of nest success or juvenile recruitment into the local population to be measurably reduced as a result of the proposed action. Therefore, we do not anticipate the proposed action will reduce the likelihood of persistence in the action area, the Conservation Zone, or the range of the species due to a reduction in numbers, reproduction, or distribution. The lack of measurable changes resulting from the proposed actions at the scale of the Conservation Zone indicates a similar lack of measurable changes in numbers, reproduction, or distribution of murrelets range-wide.

CONCLUSION: Marbled Murrelet

After reviewing the current status, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects for the murrelet, it is the Service's Biological Opinion that the action, as proposed, is not likely to jeopardize the continued existence of the murrelet.

EFFECTS OF THE ACTION: Designated Marbled Murrelet Critical Habitat

The effects of the action refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

When the Service evaluates the effects of a proposed action within critical habitat, we analyze the impacts to individual CHUs in light of their overall contribution to the survival and recovery of murrelets within the individual Conservation Zones, and within the overall range of the murrelet in Washington, Oregon, and California. We begin this analysis by evaluating an action's effects to PCEs.

PCEs are the physical and biological features of critical habitat essential to a species' conservation. In the 2011 revised Final Rule designating critical habitat for the murrelet (76 FR 61599:61607 [October 5, 2011]), the Service identified PCEs essential to provide and support suitable nesting habitat for successful reproduction of the murrelet, and thus its conservation.

- PCE1: individual trees with potential nesting platforms
- PCE 2: forested areas within 0.5 mile of individual trees with potential nesting platforms, and with a canopy height of at least half the site-potential tree height.

Areas with just PCE 1, or both PCE 1 and PCE 2, are considered to be critical habitat by definition, provided they were not excluded from designation for other reasons. Also, activities that occur within or adjacent to lands in DCH may still have an effect on PCEs depending on the particular aspects of the proposed Federal action.

We consider PNTs, defined earlier in this document to be PCE 1s, as individual trees with potential nesting platforms. A platform is defined as a relatively flat surface at least 33 ft above the ground in a live crown that is at least 4 inches wide (Hamer and Nelson 1995, p. 74; Nelson and Wilson 2002, p. 59). A platform may be a depression on a branch, an area where a limb branches, a surface created by a deformity such as a dwarf mistletoe broom, a debris/moss platform or stick nest equal to or great than 4 inches in diameter including associated moss, lichen, or duff if present (Bloxton and Rahpael 2009; Burger 2002, p. 41; Evans Mack et al 2003, p. 2; Hamer and Nelson 1995, p. 79; Nelson 1997, p. 16). Any forested area with one observed platform is capable of supporting a nest (Evans Mack et al 2003, p. 3). Platforms may be clumped in one area or dispersed throughout the forested area. The last important element of a PNT is vertical and horizontal cover for platforms. Higher quality nest sites have platforms that are generally protected by branches above (vertical cover) or to the side (horizontal cover) (Nelson et al 2006, p. 14). Such cover can be provided by limbs or foliage within the same tree or in adjacent trees. It is assumed that vertical and horizontal cover provides nest platforms both weather protection and visual cover from predators.

If a tree or forested area does not support these habitat features, it is our best professional judgment that it is "extremely unlikely" to support a murrelet nest. Similar to our definition of a PNT, a minimum tree diameter has not been used to identify a PCE 1. With so little data available on the murrelet, it is difficult to accurately judge the probability of murrelet use of a tree based solely on diameter.

Effects to PCE1

As shown in Table 5, approximately 20 large conifer trees would be removed by the proposed project across all sites. Most of these trees are of a smaller size class (18 to 32 inches) and do not provide significant platforms for murrelets.

Approximately three conifers in the largest size class (greater than 50 inches dbh) would be removed by the project at site C3, including one spruce over 72 inches dbh (See Figure 2). At site C3, realignment and grading adjacent to the newly constructed bridge requires the removal of seven additional large conifers. The exact location of the 10 conifers to be removed was not provided, so we assumed that all 10 were within DCH.

Only trees adjacent to the existing roadway will be cut and all cut trees will be replaced with planted native conifers and shrubs before project completion.

We expect that the removal of 287 trees will result in minor changes to stand structure relative to murrelet habitat and will slightly alter the amount or availability of PCE 1. Effects will be minimized by minimizing tree removal as is most practicable and mitigation in the form of tree planting throughout the disturbed area.

