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

Issuance of a Section 10 Incidental Take Permit for the Port Blakely Habitat Conservation Plan for the John Franklin Eddy Forestlands

NMFS Consultation Number: WCRO-2022-01763

Action Agency: National Marine Fisheries Service
U.S. Fish and Wildlife Service

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely to Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely to Destroy or Adversely Modify Critical Habitat?
Lower Columbia River coho salmon	Threatened	Yes	No	Yes	No
Lower Columbia River Chinook salmon (*O. tshawytscha*)	Threatened	Yes	No	Yes	No
Lower Columbia River steelhead (*O. keta*)	Threatened	Yes	No	Yes	No
Upper Willamette River spring-run Chinook salmon	Threatened	Yes	No	Yes	No
Upper Willamette River steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No

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

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

Issued By:

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Date: July 6, 2023

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1. INTRODUCTION

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

1.1 Background

Under Section 10(a)(2)(A) of the Endangered Species Act (ESA), a non-federal entity may apply to the National Marine Fisheries Service (NMFS) for an incidental take permit (ITP) providing authorization to incidentally take ESA-listed species, meaning that the activity taking the species is incidental to, but is not the purpose of, otherwise lawful activities. The application for an ITP must include a habitat conservation plan (HCP) that describes:

- The anticipated impacts from the proposed activities on the species, including the impact that will likely result from the likely result from the incidental take that may occur as a result of the proposed activities;
- The anticipated impact of the proposed activities on the habitat of the species and the likelihood of restoration of the affected habitat;
- The measures that will be taken to monitor, minimize and mitigate such impacts;
- The funding available to implement such measures;
- The alternative actions to incidental take that were considered;
- The reasons why said alternative actions are not being used;
- Any other measures required by the Secretary of Commerce as necessary or appropriate for the purpose of the plan; and
- A list of sources of data used in the preparation of the plan.

Issuance of an ITP by NMFS is subject to evaluation under section 7 of the ESA to ensure that incidental take authorized pursuant to an HCP is quantified and will not jeopardize the continued existence of ESA-listed species or destroy or adversely modify their designated critical habitats.

The NMFS prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.), as amended, and implementing regulations at 50 CFR part 402.

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

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at the NMFS Oregon Washington Coastal Office.

1.2 Consultation History

Port Blakely owns and manages 30,813 acres of commercial forestland in Clackamas County, Oregon, referred to as the John Franklin Eddy Forestlands. Port Blakely contacted NMFS and U.S. Fish and Wildlife Service (USFWS) about obtaining incidental take permits for the forestry activities occurring on these lands.

Since September 2016, Port Blakely has worked with NMFS and USFWS) to develop the Port Blakely Habitat Conservation Plan for the John Franklin Eddy Forestlands (HCP). Additional coordination by Port Blakely with the Oregon Department of Fish and Wildlife, the Oregon Department of Forestry, and the Confederated Tribes of Grande Ronde allowed it to better understand agency and tribal interests, to discuss specific technical topics, and to seek support on key components of the HCP.

In February 2022, Port Blakely submitted the ITP applications with their HCP for the long-term operation and maintenance of the John Franklin Eddy Forestlands. In June 2022, in accordance with the National Environmental Policy Act (NEPA), NMFS completed a draft Environmental Assessment (EA) to evaluate the effects of the proposed action of issuing an ITP under Section 10(a)(1)(B) of the ESA. On June 24, 2022, NMFS published a Federal Register notice (87 FR 35970) announcing the availability of the draft EA, draft HCP, and applications and solicited public comments until July 14, 2022. NMFS addressed the comments received in the final EA (NMFS 2023a) and the Finding of No Significant Impact (FONSI) (NMFS 2023b). These documents are being issued along with this biological opinion.

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 FR part 402 in 2019 ("2019 Regulations," see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court's July 5 order. On November 14, 2022, the Northern District of California issued an order granting the government's request for voluntary remand without vacating the 2019 regulations. The District Court issued a slightly amended order two days later on November 16, 2022. As a result, the 2019 regulations are once again in effect, and we are applying the 2019 regulations here. For purposes of this consultation, we considered whether the substantive analysis and conclusions articulated in the biological opinion and incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different.

1.3 Proposed Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02). Under MSA, Federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (50 CFR 600.910).

The proposed action is the issuance of an ITP pursuant to Sections 10(a)(1)(B) of the ESA by NMFS. The ITP would have a duration of 50 years. The ITP would require implementation of the HCP, which is intended to minimize potential impacts on ESA-listed species and designated critical habitat that may result from Port Blakely's forest management activities. The HCP covers all Port Blakely lands in Oregon and potentially future land acquisitions in 5^{th} field watersheds occupied by the anadromous fish covered by the ITP. Port Blakely has committed to implementing the conservation strategy outlined in the HCP for the 50-year permit term.

The ITP allows incidental take of the following ESA-listed species (referred to as the 'covered species'): threatened Lower Columbia River (LCR) Chinook salmon; threatened Upper Willamette River (UWR) Chinook salmon; threated LCR Coho salmon; threatened LCR steelhead; and threatened UWR steelhead.

The ITP covers the following activities (referred to as "covered activities") that may result in incidental take: 1) Forest management activities described in the HCP that are necessary to operate and maintain timber management on the John Franklin Eddy Forestlands, and 2) activities associated with the conservation strategies identified in the HCP. Application of forest management chemicals such as herbicides or insecticides, is not a covered activity in the HCP and is instead analyzed in the cumulative effect sections. An incidental take exemption is not provided for the application of forest management chemicals. We considered, under the ESA, whether or not the issuance of an ITP would cause any other activities and determined that it would not.

1.3.1 Covered Activities – Timber Harvest, Silviculture, and Road Management

The HCP covered activities includes those activities that are necessary to operate and maintain Port Blakely's timber management on the John Franklin Eddy Forestlands in Clackamas County, Oregon during the 50-year permit term and include forest management activities currently being implemented under Oregon Forest Practices Rules. The covered activities include:

- Timber harvest
  - Regeneration (even-age) harvest
  - Pre-commercial thinning
  - Stand recovery and natural disturbances harvest (salvage)
- Silviculture
  - Site preparation (debris clearing, piling, and burning)
  - Reforestation (planting)
  - Fertilization
  - Disease, insect, and animal damage control

    - Mechanical vegetation control
- Road management
    - Road construction and maintenance
    - Abandonment and deactivation
    - Quarrying (rock pits)

The summary that follows describes the timber harvest, silviculture, and road management activities that Port Blakely conducts according to Oregon Department of Forestry (ODF) Forest Practice Act (OFP) and Administrative Rules (OAR) 629-600-100 through OAR 600-680-800). Under the HCP, Port Blakely will continue to implement these forest practices requirements during the permit term. Section 2.2 of the HCP describes these covered activities in more detail (Port Blakely 2023, publicly available online at: https://www.fisheries.noaa.gov/action/port-blakely-habitat-conservation-plan-john-franklin-eddy-forestlands).

The HCP covered activities also include long-term conservation measures, which are discussed later in Section 1.3.2. Covered Activities - *Conservation Program.*

1.3.1.1 Timber Harvest

Port Blakely conducts timber harvest activities on the John Franklin Eddy Forestlands according to "Harvest" rules described in OAR 629-630-000 through OAR 629-630-0800. These rules address skidding and yarding practices, felling, landings, drainage systems, and harvesting on steep and landslide-prone slopes. Port Blakely integrates upland leave trees and riparian buffers as part of conducting timber harvest. Snag and leave tree requirements are described in ORS 527.676 while stream and wetland buffer requirements are described in the Water Protection Rules (OAR 629-635 through OAR 629-660). Port Blakely manages forest stands that have been subject to a catastrophic environmental event (such as wildfire, insect, disease, or windthrow) under alternate prescriptions as described in OAR 629-642-0600(3).

Under the OFP, Port Blakely employs a forest management regime to ensure the proper growth and health of a conifer-dominated forest are met. The regime involves growing stands until ready for regeneration harvest, i.e., approximately 40 years of age, and may include limited mid-rotation management determined by factors such as stand density and steepness of slopes.

Port Blakely manages its forestlands using even-aged and uneven-aged harvest strategies. Even-aged management, i.e., regeneration harvest, is the primary harvest strategy when trees in forest stands reach the desired size. Uneven-aged management consists of pre-commercial thinning, commercial thinning, and recovery treatments using conventional logging methods and equipment. Salvage operations consisting of even-aged management is considered where natural events cause damage to forest trees and threaten forest health.

- Regeneration Harvest.

Forested timber stands generally will reach regeneration harvest condition in the permit area, typically with a diameter at breast height (DBH) range of 12-18 inches, by an age of 39 years old. Under the OARs, Port Blakely's typical harvest unit size does not exceed 120 acres. Under this regime, its annual harvests will range from 1000 to 1100 acres but is variable depending on availability of eligible stands.

Port Blakely may use several harvest systems during regeneration harvests depending on topography and soil conditions. Ground-based equipment may include logging shovels, skidders, crawlers, or forwarders, some of which may be tethered or cable-assisted (anchored with cable) on steep slopes. Normally on slopes less than 35%, felling is by mechanical means. Due to potential soil compaction, Port Blakely minimizes the use of skidders and crawlers, and generally uses them in units with long skidding reaches (i.e., greater than 800 feet). On slopes greater than 35%, Port Blakely uses hand felling, and bucking or cable-assisted felling.

Port Blakely estimates that regeneration harvest of an average unit consisting of 60 acres would typically take approximately 40 days, but that the time may vary by a few days depending on conditions such as the logging system used, slope and weather. It currently conducts regeneration harvest practices and will continue to conduct them under the HCP, although it has committed to grow stands older than the economic rotation age, manage stands for structural diversity, retain more leave trees and wider riparian buffers, and implement road construction and maintenance measures that are beneficial to covered species. These conservation measures are discussed in more detail in Section 1.3.2 of this opinion.

Ground-based Harvesting on Steep or Erosion-Prone Slopes. Port Blakely will use the following conditions to reduce the potential for erosion from steep or erosion-prone slopes to enter waters of the state:

1) Slopes over 60 percent and slopes over 40 percent where soils consist of decomposed granite-type materials, or other highly erodible materials, are considered erosion-prone and subject to requirements 3 through 7 below.
2) Methods that avoid development of compacted or excavated trails are the preferred alternative for operating on steep or erosion-prone slopes. If the operation will result in excavated or compacted skid trails, requirements 4 through 7 below apply.
3) Skid trails located on steep or erosion-prone slopes shall be located at least 100 feet from any stream channels.
4) Locate skid trails where water can drain off the skid trail and onto undisturbed soils.
5) Do not locate skid trails straight up and down steep or erosion prone slopes for a distance exceeding 100 feet unless effective drainage and sediment filtration can be achieved.
6) Install effective cross ditches on all skid roads located on steep or erosion-prone slopes.
7) Limit the amount of ground with disturbed soils on steep or erosion-prone slopes as described above to no more than ten percent of the steep or erosion-prone slopes within the operation area.

Landings. Port Blakely will adhere to the following conditions:

1) Minimize the size of landings to that necessary for safe operation.
2) Locate landings on stable areas to minimize the risk of material entering waters of the state.
3) Avoid locating landings in riparian management areas. When no feasible alternative landing locations exist, submit a written plan to the State Forester before locating landings in riparian management areas.

4) Do not incorporate slash, logs, or other large quantities of organic material into landing fills.
5) Deposit excess material from landing construction in stable locations well above the high-water level.

Drainage Systems. Port Blakely will employ the following conditions to provide and maintain a drainage system for each landing, skid trail, and fire trail that will control and disperse surface runoff to minimize sediment entering waters of the state.

1) Construct dips, grade reversals or other effective water diversions in skid trails and fire trails as necessary to minimize soil displacement and to ensure runoff water is filtered before entering waters of the state.
2) Drain skid trails with water bars, or other effective means, immediately following completion of the operation and, at all times, during the operation when runoff is likely.
3) Establish effective drainage on landings during and after use.

Harvesting on High Landslide Hazard Locations. Port Blakely will adhere to the following conditions to prevent timber harvesting-related serious ground disturbance and drainage alterations on all high landslide hazard locations, and use additional requirements when there is public safety exposure below the high landslide hazard location.

1) Coordinate with the State Forester to identify high landslide hazard locations and to determine if there is public safety exposure from shallow, rapidly moving landslides and, if so, then practices described in OAR 629-623-0400 through 0800 shall also apply.
2) Do not construct skid roads on high landslide hazard locations.
3) Do not operate ground-based equipment on high landslide hazard locations.
4) Prevent deep or extensive ground disturbance on high landslide hazard locations during log felling and yarding operations.

Felling and Removal of Slash (OAR 629-630-0600) Port Blakely will fell, buck, and limb trees in ways that minimize disturbance to channels, soils and retained vegetation in riparian management areas, streams, lakes and all wetlands greater than one-quarter acre, and that minimize slash accumulations in channels, significant wetlands and lakes.

Stream Riparian Management Areas A riparian management area (RMA) is the area along each side of specified waters of the state within which vegetation retention and special management practices are required. RMAs are measured as a slope distance from the high-water level of main channels except where the slope is comprised of steep exposed soil, rock bluff or talus slope. Where these conditions occur, the RMAs are measured as a horizontal distance until the top of the exposed area is reached.

The OARs specify RMA buffer widths for stream size designations for each different stream type (OAR 629-635-0200(14)) and Port Blakely would be required to retain these buffer widths consistent with the OARs. Stream size designations are based on average annual flow to the upstream drainage area and average annual precipitation. Stream types are as follows:

- Large: Average annual flow of 10 cubic feet per second (cfs) or greater.
- Medium: Average annual flow of 2 cfs, but less than 10 cfs.
- Small: Average annual flow of 2 cfs or less.

In addition, any stream with a drainage area less than 200 acres shall be assigned to the small stream category regardless of the flow index calculated (OAR 629-635-0200(15)). Stream types are also based on presence or use by fish. Fish are defined as anadromous fish, gamefish, or fish listed as threatened or endangered under the ESA and includes special consideration for salmon, steelhead, and bull trout. The OARs designate RMA widths to provide adequate areas along streams, lakes, and significant wetlands to retain the physical components and maintain the functions necessary to accomplish the purposes and to meet the protection objectives and goals for water quality, fish, and wildlife set forth in OAR 629-635-0100.

Over a five-year period, Port Blakely proposes to conduct a regeneration harvest up to a maximum of 5,000 acres on the John Franklin Eddy Forestlands. Including the 25% increase with acquisition lands, the maximum would be 6,250 acres.

- **Pre-commercial Thinning.**

Pre-commercial thinning refers to the cutting of trees that is for growth enhancement treatments, not currently required by OARs. However, under current OARs, pre-commercial thinning, and other release activities to maintain the growth and survival of conifer reforestation can be conducted within riparian management areas.

Candidate stands for enhancement activities via pre-commercial thinning occur across Port Blakely's lands. Port Blakely considers specific stocking levels to trigger pre-commercial thinning. On slopes less than 35%, Port Blakely thins stands to a tree density target of ≤ 330 trees per acre (TPA). On slopes greater than 35%, it thins stands to a tree density target of approximately 257 TPA. After a pre-commercial thinning application, stands will have a stocking that allows for increased sun throughout the stand, resulting in radial growth and understory development.

The acreage of stands Port Blakely pre-commercial thins in any given year is variable but, on average, will range from 300 to 600 acres annually. However, as a result of the catastrophic fires of 2020, Port Blakely will conduct pre-commercial thinning on an annual basis at the lower end of this range because nearly a third of the permit area will be growing as a single age-class. Thus, it anticipates a spike in this activity as the approximately 8,100 acres of burned stands reach an age where pre-commercial thinning would be advantageous. Although not all the stands will likely require pre-commercial thinning, when Port Blakely does start this thinning, it expects there will be an increase in this activity for a period of several years in the second decade of the permit.

- **Stand Recovery and Natural Disturbances Harvest (Salvage).**

Stand recovery activity refers to the removal of single diseased or damaged stems from a timbered stand without damaging or removing the residual trees to maintain stand health and recover valuable timber. However, when larger areas (greater than two acres) become severely diseased or damaged, such as extensive wildfire damage, Port Blakely generally finds it more efficient to harvest the entire area containing the infected or damaged trees as a regeneration harvest. Port Blakely continually monitors stands for health and storm damage. Its decision to enter a stand for salvage is based on overall stand health, the percent of stems affected, stand age, and market conditions. Stand recovery ranges from 10 to 35% depending on age and stand structure, and is lower for older stands and higher for younger stands. Port Blakely generally limits stand recovery operations to slopes less than 35% for logistic, economic, and efficiency reasons, unless the "greater than two acres" condition is met. It is not the intent of this forest management activity to recover every damaged tree and in those instances where damage is minor, Port Blakely will not initiate recovery efforts, and the defective trees remain in the stand until it is regeneration harvested.

1.3.1.2 Silviculture*.*

Commercial silviculture includes a variety of forest management activities conducted to control the establishment, growth, composition, health, and quality of forests to meet diverse needs and values of landowners on a sustainable basis. There are different types of silviculture treatments including, thinning, harvesting, planting, prescribed burning and site preparation, fertilization, and activities designed to control insect and disease outbreaks, unwanted vegetation, and animal damage. Thinning and harvesting activities are described in the timber harvest section above. Port Blakely implements covered silviculture activities as described below.

- **Site Preparation (debris-clearing, piling, and burning).**

Logging slash is comprised of trees and other vegetation residue produced within the harvest operation. Treatment of slash is recognized as a necessary tool for the protection of reproduction and residual stands from the risk of fire, insects, and disease, to prepare the site for future productivity and to minimize the risk of material entering streams (OAR 629-615-0100 through OAR 629-615-0300). Such treatment may employ the use of mechanical processes, fire, chemical or other means to minimize competitive vegetation and residue from harvesting operations.

Debris-clearing, piling and mechanical site preparation. Under the OARs, Port Blakely conducts forest operations in a manner which provides adequate consideration to treatment of slash to protect residual stands of timber and reproduction to optimize conditions for reforestation of forest tree species, to maintain productivity of forestland, to maintain forest health, and to maintain air and water quality and fish and wildlife habitat. Under these rules, Port Blakely must dispose of or disperse unstable slash accumulations around landings to prevent their entry into streams.

When Port Blakely determines that mechanical site preparation is necessary in riparian management areas or near waters of the state, it conducts the operations in a way that sediment or debris does not enter waters of the state. It maintains adequate distance between disturbed soils and waters of the state to filter sediment from run-off water and places no debris or soil where it may enter waters of the state. Port Blakely does not conduct mechanical site preparation in riparian management areas under the following conditions:

- On slopes over 35 percent, with the exception of excavator-type equipment used during dry periods;
- On sites with evidence of surface or gully erosion; or

- Where exposure or compaction of the subsoil is likely to occur.

Prescribed Burning. Prescribed burning is a tool used to achieve reforestation, maintain forest health, improve wildlife habitat, and reduce wildfire hazard. Port Blakely conducts prescribed burning in a manner to protect air and water quality, and fish and wildlife habitat. The OARs that address prescribed burning aim to ensure that necessary prescribed burning is planned and managed to maximize benefits and minimize potential detrimental effects.

When planning and conducting prescribed burning, Port Blakely will:

- Comply with Oregon's "Smoke Management Rules" (629-048-0001 through 629-048-0500) to ensure compliance with the “Oregon Smoke Management Program” (updated 2021);
- Adequately protect reproduction and residual timber, humus, and soil surface;
- Lay out the unit and use harvesting methods that minimize detrimental effects to riparian management areas, streams, lakes, wetlands, and water quality during the prescribed burning operation;
- Fell and yard the unit to minimize accumulations of slash in channels and within or adjacent to riparian management areas; and
- Minimize fire intensity and amount of area burned to that necessary to achieve reforestation, forest health, or hazard reduction needs.

- **Reforestation**

The OARs require replanting or “reforestation” following regeneration harvest (OAR 629-610-000 through 629-610-0090). Depending on potential growing conditions of the soil, reforestation may occur through natural means or, more frequently, by replanting. For replanting activities, the OARs establish tree stocking standards based on soil Site Class, and size of tree being planted. Tree species are also a consideration.

Under the OARs, Port Blakely must complete a planting or seeding within 24 months of harvest unless a plan for an alternate practice for natural reforestation has been approved by the State Forester. By the end of the sixth full calendar year, Port Blakely must have established a free to grow stand of trees which meets or exceeds the minimum stocking level required by OARs.

- **Mechanical Vegetation Control**

Control of competing vegetation, including non-native invasive species, involves the use of mechanical methods and prescribed burning described above. Port Blakely will control competing vegetation, i.e., reduce or eliminate, early in the establishment of the new plantation, thus avoiding excessive competition from competitive brush species, and facilitating early growth of crop trees and trees retained in riparian areas. Port Blakely’s goal is for the crop trees to be free to grow without treatment by age five. It uses mechanical vegetation control methods, including removal of scotch-broom and/or other competitive hardwoods and can deploy them at any time during the early to mid-stages of the forest lifecycle. It is a highly manual process involving small crews with chainsaws and/or weed whackers. These activities are very localized, e.g., confined to a roadside edge or an individual harvest unit, and may take 2 to 3 days to treat an area approximately 60 acres in size, less time for roadside treatments.

1.3.1.3 Road Management.

- **Road Construction and Maintenance**

The OARs require Port Blakely to locate roads where potential impacts to waters of the state are minimized. When locating roads, Port Blakely must designate road locations which minimize the risk of materials entering waters of the state and minimize disturbance to channels, lakes, wetlands, and floodplains. This requirement includes avoidance of locating roads on steep slopes, slide areas, high landslide hazard locations, and in wetlands, RMAs, channels, or floodplains where viable alternatives exist. Additionally, Port Blakely must minimize the number of stream crossings, i.e., created only when no other viable, safe, practicable alternative is identified.

Under the OARs, Port Blakely must design and construct roads to limit the alteration of natural slopes and drainage patterns to that which will safely accommodate the anticipated use of the road and will also protect waters of the state. It must construct stream crossing structures (culverts, bridges, and fords) such that they minimize excavation of side slopes near the channel and the volume of material in the fill consistent with the OARs and Oregon fish passage requirements. Port Blakely minimizes fill material by restricting the width and height of the fill to the amount needed for safe use of the road by vehicles, and by providing adequate cover over the culvert or other drainage structure.

Over a five-year period, Port Blakely assumes a maximum mileage of road building at 28 miles on the John Franklin Eddy Forestlands. Including the 25% increase with acquisition lands, the maximum would be 35 miles over a 5-year period. Port Blakely also would deactivate approximately 10% of the roads they build.

Under the OARs, Port Blakely must design and construct stream crossings (culverts, bridges, and fords) consistent with Oregon rules (OAR 635-412-0005 through 635-412-0040), and approved by NMFS to:

- Pass peak flows that at least correspond to the 50-year return interval; and
- Allow migration of adult and juvenile fish upstream and downstream during conditions when fish movement in that stream normally occurs.

The OARs prohibit road drainage water into headwalls, slide areas, high landslide hazard locations or steep erodible fill slopes, and requires the diversion of water away from stream channels into roadside ditches (ODF 2018a).

When constructing stream crossings, Port Blakely must minimize disturbance to banks, existing channels, and RMAs. For all roads constructed or reconstructed, Port Blakely must install water crossing structures where needed to maintain the flow of water and passage of adult and juvenile fish between side channels or wetlands and main channels. It must also leave or re-establish areas of vegetation between roads and waters of the state to protect water quality.

Under the OARs, Port Blakely would be required to implement the following measures for road maintenance activities:

- Maintain active and inactive roads in a manner sufficient to provide a stable surface and to keep the drainage system operating as necessary to protect water quality;
- Inspect and maintain culvert inlets and outlets, drainage structures and ditches before and during the rainy season as necessary to diminish the likelihood of clogging and the possibility of washouts;
- Provide effective road surface drainage, such as water barring, surface crowning, constructing sediment barriers, or out sloping prior to the rainy and runoff seasons;
- Place material removed from ditches in a stable location; and
- Maintain fish passage through water crossing structures by:
  - Maintaining conditions at the structures so that passage of adult and juvenile fish is not impaired during periods when fish movement normally occurs; and
  - Keeping structures cleared of woody debris and deposits of sediment that would impair fish passage, as is reasonably practicable.