Effects to PCE2

The project will create a small gap of 0.28 acre within DCH at site C3. Additionally, sites C3, C4 West, and C4 East involve vegetation removal greater than 0.25 acre within 300 ft of DCH. Thus, the project will marginally degrade PCE 2 by increasing the fragmentation of in the remaining DCH that occurs within 110 yards of the project site. We use a distance of 110 yards (328 ft) to account for the physical effects to forest habitat along critical habitat boundaries due to the loss of trees to windthrow, reduced canopy cover, and altered forest composition (Chen et al. 1992, pp. 390-391). We mapped a 110-yard disturbance buffer along the edge of the DCH to estimate the critical habitat area exposed to potential edge effects. Based on our proximity buffers, we estimate there are 11.06 acres of DCH located within 110 yards of project sites.

PCE 2 may be degraded through project-generated edge effects as work will occur adjacent to, and within, DCH. Fragmented forests impart increased predation risks on murrelets (McShane et al. 2004, p. 4-109) and are less resistant to natural disturbances (Scott and Mitchell 2005). This effect marginally reduces the suitability for successful murrelet nesting of approximately 8.93 acres of critical habitat adjacent to project sites C3 and C4 West and approximately 2.12 acres of critical habitat adjacent to C4 East.

We anticipate that the project will marginally increase edge/fragmentation effects on critical habitat for up to approximately 10 years for small tree removal and 30 to 50 years for large conifer removal. Mitigation would be provided on site through the restoration of disturbed areas at a 3:1 impact to mitigation ratio following construction.

Effects of Interrelated and Interdependent Actions on Designated Critical Habitat

We do not anticipate any interrelated or interdependent actions within murrelet critical habitat due to activities covered by this consultation.

CUMULATIVE EFFECTS: Designated Marbled Murrelet Critical Habitat

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 Opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

For the reasons described above (*Cumulative Effects: Marbled Murrelet*), we do not know of any cumulative effects of non-Federal actions that are reasonably certain to occur and may affect murrelet critical habitat in the action area. Therefore, no significant cumulative effects on DCH associated with non-Federal actions are anticipated.

INTEGRATION AND SYNTHESIS: Designated Marbled Murrelet Critical Habitat

Under the proposed action, we estimated that up to 11.06 acres of PCE 2 will be fragmented by the creation of three gaps greater than 0.25 acre within 300 ft of DCH. We also anticipate direct impacts to PCE 1 with the removal of 10 large conifers including 1 confirmed PNT in Site C3. Our reasonable worst case assumption is that effects on PCE 2 will adversely affect PCE 1s in that same area by increasing predation risks and decreasing the resistance of habitat to natural disturbances (e.g., windthrow).

These effects on critical habitat will be reduced over time as the trees and shrubs in the disturbed areas fill the project-generated gap. Within 30 to 50 years, we anticipate that the planted trees and shrubs will fill these three gaps at project sites C3, C4 Wand C4 E.

We do not expect the proposed effects on PCEs would impair the ability of the CHU to provide for the conservation of the murrelet. The small scale of effects associated with the action, taking into account cumulative effects, is not expected to reduce the conservation value of critical habitat at the CHU or range-wide scales. Critical habitat within this Conservation Zone, and all other Conservation Zones would remain functional or retain its current ability to become functional to meet the conservation needs of the species.

CONCLUSION: Designated Marbled Murrelet Critical Habitat

After reviewing the current status of the murrelet critical habitat, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, it is the Service's Opinion that the project activity is not likely to destroy or adversely modify DCH for the murrelet.

STATUS OF CRITICAL HABITAT: Northern Spotted Owl

The final rule designating revised critical habitat for the spotted owl was published on December 4, 2012 (77 FR 71876-72068), and includes over 9.5 million acres in 11 units and 60 subunits in California, Oregon, and Washington. Critical habitat contains those areas that are essential to the conservation of the species. The recovery of the spotted owl requires habitat conservation in concert with the implementation of recovery actions that address other, non-habitat-based threats to the species, including the barred owl (77 FR 71879). The conservation role of spotted owl critical habitat is to "adequately support the life-history needs of the species to the extent that well-distributed and inter-connected spotted owl populations are likely to persist within properly functioning ecosystems at the critical habitat unit and range-wide scales" (77 FR 71938).