Port Blakely conducts road maintenance activities involving rocking of existing roads on an average of 8.5 miles, annually. There are nine permanent steel bridges on the HCP lands and Port Blakely anticipates that four of them will need replacement at some point in the next 50 years as part of the long-term road maintenance plan. It determines the need for road construction based on a variety of factors such as the annual harvest plan, the location of the harvest unit in relation to existing roads, and whether the harvest method (cable or ground-logging) requires better access than from existing roads. Port Blakely estimates its lands include 251 miles of active roads, resulting in a road density of approximately 5.2 mi/mi^2. It averages 3.9 miles of road construction activities each year and 8.5 miles of road maintenance activities involving rocking of existing roads each year.

- **Road Abandonment and Deactivation.**

The OARs also address practices of deactivating or abandoning forest roads, although the provisions are recommendations, rather than requirements, for landowners that choose to conduct this activity. These recommendations focus on leaving roads in a condition where road related damage to waters of the state is unlikely, including:

- Effectively blocking the road to prevent continued use by vehicular traffic (deactivation);
- Removing stream crossing fills and structures (deactivation and abandonment); and
- Pullback of fills on steep slopes, frequent cross ditching, and/or vegetative stabilization (abandonment).

Port Blakely will implement road abandonment activities if current and acquired lands have roads adjacent to streams or are located near sensitive sites such as wetlands or unstable slopes, and where other options exist for road placement. These abandonment activities would include removing bed and drainage structures and restoring the land to a condition capable of growing trees. Port Blakely averages 1.1 miles of road deactivation and abandonment annually. Port Blakely's ownership currently has approximately 32 miles of deactivated or abandoned roads, i.e., 13% of the existing road system.

- **Quarrying (rock pits)**

The OARs address the development, use, and abandonment of rock pits or quarries located on forestland. Rock pits and quarries used for forest management are required to be conducted using practices which maintain stable slopes and protect water quality. Under these rules, Port Blakely cannot locate quarry sites in channels and must prevent overburden, solid wastes, or petroleum products from entering streams and wetlands.

1.3.2 Covered Activities - Conservation Program

Port Blakely will implement conservation strategies corresponding to timber harvest, silviculture and road management activities discussed in Section 1.3.1. of this opinion. In general, the conservation strategies were designed to achieve the biological goals of the HCP for salmon and steelhead, which are to: 1) Improve riparian and stream ecosystem functions; 2) Contribute to viable populations of salmon and steelhead within the conservation area, and 3) Protect aquatic ecosystems from potentially unstable or over-steepened slopes. Descriptions of the conservation strategies and the biological goals are incorporated by reference from Section 6 of the HCP (Port Blakely 2023, publicly available at https://www.fisheries.noaa.gov/action/port-blakely-habitat-conservation-plan-john-franklin-eddy-forestlands), and summarized below.

Through the conservation program, Port Blakely aims to increase structural features, habitat diversity and complexity over what currently exists on the landscape. The stream and riparian conservation strategies are designed to eliminate management related sediment input to streams, increase large wood (LW) delivery to streams and reduce any potential for temperature increases of streams that result from conducting commercial forest management activities.

Stream protection conservation strategies.

Consistent with the HCP, Port Blakely would implement the following stream protection conservation strategies:

Small fish streams.

- At commercial thin harvest where conditions are uniform (all one species and age class) and overstocked (> 285 trees per acre): no removal of trees leaning over the channel or within 20' of the bank full width, and maintain a 30' equipment limitation zone (ELZ), measured horizontally from the stream bank. Thinning reduces the density of the existing forest stand, allows sunlight to reach the forest floor, encourages understory vegetation to develop, and provides conditions where the forest trees will grow much larger in diameter then would be possible in overcrowded conditions;
- At regeneration harvest: 75' minimum no-harvest (unmanaged) buffer on both sides of stream, horizontal distance, variable width to include minimum 50' no-harvest buffer around sensitive sites (wetlands, seeps, potentially unstable slopes); and
- At regeneration harvest, where LW is minimal or does not exist in the stream, placement of up to 1 tree per 300', on average, rounding up to 4 per 1000' each side of stream, from within the riparian buffer.

Medium fish streams.

- At commercial thin harvest where conditions are uniform and overstocked: no removal of trees leaning over the channel or within 20' of the bank full width, maintain 30' ELZ, horizontal distance;
- At regeneration harvest: 90' minimum no-harvest (unmanaged) buffer on both sides of stream, horizontal distance, variable width to include minimum 50' no-harvest buffer around sensitive sites (wetlands, seeps, potentially unstable slopes); and
- At regeneration harvest, where LW is minimal or does not exist in the stream, placement of up to 1 tree per 300', on average, rounding up to 4 per 1000' each side of stream, from within the riparian buffer.

Large fish streams.

- At commercial thin harvest where conditions are uniform and overstocked: no removal of trees leaning over the channel or within 20' of the bank full width, maintain 30' ELZ, horizontal distance; and
- At regeneration harvest: 100' minimum no-harvest (unmanaged) buffer on both sides of stream; horizontal distance; variable width to include minimum 50' no-harvest buffer around sensitive sites (wetlands, seeps, potentially unstable slopes).

Small non-fish, perennial streams.

- At commercial thin harvest: no removal of trees leaning over the channel or within 20' of the bank full width, maintain 30' ELZ, horizontal distance;
- At regeneration harvest: 50' minimum buffer on both sides of stream, horizontal distance;
- Buffer will consist of a 25' no-harvest zone and a 25' managed buffer for the entire length of perennial flow;
- Managed buffer will include 50% relative retention of original live trees by diameter breast height (DBH) class, representative of stand and well-distributed to outer edge;
- Buffer will be wider where necessary to retain sensitive sites undisturbed (wetlands, seeps, potentially unstable slopes); and
- Understory trees and shrubs ≤10" DBH, snags of all sizes and coarse woody debris will be retained where they exist.

Small non-fish, seasonal streams.

- Disturbance to soil will be minimized, maintain 30' ELZ, horizontal distance; and
- Retain understory trees and shrubs ≤10" DBH where they exist along the stream and where feasible.

Wetland protection conservation strategies.

Consistent with the HCP, Port Blakely would implement the following wetland protection conservation strategies:

Lakes and stream-associated wetlands > 8 acres (fish or non-fish) and bogs of any size.

- At commercial thin harvest where conditions are uniform and overstocked: no removal of trees leaning over the channel or within 20' of the bank full width, maintain 30' ELZ, horizontal distance;

- At regeneration harvest: 100' minimum buffer width, horizontal distance;
- Buffer will consist of a 50' no-harvest zone and 50' managed buffer, horizontal distance;
- Managed buffer will include 50% relative retention of original live trees by DBH class, representative of stand and well-distributed to outer edge; and
- Understory trees and shrubs ≤10" DBH, snags of any size and coarse woody debris will be retained where they exist.

Lakes >½ acre – <8 acres (non-fish)

- At commercial thin harvest where conditions are uniform and overstocked: no removal of trees leaning over the channel or within 20' of the bank full width, maintain 30' ELZ, horizontal distance;
- At regeneration harvest: 50' minimum buffer width, horizontal distance;
- Buffer will consist of a 20' no-harvest zone and 30' managed buffer, horizontal distance;
- Managed buffer will include 50% relative retention of original live trees by DBH class, representative of stand and well-distributed to outer edge;
- Understory trees and shrubs ≤10" DBH, snags of any size and coarse woody debris will be retained where they exist; and
- Applies to natural lakes only (not mill ponds).

Lakes and stream-associated wetlands < 8 acres (fish)

- At commercial thin harvest where conditions are uniform and overstocked: no removal of trees leaning over the channel or within 20' of the bank full width, maintain 30' ELZ, horizontal distance; and
- At regeneration harvest: retain 50' minimum no-harvest buffer around lake or wetland; horizontal distance, measured from the wetland or lake edge.

Lakes >1/4 acre - < ½ acre, stream-associated seeps and wetlands < 8 acres, and isolated seeps and wetlands > ¼ - < 8 acres (all non-fish)

- At regeneration harvest: no disturbance of feature, protect within variable width stream buffer if stream-associated;
- Maintain 30' ELZ, horizontal distance.

Road maintenance conservation strategies.

Consistent with the HCP, Port Blakely would implement the following road maintenance conservation strategies:

- Eliminate and prevent sediment delivery to streams and sensitive aquatic features through implementation of road maintenance measures that address water/sediment run-off;
- Design stream crossing structures to accommodate 100-year peak flow return intervals events consistent with Oregon fish passage laws and with NMFS approval;
- Prevent delivery of road associated sediment to any regulated stream or sensitive aquatic resource:
    - Restrict haul if there is risk of delivery;
    - Implement planned cross-drain installations at 308 locations;
    - Disconnect ditch-lines from streams; and

  - Abandon 1.9 miles of stream-adjacent parallel roads beginning the first year of permit issuance and complete within five years of permit issuance.
- Implement strategies that reduce impacts to aquatic species
  - Facilitate fish passage for all life stages of all native species of fish;
  - Decommission roads that won't be needed and abandon non-essential roads; and
  - All roads will be closed to the public unless via written authorization.
- All rock pits and quarrying activities will be located outside of stream channels and riparian management areas to prevent delivery of sediment into water, and to prevent erosion or landslides.

Wood recruitment conservation strategies.

Consistent with the HCP, Port Blakely would implement the following wood recruitment conservation strategies:

- Following regeneration harvest, placement of one tree, on average, per 300 feet of stream length, i.e., approximately three trees per 1000 feet, on each side of stream where operations occur;
- Proportions of trees will be rounded up to the next whole tree, e.g., stream lengths > 900 feet but < 1200 feet would receive four trees;
- Use Oregon Department of Forestry and Oregon Department of Fish and Wildlife (ODFW) Wood Placement Guidance; and
- Consult with ODFW to the extent possible.

In-stream conservation strategies.

Consistent with the HCP, Port Blakely would implement the following in-stream conservation strategies:

- Manage culverts and bridges to accommodate 100-year event flow plus debris on fish and non-fish-bearing streams.
- Continue fish passage barrier removal program;
- Remove or repair 11 known fish passage barriers reconnecting 3.5 miles of fish habitat beginning the first year of permit issuance and complete within five years of permit issuance; and
- Remove or repair new barriers as soon as operationally possible but no later than within three years of discovery.
- Conduct all in-water work during the ODFW recommended in-water work windows

Restoration funding conservation strategies.

Consistent with the HCP, Port Blakely would implement the following restoration funding conservation strategies:

- Contribute to watershed restoration projects through in-kind, product or monetary support at a minimum rate of $10,000 per year and a maximum rate of $25,000 per year.
- The restoration commitment will increase at thresholds based on increases in ownership acres, not to exceed 25% based on initial HCP acres.

1.3.3 Monitoring and Adaptive Management

The HCP includes monitoring and adaptive management requirements, which will ensure compliance with the HCP, assess the response of covered species and habitat conditions to conservation actions, and evaluate the efficacy of conservation measures. Port Blakely will continually evaluate the monitoring program to ensure compliance with the HCP and its effectiveness at meeting the biological goals and objectives. The HCP monitoring and adaptive management requirements also include annual compliance reporting requirements as described below.

Monitoring

The monitoring program in the HCP includes annual compliance reporting and effectiveness monitoring. Section 6.4 of the HCP discusses compliance and effectiveness monitoring in detail. In summary, Port Blakely will conduct compliance monitoring (also known as implementation monitoring) on the covered activities to track the status of HCP implementation and document that the requirements of the HCP are being met. Compliance monitoring will also verify that Port Blakely is carrying out the terms of the HCP and ITP.

Port Blakely will also conduct effectiveness monitoring that will assess the implementation of the conservation strategy. In coordination with NMFS, Port Blakely will use the established success thresholds of the conservation program for management actions to measure the success of conservation actions relative to achieving the biological goals and objectives identified in Chapter 6.2 of the HCP. Port Blakely will apply the effectiveness monitoring to aquatic habitat, and include turbidity and water temperature monitoring parameters. It will conduct effectiveness monitoring in partnership with ODFW through ODFW's Aquatic Inventories Project.

Adaptive management strategy

Adaptive management is based on a flexible approach whereby actions can be adjusted as uncertainties become better understood or as assumptions change. Although there is relative certainty of the biology and biological needs of the covered species, and there are relatively certain effects of the forest management activities and conservation measures on habitat quality and covered species populations, Port Blakely identified several conservation measures where adaptive management may be implemented to improve habitat conditions for some of the covered species. The adaptive strategies that pertain to salmon and steelhead include:

- Adapt large wood placement measures to provide best functional use, as supported by best available science;
- Adapt harvest and road management activities to reflect changes in stream classification, including fish distribution and occurrence of year-round flow;
- Adapt strategies to increase development of aquatic habitats to reflect improved forest management techniques and best available science.

1.3.4 Assurances

Port Blakely requested regulatory assurances under the No Surprises Rule (63 FR 8859) for all covered species in the HCP. The purpose of the No Surprises assurances is to provide assurances to non-federal landowners participating in habitat conservation planning under the ESA that no additional land restrictions or financial compensation will be required without their consent for species adequately covered by a properly implemented HCP. In accordance with the No Surprises assurances, Port Blakely will be responsible for implementing and funding measures in response to any changed circumstances. If an unforeseen circumstance occurs, unless Port Blakely consents, USFWS and NMFS will not require it to commit additional land, water, or financial compensation or impose additional restrictions on the use of land, water, or other natural resources beyond the level agreed to in the HCP. But Port Blakely will l work with the USFWS and NMFS to address these unforeseen circumstances within the funding and other constraints of the HCP should they occur.

1.3.4.1 Changed circumstances.

"Changed Circumstances" are defined in 50 CFR 222.102 as changes in circumstances affecting a species or geographic area covered by an HCP that can reasonably be anticipated by HCP developers and NMFS that can be planned for (e.g., the listing of new species, or a fire or other natural catastrophic event in areas prone to such events). If additional conservation and mitigation measures are deemed necessary to respond to changed circumstances, and such measures were not provided for in the HCP, NMFS will not require those additional measures, provided that the commitments and provisions of the HCP have been or are fully implemented. Port Blakely may elect to implement additional voluntary conservation measures. Port Blakely identified six types of changed circumstances including new species listings; windthrow; ice storms; low severity fires; insect and disease infestation; and climate change. These are described in detail in Section 8.1 of the HCP and summarized below.

New species listing. Over the permit term, NMFS could list species under the ESA that are not covered species under the HCP. This changed circumstance will be triggered when a noncovered species associated with habitat in the permit area has been proposed for listing, becomes a candidate for listing, or is emergency-listed. When a new species is listed, Port Blakely will 1) evaluate and determine if the species occurs in the plan area and if take of the species would occur from the covered activities; 2) identify and implement any necessary measures provided by NMFS in the permit area to avoid take of the species until a permit amendment is finalized or an alternate permit is issued to ensure compliance with the ESA; and 3) apply for a permit amendment or alternative take coverage.

Windthrow. Windthrow from strong winds is one of the primary weather-related damaging agents affecting Port Blakely forestlands. There have been several catastrophic wind events in the Northwest in recorded history. Under the HCP, a windstorm constitutes a changed circumstance if one or more of the following conditions apply:

- *Riparian habitat.* Windthrow of > 75% of riparian stand density and > 20% of contiguous riparian habitat acres over a 0.25 mile (1,320 feet) of stream length within a watershed.

- *Upland habitat.* Windthrow of > 75% of upland stand density on > 100 acres but < 500 acres of upland stands.

For windstorms that are classified as changed circumstances, Port Blakely will confer with the NMFS and USFWS within 60 days following the event and present an evaluation of the event and proposed minor modifications to riparian or upland prescriptions, if any.

Ice Storms. Ice damage to trees after strong ice storms can also affect Port Blakely forestlands, though ice storms seem to be particularly damaging to younger trees and hardwoods more than conifers. If an ice storm results in damage to > 5% but < 10% of forested acres within the permit area, Port Blakely, USFWS and NMFS will confer to establish appropriate supplemental or changed prescriptions for salvage harvest of damaged trees or restoration work in the younger plantations which will be incorporated into the existing harvest plan. These additional or changed prescriptions will be established consistent with the HCP conservation measures to the extent practicable. If the ice storm event results in conditions that exceed the conditions above, i.e., >10% of the permit area, it will be considered an unforeseen circumstance.

Low severity fires. Fire has been a prominent natural disturbance of Pacific Northwest forest ecosystems since the end of the last glaciation period over 12,000 years ago. Projected temperature increases for the 21st century could lead to larger and/or more frequent fires in drier climates if trends forecast from climate models occur, especially if precipitation does not increase. The fire season is lengthening due to declining mountain snowpack and earlier spring melt (Westerling et al 2006). Although most fires are started by humans, cooler, wetter springs allow for fine fuels to build up. When followed by hotter temperatures and increasingly severe droughts, fire risk and severity are exacerbated.

The ability to accurately predict the frequency and severity of wildfire in this region, especially in light of changing temperature and precipitation regimes, is an evolving science and has an associated level of uncertainty. Existing historical records and the limited trend data for the Port Blakely area suggests low severity fire burns greater than 50 acres but less than 300 acres may be expected on Port Blakely forestlands. Accordingly, a changed circumstance will occur if a small, low severity fire burns greater than 50 acres but less than 300 acres on Port Blakely forestlands. When a low severity fire occurs, Port Blakely will maintain its commitment to the biological goals and objectives described in this HCP by providing NMFS and USFWS with information regarding the fire within 60 days and conferring in considering adjustments to timber harvest and implementation of conservation in the fire zone.

Disease. Disease infestations (insect, root and foliage) can all cause significant damage to forest ecosystems. Change circumstances related to disease are: Douglas-fir beetle outbreak causing significant tree damage to > 10% but < 25% of trees > 40 years of age within the permit area; or Forest disease infestation causing significant tree damage to < 2% of the permit area. Under these conditions, Port Blakely will respond by providing NMFS and USFWS with information regarding the infestation within 60 days and conferring in considering adjustments to timber harvest and implementation of conservation in the infestation area.

Climate change. Climate change poses the most uncertainty and risk to Oregon's forestlands and is a threat to the covered species addressed in this opinion. Climate change will likely be a driver for many of the changed circumstances described above, increasing the potential for these events to occur. Climate change can also have an effect on forest species composition over the 50-year permit term. If it becomes clear that the current forest composition of the permit area, comprised primarily of Douglas fir, is trending to less than 70% Douglas-fir with replacement by species suited to warmer temperatures, Port Blakely will consider this a changed circumstance. Changes to forest management will be considered at this point, in coordination with Federal and State agencies.

1.3.4.2 Unforeseen circumstances.

"Unforeseen circumstances" are defined in 50 CFR 222.102 as changes in circumstances affecting a species or geographic area covered by an HCP that could not reasonably be anticipated at the time of the negotiation and development of the HCP, and that result in a substantial and adverse change in the status of the covered species. Port Blakely is not obligated to respond to an unforeseen circumstance, but may do so voluntarily. If unforeseen circumstances require additional conservation and mitigation measures, those measures will be negotiated between Port Blakely and NMFS on a case-by-case basis.

NMFS bears the burden of demonstrating that unforeseen circumstances exist using the best available scientific and commercial data available. In deciding whether unforeseen circumstances exist, NMFS will consider, but not be limited to, the following factors (50 CFR 222.307(g)(3)(iii)):

1. The size of the current range of the affected species;
2. The percentage of the range adversely affected by the conservation plan;
3. The percentage of the range conserved by the conservation plan;
4. The ecological significance of that portion of the range affected by the conservation plan;
5. The level of knowledge about the affected species and the degree of specificity of the conservation program for that species under the conservation plan; and
6. Whether failure to adopt additional conservation measures would appreciably reduce the likelihood of survival and recovery of the affected species in the wild.

In negotiating unforeseen circumstances, NMFS will not require the commitment of additional land, water, or financial compensation or additional restrictions on the use of land, water, or other natural resources beyond the level otherwise agreed upon for the species covered by the HCP without the consent of the permittee (50 CFR §§ 222.307(g)(3)(i)). If additional conservation and mitigation measures are deemed necessary to respond to unforeseen circumstances, NMFS may require additional measures of the permittee where the HCP is being properly implemented only if such measures are limited to modifications within conserved habitat areas, if any, or to the HCP's operating conservation program for the affected species, while maintaining the original terms of the plan to the maximum extent possible (50 CFR § 222.307(g)(3)(ii)). Additional conservation and mitigation measures will not involve the commitment of additional land, water or financial compensation or additional restrictions on the use of land, water, or other natural resources otherwise available for development or use under the original terms of the HCP without the consent of Port Blakely.

1.3.5 Reporting

Port Blakely will submit HCP implementation and compliance reports to the NMFS and USFWS documenting forest management activities and implementation of conservation measures described in the HCP. Reports will be submitted annually for the first five years of the permit period, biennially for the following ten years, and then every five years for the remainder of the permit term. Port Blakely reporting will include, but not be limited to, the following:

- Forest management activities, including thinning and regeneration harvests that occurred;
- Any new data on covered species occurrences and/or habitat use and protective measures implemented;
- The location of large wood placement in streams associated with regeneration harvest;
- The occurrence and location of road construction, decommissioning, and maintenance;
- The occurrence and location of fish passage structure improvements; and
- The contribution towards watershed restoration projects including the location, recipient, and type of support (in-kind, monetary, or product).
- The results of the effectiveness monitoring program.
- Any implementation of adaptive management measures.

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

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species or to adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS, and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provide an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

2.1 Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This biological opinion relies on the definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR 402.02).

The designations of critical habitat for LCR coho salmon, LCR Chinook salmon, LCR steelhead, UWR Chinook salmon and UWR steelhead use the term primary constituent element (PCE) or essential features. The 2016 final rule (81 FR 7414; February 11, 2016) that revised the critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). 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. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

The ESA Section 7 implementing regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the final rule revising the definition and adding this term (84 FR 44976, 44977; August 27, 2019), that revision does not change the scope of our analysis, and in this opinion we use the terms "effects" and "consequences" interchangeably.

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Evaluate the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Evaluate the environmental baseline of the species and critical habitat.
- Evaluate the effects of the proposed action on species and their habitat using an exposure-response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to: (1) directly or indirectly reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species, or (2) directly or indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.
- If necessary, suggest a reasonable and prudent alternative to the proposed action.

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that is likely to be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' "reproduction, numbers, or distribution" for the jeopardy analysis. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the function of the PBFs that are essential for the conservation of the species.

One factor affecting the status of ESA-listed species considered in this opinion, and aquatic habitat at large, is climate change. Climate change is likely to play an increasingly important role in determining the abundance and distribution of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. These changes will not be spatially homogeneous across the Pacific Northwest. Major ecological realignments are already occurring in response to climate change (IPCC WGII, 2022). Long-term trends in warming have continued at global, national and regional scales. Global surface temperatures in the last decade (2010s) were estimated to be 1.09 °C higher than the 1850-1900 baseline period, with larger increases over land ~1.6 °C compared to oceans ~0.88 (IPCC WGI, 2021). The vast majority of this warming has been attributed to anthropogenic releases of greenhouse gases (IPCC WGI, 2021). Globally, 2014-2018 were the 5 warmest years on record both on land and in the ocean (2018 was the 4th warmest) (NOAA NCEI 2022). Events such as the 2013-2016 marine heatwave (Jacox et al. 2018) have been attributed directly to anthropogenic warming in the annual special issue of Bulletin of the American Meteorological Society on extreme events (Herring et al. 2018). Global warming and anthropogenic loss of biodiversity represent profound threats to ecosystem functionality (IPCC WGII 2022). These two factors are often examined in isolation, but likely have interacting effects on ecosystem function.

Updated projections of climate change are similar to or greater than previous projections (IPCC WGI, 2021). NMFS is increasingly confident in our projections of changes to freshwater and marine systems because every year brings stronger validation of previous predictions in both physical and biological realms. Retaining and restoring habitat complexity, access to climate refuges (both flow and temperature) and improving growth opportunity in both freshwater and marine environments are strongly advocated in the recent literature (Siegel and Crozier 2020).