The primary constituent elements identified in the spotted owl critical habitat rule include (1) forest types in early-, mid-, or late-seral stages that support the spotted owl across its geographic range; (2) nesting and roosting habitat; (3) foraging habitat; and (4) dispersal habitat (77 FR 72051-72052). Critical habitat encompasses a broad range of forest types and seral conditions. Much of the suitable nesting and roosting habitat within the critical habitat exists in fragmented patches due to the effects of past timber harvest, wildfire, disease, and other disturbances. Based on the spotted owl habitat data developed for monitoring the Northwest Forest Plan (Davis et al. 2011), we estimate that approximately 48 percent of the lands within critical habitat currently contain suitable spotted owl nesting and roosting habitat (4.59 million acres).

Detailed information regarding the status, threats, life history and conservation needs of the spotted owl are presented in the Service's 2011 Revised Recovery Plan for the Northern Spotted Owl (USFWS 2011), the 2012 final rule designating critical habitat (77 FR 71876), and Appendix F: Status of Designated Critical Habitat: Northern Spotted Owl.

ENVIRONMENTAL BASELINE: Designated Northern Spotted Owl Critical Habitat

Regulations implementing the Act (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area. Also included in the environmental baseline are the anticipated impacts of all proposed federal projects in the action area that have undergone section 7 consultation, and the impacts of state and private actions which are contemporaneous with the consultation in progress.

Spotted owl critical habitat on the Olympic Peninsula is located in two subunits (NCO-1 and NCO-2). The critical habitat designation includes 507,165 acres located within the ONF (Table 6). These subunits are associated with the North Coast and Olympic Peninsula (Unit 1) critical habitat unit that encompasses the Olympic Peninsula and the northern coastal region of Oregon. Subunits NCO-1 and NCO-2 are expected to provide demographic support for the overall spotted owl population. These subunits are essential for the conservation of the species to meet the recovery criterion that calls for the continued maintenance and recruitment of spotted owl habitat. The increase and enhancement of spotted owl habitat are necessary to provide for population expansion, successful dispersal, and buffering from competition with the barred owl (77 FR 71920).

Table 6. Summary of northern spotted owl critical habitat subunits and baseline habitat conditions on the Olympic Peninsula.

CH Unit Name	CH Subunit	Total designated CH acres	Nesting/ roosting acres	Dispersal acres	Forested, but not dispersal acres	Non-forested acres	Percent of CH in nesting/ roosting	Percent of CH in nesting/ roosting and dispersal
North Coast Ranges and Olympic Peninsula	NCO 1	293,469	140,263	91,039	60,331	1,836	47.8%	78.8%
North Coast Ranges and Olympic Peninsula	NCO 2	213,697	98,128	68,452	42,353	4,764	45.9%	78.0%
Totals	-	**507,165**	**238,390**	**159,491**	**102,684**	**6,600**	**47.0%**	**78.5%**

Notes: Due to rounding errors associated with GIS, the acreage values reported here may differ slightly from values reported elsewhere. Spotted owl habitat estimates are approximate values derived from habitat maps developed for the Northwest Forest Plan 15-year monitoring report (Davis et al. 2011).

Status of Designated Spotted Owl Critical Habitat in the Action Area

As stated prior, the action area includes all area within 5.9 miles of project site limits, due to the nature of the farthest reaching physical effects of the action: noise generated during pile driving activities. The action area is depicted in the BA (p. 19, Figure 2) which states the overall action area consists primarily of a mix of public and private open forest land, with a few scattered rural residences located near MP 6.0 (p.21). Primary land uses include commercial forest lands owned and managed for timber or wildlife habitat by various private and governmental entities. The result is a complex mix of mature forests suitable for roosting and foraging, maturing forest that may grow into suitable northern spotted owl nesting habitat in the future, intensively managed timber plantations where habitat development is not likely in the near term, and open space.

The project is located in the Westside Lowland Conifer-Hardwood Forest habitat type, described in Wildlife-Habitat Relationships in Oregon and Washington (Johnson and O'Neil 2000, pp. 24-26). The BA states that most of the action area is occupied by native upland and wetland forest vegetation, except for the ditches and cleared areas adjacent to the roadside, which often were characterized by non-native species. These low-elevation forests include a mix of mature conifer-dominated and mixed-species stands, young stands comprised variably of hardwoods or conifers, and developed parcels. Forest stands along the Upper Hoh Road are generally mid-seral, but several areas of old growth are present, particularly near Tower Creek. Numerous

large trees greater than 18-inches dbh occur in the action area, including Sitka spruce, western red cedar (*Thuja plicata*), Douglas-fir (*Pseudotsuga menziesii*), and western hemlock (*Tsuga heterophylla*).