Climate change is systemic, influencing freshwater, estuarine, and marine conditions. Other systems are also being influenced by changing climatic conditions. Literature reviews on the impacts of climate change on Pacific salmon (Crozier 2015, 2016, 2017, Crozier and Siegel 2018, Siegel and Crozier 2019, 2020) have collected hundreds of papers documenting the major themes relevant for salmon. Here we describe habitat changes relevant to Pacific salmon and steelhead, prior to describing how these changes result in the varied specific mechanisms impacting these species in subsequent sections.

Forests

Climate change will impact forests of the western U.S., which dominate the landscape of many watersheds in the region. Forests are already showing evidence of increased drought severity, forest fire, and insect outbreak (Halofsky et al. 2020). Additionally, climate change will affect tree reproduction, growth, and phenology, which will lead to spatial shifts in vegetation. Halofsky et al. (2018) projected that the largest changes will occur at low- and high-elevation forests, with expansion of low-elevation dry forests and diminishing high-elevation cold forests and subalpine habitats.

Forest fires affect salmon streams by altering sediment load, channel structure, and stream temperature through the removal of canopy. Holden et al. (2018) examined environmental factors contributing to observed increases in the extent of forest fires throughout the western U.S. They found strong correlations between the number of dry-season rainy days and the annual extent of forest fires, as well as a significant decline in the number of dry-season rainy days over the study period (1984-2015). Consequently, predicted decreases in dry-season precipitation, combined with increases in air temperature, will likely contribute to the existing trend toward more extensive and severe forest fires and the continued expansion of fires into higher elevation and wetter forests (Alizedeh 2021).

Agne et al. (2018) reviewed literature on insect outbreaks and other pathogens affecting coastal Douglas-fir forests in the Pacific Northwest and examined how future climate change may influence disturbance ecology. They suggest that Douglas-fir beetle and black stain root disease could become more prevalent with climate change, while other pathogens will be more affected by management practices. Agne et al. (2018) also suggested that due to complex interacting effects of disturbance and disease, climate impacts will differ by region and forest type.

Freshwater Environments

The following is excerpted from Siegel and Crozier (2019), who present a review of recent scientific literature evaluating effects of climate change, describing the projected impacts of climate change on instream flows:

Cooper et al. (2018) examined whether the magnitude of low river flows in the western U.S., which generally occur in September or October, are driven more by summer conditions or the prior winter's precipitation. They found that while low flows were more sensitive to summer evaporative demand than to winter precipitation, interannual variability in winter precipitation was greater. Malek et al. (2018), predicted that summer evapotranspiration is likely to increase in conjunction with declines in snowpack and increased variability in winter precipitation. Their results suggest that low summer flows are likely to become lower, more variable, and less predictable.

The effect of climate change on ground water availability is likely to be uneven. Sridhar et al. (2018) coupled a surface-flow model with a ground-flow model to improve predictions of surface water availability with climate change in the Snake River Basin. Projections using RCP 4.5 and 8.5 emission scenarios suggested an increase in water table heights in downstream areas of the basin and a decrease in upstream areas.

As cited in Siegel and Crozier (2019), Isaak et al. (2018), examined recent trends in stream temperature across the Western U.S. using a large regional dataset. Stream warming trends paralleled changes in air temperature and were pervasive during the low-water warm seasons of 1996-2015 (0.18-0.35°C/decade) and 1976-2015 (0.14-0.27°C/decade). Their results show how continued warming will likely affect the cumulative temperature exposure of migrating sockeye salmon *O. nerka* and the availability of suitable habitat for brown trout *Salmo trutta* and rainbow trout *O. mykiss*. Isaak et al. (2018) concluded that most stream habitats will likely remain suitable for salmonids in the near future, with some becoming too warm. However, in cases where habitat access is currently restricted by dams and other barriers salmon and steelhead will be confined to downstream reaches typically most at risk of rising temperatures unless passage is restored (FitzGerald et al. 2020, Myers et al. 2018).

Streams with intact riparian corridors and that lie in mountainous terrain are likely to be more resilient to changes in air temperature. These areas may provide refuge from climate change for a number of species, including Pacific salmon. Krosby et al. (2018), identified potential stream refugia throughout the Pacific Northwest based on a suite of features thought to reflect the ability of streams to serve as such refuges. Analyzed features include large temperature gradients, high canopy cover, large relative stream width, low exposure to solar radiation, and low levels of human modification. They created an index of refuge potential for all streams in the region, with mountain area streams scoring highest. Flat lowland areas, which commonly contain migration corridors, were generally scored lowest, and thus were prioritized for conservation and restoration. However, forest fires can increase stream temperatures dramatically in short time-spans by removing riparian cover (Koontz et al. 2018), and streams that lose their snowpack with climate change may see the largest increases in stream temperature due to the removal of temperature buffering (Yan et al. 2021). These processes may threaten some habitats that are currently considered refugia.

Marine and Estuarine Environments

Along with warming stream temperatures and concerns about sufficient groundwater to recharge streams, a recent study projects nearly complete loss of existing tidal wetlands along the U.S. West Coast, due to sea level rise (Thorne et al. 2018). California and Oregon showed the greatest threat to tidal wetlands (100%), while 68% of Washington tidal wetlands are expected to be submerged. Coastal development and steep topography prevent horizontal migration of most wetlands, causing the net contraction of this crucial habitat.

Rising ocean temperatures, stratification, ocean acidity, hypoxia, algal toxins, and other oceanographic processes will alter the composition and abundance of a vast array of oceanic species. In particular, there will be dramatic changes in both predators and prey of Pacific salmon, salmon life history traits and relative abundance. Siegel and Crozier (2019) observe that changes in marine temperature are likely to have a number of physiological consequences on fishes themselves. For example, in a study of small planktivorous fish, Gliwicz et al. (2018) found that higher ambient temperatures increased the distance at which fish reacted to prey. Numerous fish species (including many tuna and sharks) demonstrate regional endothermy, which in many cases augments eyesight by warming the retinas. However, Gliwicz et al. (2018) suggest that ambient temperatures can have a similar effect on fish that do not demonstrate this trait. Climate change is likely to reduce the availability of biologically essential omega-3 fatty acids produced by phytoplankton in marine ecosystems. Loss of these lipids may induce cascading trophic effects, with distinct impacts on different species depending on compensatory mechanisms (Gourtay et al. 2018). Reproduction rates of many marine fish species are also likely to be altered with temperature (Veilleux et al. 2018). The ecological consequences of these effects and their interactions add complexity to predictions of climate change impacts in marine ecosystems.

Perhaps the most dramatic change in physical ocean conditions will occur through ocean acidification and deoxygenation. It is unclear how sensitive salmon and steelhead might be to the direct effects of ocean acidification because of their tolerance of a wide pH range in freshwater (although see Ou et al. 2015 and Williams et al. 2019), however, impacts of ocean acidification and hypoxia on sensitive species (e.g., plankton, crabs, rockfish, groundfish) will likely affect salmon indirectly through their interactions as predators and prey. Similarly, increasing frequency and duration of harmful algal blooms may affect salmon directly, depending on the toxin (e.g., saxitoxin vs domoic acid), but will also affect their predators (seabirds and mammals). The full effects of these ecosystem dynamics are not known but will be complex. Within the historical range of climate variability, less suitable conditions for salmonids (e.g., warmer temperatures, lower streamflows) have been associated with detectable declines in many of these listed units, highlighting how sensitive they are to climate drivers (Ford 2022, Lindley et al. 2009, Williams et al. 2016, Ward et al. 2015). In some cases, the combined and potentially additive effects of poorer climate conditions for fish and intense anthropogenic impacts caused the population declines that led to these population groups being listed under the ESA (Crozier et al. 2019).

Climate change effects on salmon and steelhead

In freshwater, year-round increases in stream temperature and changes in flow will affect physiological, behavioral, and demographic processes in salmon, and change the species with which they interact. For example, as stream temperatures increase, many native salmonids face increased competition with more warm-water tolerant invasive species. Changing freshwater temperatures are likely to affect incubation and emergence timing for eggs, and in locations where the greatest warming occurs may affect egg survival, although several factors impact intergravel temperature and oxygen (e.g., groundwater influence) as well as sensitivity of eggs to thermal stress (Crozier et al. 2020). Changes in temperature and flow regimes may alter the amount of habitat and food available for juvenile rearing, and this in turn could lead to a restriction in the distribution of juveniles, further decreasing productivity through density dependence. For migrating adults, predicted changes in freshwater flows and temperatures will likely increase exposure to stressful temperatures for many salmon and steelhead populations, and alter migration travel times and increase thermal stress accumulation for ESUs or DPSs with early-returning (i.e. spring- and summer-run) phenotypes associated with longer freshwater holding times (Crozier et al. 2020, FitzGerald et al. 2020). Rising river temperatures increase the energetic cost of migration and the risk of *en route* or pre-spawning mortality of adults with long freshwater migrations, although populations of some ESA-listed salmon and steelhead may be able to make use of cool-water refuges and run-timing plasticity to reduce thermal exposure (Keefer et al. 2018, Barnett et al. 2020).

Marine survival of salmonids is affected by a complex array of factors including prey abundance, predator interactions, the physical condition of salmon within the marine environment, and carryover effects from the freshwater experience (Holsman et al. 2012, Burke et al. 2013). It is generally accepted that salmon marine survival is size-dependent, and thus larger and faster growing fish are more likely to survive (Gosselin et al. 2021). Furthermore, early arrival timing in the marine environment is generally considered advantageous for populations migrating through the Columbia River. However, the optimal day of arrival varies across years, depending on the seasonal development of productivity in the California Current, which affects prey available to salmon and the risk of predation (Chasco et al. 2021). Siegel and Crozier (2019) point out the concern that for some salmon populations, climate change may drive mismatches between juvenile arrival timing and prey availability in the marine environment. However, phenological diversity can contribute to metapopulation-level resilience by reducing the risk of a complete mismatch. Carr-Harris et al. (2018), explored phenological diversity of marine migration timing in relation to zooplankton prey for sockeye salmon *O. nerka* from the Skeena River of Canada. They found that sockeye migrated over a period of more than 50 days, and populations from higher elevation and further inland streams arrived in the estuary later, with different populations encountering distinct prey fields. Carr-Harris et al. (2018) recommended that managers maintain and augment such life-history diversity.

Synchrony between terrestrial and marine environmental conditions (e.g., coastal upwelling, precipitation and river discharge) has increased in spatial scale causing the highest levels of synchrony in the last 250 years (Black et al. 2018). A more synchronized climate combined with simplified habitats and reduced genetic diversity may be leading to more synchrony in the productivity of populations across the range of salmon (Braun et al. 2016). For example, salmon productivity (recruits/spawner) has also become more synchronized across Chinook populations from Oregon to the Yukon (Dorner et al. 2018, Kilduff et al. 2014). In addition, Chinook salmon have become smaller and younger at maturation across their range (Ohlberger 2018). Other Pacific salmon species (Stachura el al. 2014) and Atlantic salmon (Olmos et al. 2020) also have demonstrated synchrony in productivity across a broad latitudinal range.

At the individual scale, climate impacts on salmon in one life stage generally affect body size or timing in the next life stage and negative impacts can accumulate across multiple life stages (Healey 2011; Wainwright and Weitkamp 2013, Gosselin et al. 2021). Changes in winter precipitation will likely affect incubation and/or rearing stages of most populations. Changes in the intensity of cool season precipitation, snow accumulation, and runoff could influence migration cues for fall, winter and spring adult migrants, such as coho and steelhead. Egg survival rates may suffer from more intense flooding that scours or buries redds. Changes in hydrological regime, such as a shift from mostly snow to more rain, could drive changes in life history, potentially threatening diversity within an ESU (Beechie et al. 2006). Changes in summer temperature and flow will affect both juvenile and adult stages in some populations, especially those with yearling life histories and summer migration patterns (Crozier and Zabel 2006; Crozier et al. 2010, Crozier et al. 2019).

At the population level, the ability of organisms to genetically adapt to climate change depends on how much genetic variation currently exists within salmon populations, as well as how selection on multiple traits interact, and whether those traits are linked genetically. While genetic diversity may help populations respond to climate change, the remaining genetic diversity of many populations is highly reduced compared to historic levels. For example, Johnson et al. (2018), compared genetic variation in Chinook salmon from the Columbia River Basin between contemporary and ancient samples. A total of 84 samples determined to be Chinook salmon were collected from vertebrae found in ancient middens and compared to 379 contemporary samples. Results suggest a decline in genetic diversity, as demonstrated by a loss of mitochondrial haplotypes as well as reductions in haplotype and nucleotide diversity. Genetic losses in this comparison appeared larger for Chinook from the mid-Columbia than those from the Snake River Basin. In addition to other stressors, modified habitats and flow regimes may create unnatural selection pressures that reduce the diversity of functional behaviors (Sturrock et al. 2020). Managing to conserve and augment existing genetic diversity may be increasingly important with more extreme environmental change (Anderson et al. 2015), though the low levels of remaining diversity present challenges to this effort (Freshwater 2019). Salmon historically maintained relatively consistent returns across variation in annual weather through the portfolio effect (Schindler et al. 2015), in which different populations are sensitive to different climate drivers. Applying this concept to climate change, Anderson et al (2015) emphasized the additional need for populations with different physiological tolerances. Loss of the portfolio increases volatility in fisheries, as well as ecological systems, as demonstrated for Fraser River and Sacramento River stock complexes (Freshwater et al. 2019, Munsch et al. 2022)

2.2.1 Status of the Species

Table 1, below, provides a summary of listing and recovery plan information, status summaries and limiting factors for the species addressed in this opinion. More information can be found in recovery plans and status reviews for these species. Acronyms appearing in the table include DPS (Distinct Population Segment), ESU (Evolutionarily Significant Unit), ICTRT (Interior Columbia Technical Recovery Team), MPG (Multiple Population Grouping), NWFSC (Northwest Fisheries Science Center), TRT (Technical Recovery Team), and VSP (Viable Salmonid Population).

Table 1. Listing classification and date, recovery plan reference, most recent status review, status summary, and limiting factors for each species considered in this opinion.

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River Chinook salmon	Threatened 6/28/05	NMFS 2013	NMFS 2016; Ford 2022	This ESU comprises 32 independent populations. Relative to baseline VSP levels identified in the recovery plan (Dornbusch 2013), there has been an overall improvement in the status of a number of fall-run populations although most are still far from the recovery plan goals; Spring-run Chinook salmon populations in this ESU are generally unchanged; most of the populations are at a "high" or "very high" risk due to low abundances and the high proportion of hatchery-origin fish spawning naturally. Many of the populations in this ESU remain at "high risk," with low natural-origin abundance levels. Overall, we conclude that the viability of the Lower Columbia River Chinook salmon ESU has increased somewhat since 2016, although the ESU remains at "moderate" risk of extinction	● Reduced access to spawning and rearing habitat ● Hatchery-related effects ● Harvest-related effects on fall Chinook salmon ● An altered flow regime and Columbia River plume ● Reduced access to off-channel rearing habitat ● Reduced productivity resulting from sediment and nutrient-related changes in the estuary ● Contaminant
Upper Willamette River Chinook salmon	Threatened 6/28/05	NMFS 2011	NMFS 2016; Ford 2022	This ESU comprises seven populations. Abundance levels for all but Clackamas River DIP remain well below their recovery goals. Overall, there has likely been a declining trend in the viability of the Upper Willamette River Chinook salmon ESU since the last review. The magnitude of this change is not sufficient to suggest a change in risk category, however, so the Upper Willamette River Chinook salmon ESU remains at "moderate" risk of extinction.	● Degraded freshwater habitat ● Degraded water quality ● Increased disease incidence ● Altered stream flows ● Reduced access to spawning and rearing habitats ● Altered food web due to reduced inputs of microdetritus ● Predation by native and non-native species, including hatchery fish ● Competition related to introduced salmon and steelhead ● Altered population traits due to fisheries and bycatch

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River coho salmon	Threatened 6/28/05	NMFS 2013	NMFS 2016; Ford 2022	Of the 24 populations that make up this ESU only six of the 23 populations for which we have data appear to be above their recovery goals. Overall abundance trends for the Lower Columbia River coho salmon ESU are generally negative. Natural spawner and total abundances have decreased in almost all DIPs, and Coastal and Gorge MPG populations are all at low levels, with significant numbers of hatchery-origin coho salmon on the spawning grounds. Improvements in spatial structure and diversity have been slight, and overshadowed by declines in abundance and productivity. For individual populations, the risk of extinction spans the full range, from "low" to "very high." Overall, the Lower Columbia River coho salmon ESU remains at "moderate" risk, and viability is largely unchanged since 2016.	● Degraded estuarine and near-shore marine habitat ● Fish passage barriers ● Degraded freshwater habitat: Hatchery-related effects ● Harvest-related effects ● An altered flow regime and Columbia River plume ● Reduced access to off-channel rearing habitat in the lower Columbia River ● Reduced productivity resulting from sediment and nutrient-related changes in the estuary ● Juvenile fish wake strandings ● Contaminants
Lower Columbia River steelhead	Threatened 1/5/06	NMFS 2013	NMFS 2016; Ford 2022	This DPS comprises 23 historical populations, 17 winter-run populations and 6 summer-run populations. 10 are nominally at or above the goals set in the recovery plan (Dornbusch 2013); however, it should be noted that many of these abundance estimates do not distinguish between natural- and hatchery- origin spawners. The majority of winter-run steelhead DIPs in this DPS continue to persist at low abundance levels (hundreds of fish), with the exception of the Clackamas and Sandy River DIPs, which have abundances in the low 1,000s. Although the five-year geometric abundance means are near recovery plan goals for many populations, the recent trends are negative. Overall, the Lower Columbia River steelhead DPS is therefore considered to be at "moderate" risk.	● Degraded estuarine and nearshore marine habitat ● Degraded freshwater habitat ● Reduced access to spawning and rearing habitat ● Avian and marine mammal predation ● Hatchery-related effects ● An altered flow regime and Columbia River plume ● Reduced access to off-channel rearing habitat in the lower Columbia River ● Reduced productivity resulting from sediment and nutrient-related changes in the estuary ● Juvenile fish wake strandings ● Contaminants

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Upper Willamette River steelhead	Threatened 1/5/06	NMFS 2011	NMFS 2016; Ford 2022	This DPS has four demographically independent populations. Populations in this DPS have experienced long-term declines in spawner abundance. Although the recent magnitude of these declines is relatively moderate, continued declines would be a cause for concern. In the absence of substantial changes in accessibility to high-quality habitat, the DPS will remain at "moderate-to-high" risk. Overall, the Upper Willamette River steelhead DPS is therefore at "moderate-to-high" risk, with a declining viability trend.	● Degraded freshwater habitat ● Degraded water quality ● Increased disease incidence ● Altered stream flows ● Reduced access to spawning and rearing habitats due to impaired passage at dams ● Altered food web due to changes in inputs of microdetritus ● Predation by native and non-native species, including hatchery fish and pinnipeds ● Competition related to introduced salmon and steelhead ● Altered population traits due to interbreeding with hatchery origin fish

2.2.2 Status of Critical Habitat

This section describes the status of designated critical habitat affected by the proposed action by examining the condition and trends of the essential physical and biological features of that habitat throughout the designated areas. These features are essential to the conservation of the ESA-listed species because they support one or more of the species' life stages (e.g., sites with conditions that support spawning, rearing, migration and foraging).

For most salmon and steelhead, NMFS's critical habitat analytical review teams (CHARTs) ranked watersheds within designated critical habitat at the scale of the fifth-field hydrologic unit code (HUC5) in terms of the conservation value they provide to each ESA-listed species that they support (NMFS 2005). The conservation rankings were high, medium, or low. To determine the conservation value of each watershed to species viability, the CHARTs evaluated the quantity and quality of habitat features, the relationship of the area compared to other areas within the species' range, and the significance to the species of the population occupying that area. Even if a location had poor habitat quality, it could be ranked with a high conservation value if it were essential due to factors such as limited availability, a unique contribution of the population it served, or is serving another important role.

A summary of the status of critical habitats, considered in this opinion, is provided in Table 2, below.

Table 2. Critical habitat, designation date, federal register citation, and status summary for critical habitat considered in this opinion

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Lower Columbia River Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 47 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some, or high potential for improvement. We rated conservation value of HUC5 watersheds as high for 30 watersheds, medium for 13 watersheds, and low for four watersheds.
Upper Willamette River Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Oregon containing 56 occupied watersheds, as well as the lower Willamette/Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some, or high, potential for improvement. Watersheds are in good to excellent condition with no potential for improvement only in the upper McKenzie River and its tributaries (NMFS 2005). We rated conservation value of HUC5 watersheds as high for 22 watersheds, medium for 16 watersheds, and low for 18 watersheds.
Lower Columbia River coho salmon	2/24/16 81 FR 9252	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 55 occupied watersheds, as well as the lower Columbia River and estuary rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 34 watersheds, medium for 18 watersheds, and low for three watersheds.
Lower Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses nine subbasins in Oregon and Washington containing 41 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 28 watersheds, medium for 11 watersheds, and low for two watersheds.
Upper Willamette River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses seven subbasins in Oregon containing 34 occupied watersheds, as well as the lower Willamette/Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. Watersheds are in good to excellent condition with no potential for improvement only in the upper McKenzie River and its tributaries (NMFS 2005). We rated conservation value of HUC5 watersheds as high for 25 watersheds, medium for 6 watersheds, and low for 3 watersheds.

2.3 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). As summarized in Section 1.3 and described in the HCP, the proposed action includes implementation of the covered activities and conservation program on Port Blakely's John Franklin Eddy Forestlands as well as any lands acquired by Port Blakely within the range of the covered species within the 50-year permit term. As such, the action area is those 4th field watersheds where Port Blakely lands occur or may occur that support ESA-listed anadromous species and/or contain designated critical habitat (Figure 1). Potential effects of the covered activities and conservation program will occur immediately downstream of the project sites and are not expected to extend beyond these watersheds included in the action area:

- 17090012, Lower Willamette
- 17090011, Clackamas
- 17090007, Middle Willamette
- 17090009, Molalla/Pudding
- 17090005, North Santiam
- 17090006, South Santiam
- 17090003, Upper Willamette

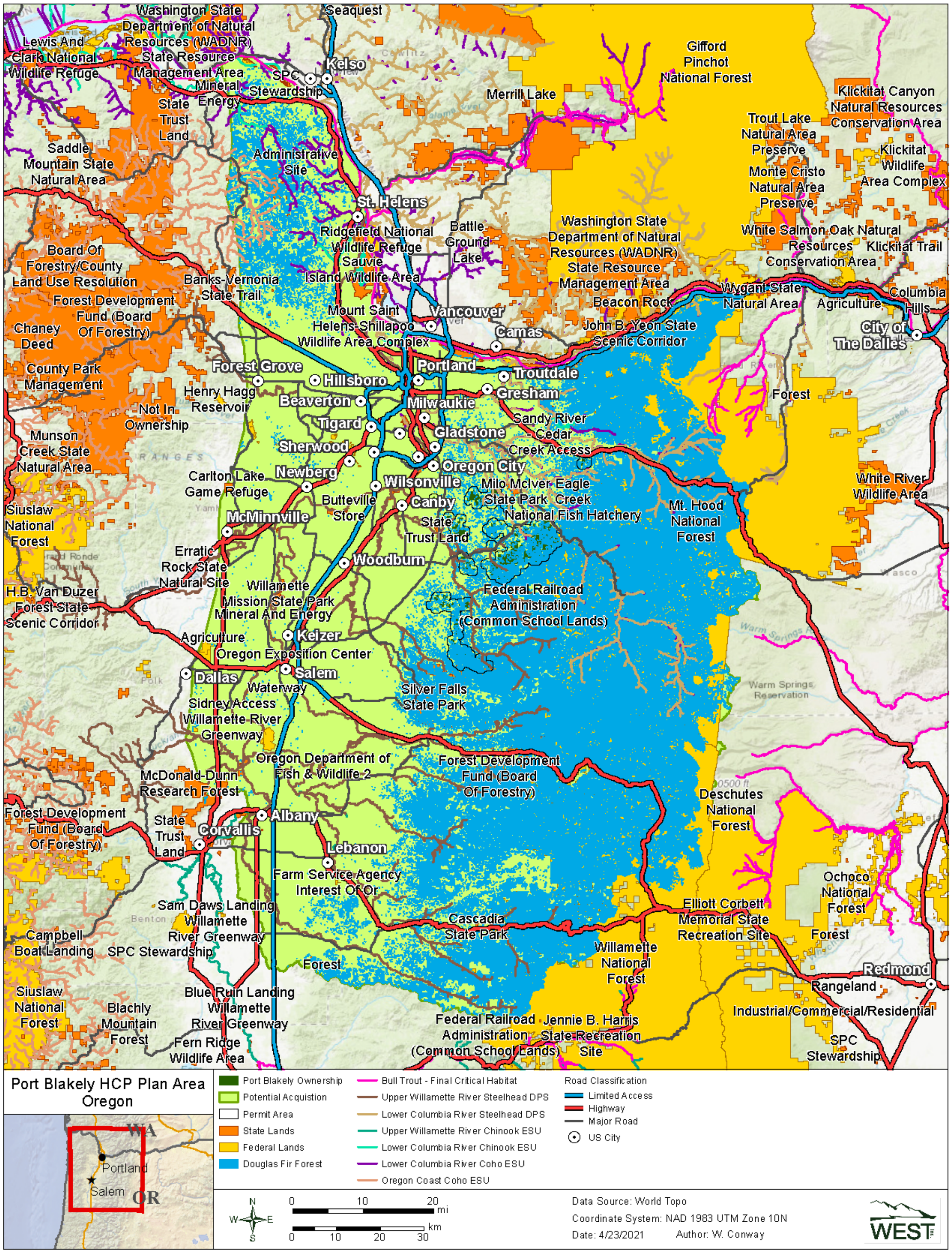


Figure 1. Vicinity Map of the Port Blakely John Franklin Eddy Forestlands.