DCH for northern spotted owl within the action area lies entirely within the ONF, as depicted in Figure 2. Other DCH originally appeared to exist in near proximity and overlapping project sites C1 and C2; however, this DCH exists on state lands managed by WSDNR. In the process of reviewing the proposed action, we found that the effect determination of "may affect, and likely to adversely affect" for northern spotted owl critical habitat for these sites (C1, C2, MP4) is not applicable given the designation of critical habitat on these lands was superseded in 1997 with the approval of the WSDNR Habitat Conservation Plan for state trust lands (FR 61:26256, [May 24, 1996]), (FR 81:51365 [Aug. 4, 2016]).

EFFECTS OF THE ACTION: Designated Northern Spotted Owl Critical Habitat

The effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

The primary constituent elements (PCEs) identified in the revised spotted owl critical habitat rule include (1) forest types in early-, mid-, or late-seral stages that support the spotted owl across its geographic range; (2) nesting and roosting habitat; (3) foraging habitat; and (4) dispersal habitat (77 FR 72051-72052). When determining whether an action is likely to adversely affect critical habitat, the Service recommends evaluating the effects of a proposed action at a scale that is relevant to the spotted owl life-history functions supplied by the PCEs (77 FR 71939).

Critical habitat in the action area is comprised of PCEs 1, 3, and 4. The baseline condition of critical habitat in the action area is that of moderate quality dispersal or foraging habitat. Overall canopy cover in action area near the project site is low, hardwood trees are abundant, and the few snags in the stand are small-diameter trees and contain only small cavities, so the site does not have the structural diversity to function as nesting, roosting or foraging habitat. Higher canopy cover and a smaller hardwood component are more typical of foraging habitat. Diverse tree sizes and dead wood accumulations on the forest floor provide complex habitat, though the proximity of impacted DCH to the Upper Hoh River Road means it is subject to recurring disturbance from vehicle noise.

Effects to PCE 1: Forest types in early, mid, or late-seral stages that support the spotted owl

Up to 287 trees will be removed at all project sites, including up to 20 large conifers that are greater than 18-inch dbh, and three greater than 50-inch dbh. Up to 10 of these 20 large conifers may be removed within DCH for the northern spotted owl. Most of these trees are adjacent to the existing roadway and all cut trees will be replaced with planted native conifers and shrubs before project completion. Vegetation clearing in the amount of 0.28 acres will occur within

DCH and degradation of remaining DCH that occurs within 110 yards of project site activity is anticipated. We use a distance of 110 yards (328 ft) to account for the physical effects to forest habitat along critical habitat boundaries due to the loss of trees to windthrow, reduced canopy cover, and altered forest composition (Chen et al. 1992, pp. 390-391). We mapped a 110-yard disturbance buffer along the edge of the DCH to estimate area exposed to potential edge effects. Based on our proximity buffers, we estimate there are 11.06 acres of DCH located within 110 yards of project sites. Habitat within these areas is likely to be degraded, and in some cases potentially lost due to windthrow effects. The severity of windthrow effects is highly variable depending on stand condition, aspect, and topographic orientation (Nowacki and Kramer 1998, p. 1).

Critical habitat subunit NCO-1 encompasses over 293,000 acres on the ONF and is currently estimated to contain over 140,000 acres of suitable spotted owl NRF habitat (Table 7, above). The degradation of 11.06 acres of spotted owl NRF habitat located within 110 yards of project site boundaries is considered to be an adverse effect to the PCEs due to the loss and degradation of PCEs at the stand scale (77 FR 71939-71940). While these effects are measurable at the site scale, they are not measurable at the landscape scale within the subunit. The windthrow effects along the project site boundaries are not expected to significantly influence the capability of the critical habitat to remain functional to serve its intended recovery role to provide for a well-distributed and self-sustaining northern spotted owl population at the scale of the subunit, the North Coast and Olympic Peninsula critical habitat unit, or range-wide.

Effects to PCE 3: Foraging Habitat

Approximately 0.28 acres of PCE 3 will be removed by the proposed action. It is not expected that this will result in a measurably alter the amount or availability of prey for the northern spotted owl. Effects to this PCE are therefore insignificant.

Effects to PCE 4: Dispersal Habitat

Dispersal habitat is not a limiting factor within the NCO-1 subunit on the Olympic Peninsula. The temporary impact to trees in approximately 11.06 acres of potential dispersal habitat is not expected to measurably affect the function of this PCE, spotted owl dispersal connectivity, or success at the scale of an individual project site or at the scale of the critical habitat subunit. Therefore, the effect of the action on PCE 4 is insignificant.