2.4 Environmental Baseline

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

The climate change effects on the environmental baseline are described in Section 2.2 of this opinion.

In addition to natural disturbances such as wildfires, forest insect and disease outbreaks, landslides, glacial debris flows, and floods, the watersheds in the action area have also been impacted by a history of human-caused disturbances, such as recreation, logging, road construction, hydro-power development, irrigation and municipal water diversions, and wildfire suppression. In recent decades, river restoration projects have been implemented where potential for improvements exist. The action area also includes a variety of land uses and types, including urban or residential areas, private lands managed for forestry or agriculture, and state and federal lands composed primarily of forestlands. Activities on these lands include forest management, road building, urbanization, grazing, gravel mining, and irrigation and water withdrawals for domestic, industrial and agricultural uses.

Within the action area, Port Blakely’s John Franklin Eddy Forestlands encompasses 29,395 forested acres in Clackamas County, in the vicinity of Molalla, Oregon. The current ownership is comprised of discontiguous parcels of commercial forestland distributed across 110 Sections within six Townships in the central part of the county at the western edge of the Cascade Mountain Range. Port Blakely owes an additional 1,418 acres of non-forest land, i.e., buildings, powerlines, roads, and rock pits. Port Blakely purchased the majority of the property (27,271 acres) in 1987 from Times Mirror and inherited the existing road infrastructure. The total amount of active roads on Port Blakely’s ownership is 251 miles resulting in a road density of approximately 5.2 mi/mi2. There are nine permanent steel bridges on the current ownership as well as 18 rock pits covering approximately 40 acres.

The ownership is surrounded by and/or intermixed with small towns, residential areas, private lands managed for forestry or agriculture, other commercial forestlands, and state and federal lands composed primarily of forestlands. Lands within the potential land acquisitions boundary shown in Figure 1, are similarly comprised of a variety of ownerships, primarily urban, agricultural and forestry Port Blakely may acquire lands within this boundary and request they be included in the HCP. Under the terms of the HCP, these lands would have characteristics similar to the current ownership. They will be nonfederal and nonstate forestlands, e.g., small landowner or industrial forestlands, within the LCR and UWR ESUs, and have vegetative, species, and landscape characteristics similar to the current HCP lands.

Port Blakely's forest stands are comprised primarily of Douglas-fir with a small amount of white wood (true firs, western hemlock, Sitka spruce, and several pine species), hardwoods (red alder, cottonwood, maple, oak and ash) and a limited number of western red cedar. The forested stands are field surveyed to identify proportions of species, amount of associated basal area, and potential forest health concerns. The age structure is diverse and was fairly evenly distributed prior to the late-summer 2020 catastrophic wildfires. These fires affected approximately 8,100 acres in the eastern and southern parcels of the current ownership with fire of varying intensities of heat. High and medium severity stands and acres by age class from fire were assumed dead. The current age-class distribution post-fire is shown in Table 3.

Table 3. Acreage of Port Blakely forest age-classes in the current ownership in Year 2022 (post fire).

Age Class	Gross Acres	Percent
0-10	10,132	33%
11-20	3,356	11%
21-30	2,561	8%
31-40	3,430	11%
41-50	5,311	17%
51+	6,076	20%
Total	**30,866**	**100%**

A portion of Port Blakely's forestlands located in eight separate parcels throughout its current ownership was previously managed for agricultural purposes, e.g., Christmas tree farms, orchards, and pastures. These parcels, totaling 2,496 acres, have been converted back to commercially managed forestlands. The remainder of the forestland has sustained at least two harvest rotations, i.e., is either second or third growth, managed under past forest practices regulations with limited requirements to retain woody features. The catastrophic wildfires of late-summer 2020 also changed the condition of forest stands on the easternmost and southernmost parcels of current ownership. While the majority of the affected lands are anticipated to be a complete loss, that is minimal tree survival is anticipated to occur, some areas are expected to survive.

Given these conditions, the distribution of established large wood jams to provide diversity and complexity across the landscape is less than current forest conservation standards. This is true for both terrestrial forest habitat in the uplands and riparian habitat along streams and wetlands. Structural features such as standing snags, older trees, forest-floor coarse woody material, and large wood in streams are uncommon across much of Port Blakely's current ownership. What remains are managed stands that have matured from previous agricultural conditions with few legacy features, stands harvested two or three times under current OARs, and stands that burned at various intensities during the 2020 wildfires.

Approximately 190 miles of streams flow on the John Franklin Eddy Forestlands. Of these stream miles, 22.5 % are small fish-bearing streams (including salmon, steelhead and bulltrout (SSBT)), while more than ½ of the streams (55%) are small non-fish perennial and seasonal streams (Table 4).

Table 4. Miles of known fish and non-fish-bearing streams by stream type, including SSBT streams, and percent of total stream miles on the current ownership.

Stream Type	**Miles**	**Percent**
Large Fish	17.7	9.3
Medium Fish – Non SSBT	18.0	9.5
Medium Fish - SSBT	6.9	3.6
Small Fish – Non SSBT	42.3	22.3
Small Fish - SSBT	0.3	0.2
Large NF	0.0	0.0
Medium NF	0.2	0.1
Small NF	104.5	55.0
Domestic	0.1	0.0
Total Miles	**190.0**	**100**

For larger fish-bearing streams and rivers that flow through or adjacent to the Port Blakely ownership, it is assumed that a variety of fish species, representing all fresh-water life-stages are present. The fish utilizing the headwater streams that flow through the current ownership include resident cutthroat trout, steelhead, and sculpin species. Occasionally coho and lamprey are detected. Salmonids that are detected within these headwater streams are typically rearing juveniles, while sculpin and lamprey have been detected at all life-stages. Under the OARs, fish-bearing streams are defined by fish use. "Fish use" means inhabited at any time of the year by anadromous or game fish species or fish that are listed as threatened or endangered species under the federal or state endangered species acts (ODF 2018a). Fish streams are not typed as such if anadromous, game or listed species are not present, even if other native fish are present. However, Port Blakely considers all native fish as “fish” for purposes of stream typing and HCP protections.

2.4.1 ESA-listed Species in the Action Area

The action area is occupied by LCR coho salmon, LCR and UWR Chinook salmon, and LCR and UWR steelhead. The migration and rearing timing of adults and juveniles of these species varies by species and location in the action area. Table 5 summarizes these species’ general spawning, migration, and rearing timing in the action area.

Table 5. Covered listed species

Population	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
LCR coho salmon												
Adult migration												
Adult spawning												
Juvenile migration												
Juvenile rearing												
LCR Chinook salmon												
Adult migration												
Adult spawning												
Juvenile migration												
Juvenile rearing												
UWR Chinook salmon												
Adult migration												
Adult spawning												
Juvenile migration												
Juvenile rearing												
LCR steelhead												
Adult migration												
Adult spawning												
Juvenile migration												
Juvenile rearing												
UWR steelhead												
Adult migration												
Adult spawning												
Juvenile migration												
Juvenile rearing												

Salmon and steelhead populations that occur in the action area are:

1. ***LCR Chinook Salmon***. The Clackamas River population that has a very low persistence probability rating. The recovery plan target for this population is to increase persistence to Medium (NMFS 2013).
2. ***LCR Coho salmon*.** The Clackamas River population that has a moderate persistence probability rating. The recovery plan target for this population is to increase persistence probability to Very High (NMFS 2013).
3. ***LCR Steelhead*.** The Clackamas River population that has a moderate persistence probability rating. The recovery plan target for this population is to increase persistence to High (NMFS 2013)
4. ***UWR Chinook* Salmon.** The Clackamas River population that has a moderate risk of extinction; and the Molalla River population that has a very high risk of extinction. The recovery plan target for these populations is to decrease risk to Very Low and High Risk, respectively (NMFS 2011)

5. ***UWR Steelhead*.** The Molalla River population that has a low extinction risk. The recovery plan target for this population is to decrease risk to Very Low (NMFS 2011).

Factors limiting the recovery of these species in the action area vary with the overall condition of aquatic habitats on private, state, and federal lands. The environmental baseline in the action area is also degraded by the key management activities mentioned above. These activities and the changes to critical habitat described above have adversely affected the covered listed species individuals in the action area and have contributed to their decline. Construction and operations related to key management activities have resulted in lethal and sub-lethal injury and adverse behavior modification of covered listed species that have caused reduced growth, survival and fitness of individuals.

2.4.2 Critical Habitat in the Action Area

LCR coho salmon, LCR and UWR Chinook salmon, and LCR and UWR steelhead have designated critical habitat in the action area. The critical habitat PBFs that support spawning, rearing, and migration for the covered listed species are described in section 2.2.1 of this opinion (*Status of Critical Habitat*). PBFs include substrate, floodplain connectivity, forage, natural cover, water quality, water quantity, and fish passage free of artificial obstruction.

As described in Table 2 in the section 2.2.1 and section 2.3.1 of this opinion, key management activities that have reduced the quality and function of these five listed species' critical habitat in the action area includes forest management, road building, agriculture, urbanization, irrigation and water withdrawals, grazing, and gravel mining. Each of these activities has contributed to a myriad of interrelated factors for the decline in quality and function of critical habitat PBFs essential for the conservation of these species. Among the most important changes to critical habitat are altered stream channel morphology, degradation of spawning substrates, reduced in-stream channel roughness and natural cover, loss and degradation of riparian areas, water quality degradation (e.g., water temperature, sediment, and dissolved oxygen), altered water quantity and stream flows, blocked fish passage, and loss of off-channel habitats and floodplain connectivity.

2.5 Effects of the Action

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action (see 50 CFR 402.02). A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered the factors set forth in 50 CFR 402.17(a) and (b).

The conservation strategy for this HCP was developed in the context of a forested landscape that has been modified from historical conditions across the permit area. Over the life of the HCP, habitat for the covered species may be adversely affected or lost through timber harvest or other covered activities; however, habitat affected or lost to covered activities will be offset by implementing conservation strategies throughout the permit area. In the context of the HCP, implementation planning will include planning for the timber harvest, silviculture, and road management and conservation program to ensure conservation strategies are implemented temporally and spatially across Port Blakely ownership along with these activities to have the greatest impact in avoiding, minimizing, and mitigating the effects of HCP implementation on covered species and their habitats.

2.5.1 Effects of the Action on Aquatic Habitat

The proposed action is our proposed issuance of an ITP to Port Blakely to authorize incidental take of the covered species related to the covered activities described in the HCP. Our analysis considers Port Blakely's covered activities to understand how Port Blakely's implementation of the HCP will affect ecological processes, environmental indicators, and covered species and their habitat in the action area.