CUMULATIVE EFFECTS: Designated Northern Spotted Owl Critical Habitat

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 Opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

As previously outlined in the Cumulative Effects section for marbled murrelets, we do not anticipate cumulative effects from non-Federal actions that are reasonably certain to occur in the action area. Therefore, no significant cumulative effects on DCH associated with non-Federal actions are anticipated.

INTEGRATION AND SYNTHESIS: Designated Northern Spotted Owl Critical Habitat

We estimate 11.06 acres of spotted owl DCH will be degraded or lost due to windthrow and habitat fragmentation adjacent to vegetation clearing along the boundaries of spotted owl critical habitat subunit NCO-1. The loss of suitable habitat within DCH is considered to be an adverse effect, but due to the small size of vegetation clearing and the proximity of these sites to the existing Upper Hoh road along the boundary of the critical habitat subunit, these effects will not reduce the capability of the subunit to support spotted owl reproduction, connectivity, or recovery at the scale of the critical habitat subunit, the critical habitat unit, or range-wide.

CONCLUSION: Designated Northern Spotted Owl Critical Habitat

After reviewing the current status of designated spotted owl critical habitat, the environmental baseline for the action area, the effects of the action, and the cumulative effects, it is the Service's Opinion that implementation of the project, as proposed, is not likely to destroy or adversely modify DCH.

INCIDENTAL TAKE STATEMENT

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

The measures described below are non-discretionary, and must be undertaken by the FHWA so that they become binding conditions of any grant or permit issued, as appropriate, for the exemption in section 7(o)(2) to apply. The FHWA has a continuing duty to regulate the activity covered by this Incidental Take Statement. If the FHWA 1) fails to assume and implement the

terms and conditions or 2) fails to require the contractor or applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the FHWA must report the progress of the action and its impact on the species to the Service as specified in this Incidental Take Statement [50 CFR 402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE

Bull Trout

In the accompanying Opinion, we determined that the proposed action will result in incidental take of bull trout. The take is in the form of harm and harassment. The Service anticipates that incidental take of bull trout will be difficult to detect or quantify for the following reasons: 1) the low likelihood of finding dead or injured adults, subadults, or juveniles; 2) delayed mortality; and, 3) sublethal nature of effects. Where this is the case, we use a description of the affected habitat (i.e., physical extent, frequency, and duration), as an appropriate surrogate indicator of take.

The Service anticipates that juvenile, subadult and adult bull trout may be taken as a result of the proposed road repairs adjacent to the Hoh River. The Service anticipates the following incidental take:

Incidental take of juvenile, subadult, adult bull trout in the form of ***harassment*** (i.e., physiological stress and/or sub-lethal injury) resulting from short-term exposures to construction-related turbidity and sediment plumes within a distance of 300 ft downstream from the construction sites. These sublethal effects are considered to be a significant disruption of normal behaviors which creates a likelihood of injury to exposed individuals caused by avoidance behaviors, abandonment of cover, short-term reductions in feeding rates, or gill irritation. Based on the limited area of exposure, and the expected low density of bull trout in the action area, we expect very low numbers of individual bull trout will be affected. ***Harassment*** take is limited to approximately 21.2 acres along 4,775 linear ft (0.9 mile) of north bank of the Hoh River.

Incidental take of juvenile bull trout (juveniles less than 100 mm in length) in the form of ***harm*** (direct injury and/or mortality) from crushing and/or smothering associated with direct placement of rip-rap and rock/log toe-roughened structures below the ordinary high water line. Based on the limited area of exposure, and the expected low density of bull trout in the action area, we expect a small, but unquantifiable number of juvenile bull trout will be injured or killed within the total distance of rock placement.

Take in the form of ***Harm*** is limited to a small expected number of juveniles that will suffer direct mortality due to smothering or crushing. The number of individuals is an unknown but very low number of juvenile bull trout associated with placement of ELJ along the right bank of the Hoh River affecting up to a total area of 49,500 square ft for up to 45 days during the in-water work window of July 15 to August 31. Additionally, at site C5, the same effect is expected to occur within the approximately 1,800 square ft that would be dewatered and isolated, for up to ten days.

Marbled Murrelet

We anticipate that incidental take of murrelets will be difficult to detect or quantify because the species is cryptic, and actual murrelet nest locations are rarely located. However, based on the documented history of murrelet use in the Hoh River watershed and the surrounding vicinity, presence of suitable habitat and nesting structure in the action area, and proximity to marine foraging habitat, we expect that the suitable murrelet nesting habitat in the project area is occupied. Therefore we estimated the amount of nesting habitat that would be exposed to actions that could result in take as a surrogate measure for this species.

In the accompanying Opinion, we determined that noise and activity associated with the use of construction equipment and pile-driving will result in the incidental take of murrelets nesting in close proximity to the project sites. This take is in the form of harassment, through the significant disruption of normal nesting behaviors.

Murrelet nesting habitat will be exposed to construction noise and activity, causing disturbance impacts. ***Harassment*** of murrelets is expected to occur in areas approximately up to 26.5 acres within 110 yards of construction-related ground activity (107 days) and in areas totaling 13.5 acres within 120 yards during pile driving (7 days) at two project sites.

The information is phrased as "up to" because some habitat overlaps the disturbance zone for two sites, so these are conservative overestimates of the total area of suitable habitat for each species exposed to project activities. The disturbance from these activities is anticipated to create a likelihood of injury by increasing the risk of predation to both adults and chicks, and/or decreasing the fitness of chicks through missed feedings.

The Service will not refer the incidental take of any migratory bird for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703-712) if such take is in compliance with the terms and conditions (including the amount and/or number) specified herein.

EFFECT OF THE TAKE

In the accompanying Opinion, the Service determined that the level of anticipated take is not likely to result in jeopardy to the murrelet or result in the destruction or adverse modification of murrelet critical habitat.

The proposed action incorporates design elements and conservation measures which we expect will reduce permanent effects to habitat and avoid and minimize impacts during construction.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures (RPMs) are necessary and appropriate to minimize the impact of incidental take to the murrelet:

1) Minimize the loss of trees from forest stands containing murrelet nesting habitat to the greatest extent practicable.

2) Monitor implementation of timing restrictions that reduce the risk of predation expected to result from noise and visual disturbance to murrelets during the proposed project.

3) Implement trash-handling procedures to minimize corvid predation risk in the action area adjacent to the roadway.

The conservation measures negotiated in cooperation with the Service and included as part of the proposed action constitute all other reasonable measures necessary to minimize the impacts of incidental take.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the FHWA or their designee must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are nondiscretionary.

The following term and condition is required for the implementation of RPM 1:

1) The construction footprint shall be adequately marked prior to the felling of trees and/or operating heavy equipment. Old or obsolete markings shall be removed, and on-the-ground orientation by FHWA or their designee shall be held with fellers and operators to ensure they understand the layout and what is expected. Proper understanding and communication will help to avoid inadvertent removal of potential nest trees, trees that provide cover to potential platforms, and additional trees that help ensure stand integrity. Only trees within the marked work area shall be felled in preparation for or during construction.

The following term and condition is required for the implementation of RPM 2:

2) Record the start and stop times of construction each day to ensure compliance with the limited operating period. Submit a report detailing these times to the Service by November 30 following the construction season to document compliance with the daily limited operating period. The report should be submitted to the Service's consulting biologists (Marty Acker and Jamie Hanson; Washington Fish and Wildlife Office, Lacey Washington).

The following term and condition is required for the implementation of RPM 3:

3) In order to minimize the potential for corvid predation on murrelet nestlings, the FHWA or their designee will implement a trash handling plan to insure that food wastes and other items attractive to crows, jays, and other Corvidae will be disposed of in a manner that makes it unavailable to these species at any time.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is 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.

The Service is to be notified within three working days upon locating a dead, injured or sick endangered or threatened species specimen. Initial notification must be made to the nearest U.S. Fish and Wildlife Service Law Enforcement Office. Notification must include the date, time, precise location of the injured animal or carcass, and any other pertinent information. Care should be taken in handling sick or injured specimens to preserve biological materials in the best possible state for later analysis of the cause of death if that occurs. In conjunction with the care of sick or injured endangered or threatened species or preservation of biological materials from a dead animal, the finder has the responsibility to ensure that evidence associated with the specimen is not unnecessarily disturbed. Contact the U.S. Fish and Wildlife Service Law Enforcement Office at (425) 883-8122, or the Service's Washington Fish and Wildlife Office at (360) 753-9440.

REINITIATION NOTICE

This concludes formal consultation on the action(s) outlined in the request for formal consultation. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; 3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion, or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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