Our analysis considers each of the covered activities and the resulting effects. These include such actions as timber harvest, silviculture, road management and the conservation strategies. In this section, our analysis focuses on the primary ecological habitat indicators affected by these activities and include: stream temperature; suspended sediment and embeddedness; chemical contamination/nutrients; large wood recruitment; pool frequency and quality, large pools, off-channel habitat, refugia, width to depth ratio, streambank condition, floodplain connectivity; change in peak/base flow, increase in drainage network; road density and location; disturbance history and regime; and riparian reserves. Our assessment of these proposed activities and their effects on the habitat indicators are necessarily of a generalized nature for this HCP. The effects of the habitat indicators are then used to described the effects on ESA-listed species in the next section.

Stream Temperature

Forest management associated activities can influence water temperature at a sub-reach or reach scale and potentially at a watershed scale as follows.

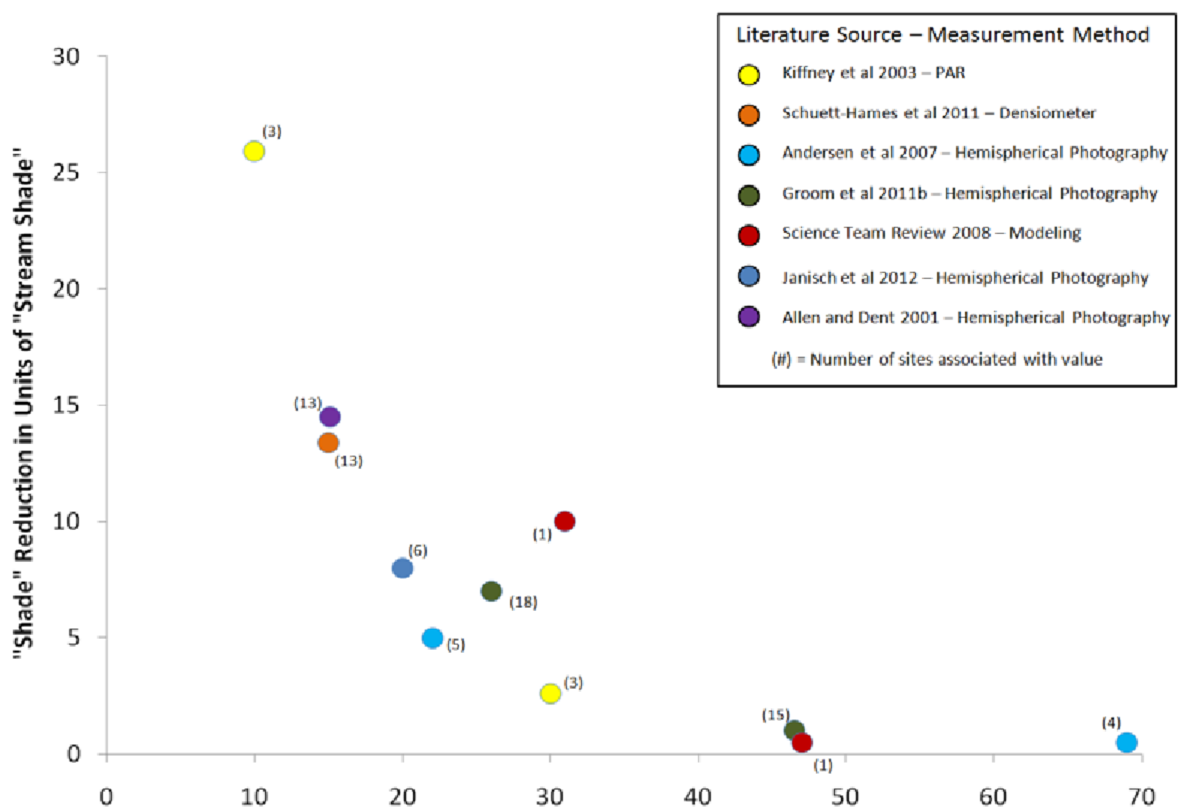
Timber Felling and Yarding. Removing trees in riparian areas reduces the amount of shade which exposes streams to increased thermal loading (Moore and Wondzell 2005). In clearcuts, small effects on shade were observed in studies that examined no-cut buffers 46 m (150 feet) wide (Anderson et al. 2007, Leinenbach et al. 2013, Groom et al. 2011a, Groom et al. 2011b). The limited response observed in these studies can be attributed to the lack of trees that were capable of casting a shadow more than 46 m (150 feet) during most of the day in the summer (Leinenbach 2011). These results demonstrate that vegetation that is 46 m (150 feet) away from streams contributes shade to streams in some situations.

As is seen in no-cut buffer widths with clearcut prescriptions, the wider no-cut buffers resulted in lower reductions of stream shade (Anderson et al. 2007, Park et al. 2008). In addition, the canopy density of the no-cut buffer appeared to have an ameliorating effect on thinning activities outside of the buffer, with higher protection associated with greater canopy densities in the no-cut buffer

(Leinenbach et al. 2013). Finally, higher residual vegetation densities outside of the no-cut buffers were shown to result in less shade loss (Leinenbach et al. 2013).

Although stream shade correlates with the width of no-cut buffers, the relationship is quite variable, depending on site-specific factors such as stream size, substrate type, stream discharge, topography (Caissie 2006), channel aspect, and forest structure and species composition. Silvicultural prescriptions used by Port Blakely to retain variable amounts of shade are intended to minimize the importance of those site-specific differences, and result in less stream exposure to thermal loading. Inputs of cold water from the streambed, seepage areas on the stream bank, and tributaries can help cool the stream on hot summer days if they are sufficiently large relative to the stream discharge (Wondzell 2012). The density of vegetation in riparian areas affects shade and thermal loading to a stream due to the penetration of solar radiation through gaps in the canopy and among the branches and stems (Brazier and Brown 1973; DeWalle 2010). In some instances (such as narrow streams with dense, overhanging streamside vegetation, or stands on the north sides of streams with an east-west orientation), no-cut buffers as narrow as 30 feet adjacent to clearcuts can maintain stream shade (Brazier and Brown 1973).

EPA (Science Team Review in 2008), developed a statistical correlation model estimating the association between riparian buffer width reductions and stream shade loss. This empirical model ($r2 = 0.97$) indicates that shade loss is minimal when buffer widths are relatively wide (e.g., 120 ft to 180 ft), but loss of shade increases dramatically when the buffer is narrowed to less than 100 ft. This indicates that riparian vegetation located near the stream has relatively greater impact on stream shade conditions than riparian vegetation located further away.



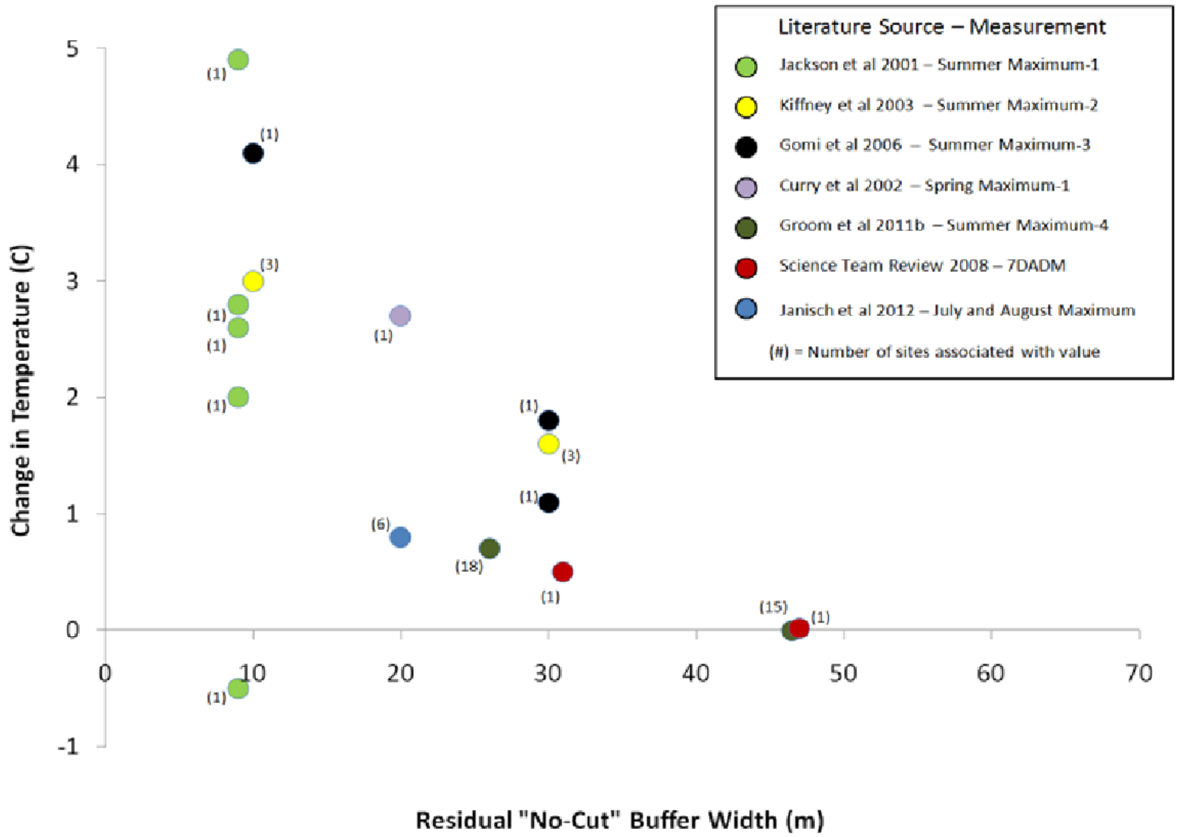


Figure 2. Observed "shade" and temperature response associated with "no-cut" riparian buffers adjacent clearcut harvest. Note that many of these studies evaluated correlates of shade (e.g, canopy density) as opposed to direct measurements of shade. Abbreviations: PAR = photosynthetically active radiation; 7DAADM = seven-day moving average of daily maximum temperature (Leinenbach 2013).

Again, the relationship between the width of no-cut buffers on thinning versus clearcut prescriptions and stream shade is difficult to generalize because of the limited number studies that have specifically evaluated no-cut buffers in thinning prescriptions. Thus, quantifying the stream shade loss and subsequent stream temperature increase is difficult. Nonetheless, the best available scientific information supports a direct relationship between the loss of shade resulting from tree harvest in riparian areas with stream buffers and localized increases in stream temperatures. Resulting increases in stream temperature are variable depending on the intensity of harvest and other factors described above (stream size, substrate type, stream discharge, topography, channel aspect, and forest structure and species composition) and could range from not measurable (low intensity thinning) to significant increases that render aquatic habitats unusable during certain seasons (clearcutting). Because the Port Blakely's program consists of regeneration harvest in some riparian zones, it is reasonably certain the HCP will result in a small amount of shade loss and subsequently, a localized and temporal small increase in stream temperature that would cause minor adverse effects to aquatic habitat.

Large wood restoration. Port Blakely proposes to fall trees into streams to restore in-stream habitat. Fall and leave treatments will not cause an increase in stream temperature. This is because the Port Blakely will only fall understory trees, while leaving the larger overstory trees to continue providing shade. This large wood will provide habitat for ESA-listed species as well as help regulate sediment and flow routing, influence stream channel complexity and stability, increase pool volume and area, and provide hydraulic refugia and cover for fish (Bisson et al. 1987, Gregory et al. 1987, Hicks et al. 1991, Ralph et al. 1994, Bilby and Bisson 1998). In addition, the remaining trees in the RMAs will continue to provide shade to streams.

Timber Yarding. Port Blakely proposes to use yarding corridors that may require removal of some trees in the upland and the RMAs. Timber yarding will not likely cause an increase in stream temperature because the Port Blakely will minimize effects on stream shade by limiting yarding corridors through the no-cut buffers on units adjacent to fish streams. On all other streams, Port Blakely will limit yarding corridors through the no-cut buffers to spacing the corridors at least 50-80 feet apart. In addition, yarding corridors are relatively narrow and trees in the remainder of the stands will continue to provide the majority of stream shade.

Road Work. Removing trees in riparian areas reduces the amount of shade which exposes the stream to increased thermal loads (Moore and Wondzell 2005). Road work in the RMAs would remove trees and could cause a decrease in shade and a subsequent increase in stream temperature. The proposed road work consists of road and landing construction/reuse; road and landing maintenance, and reconstruction; road decommissioning. As part of the road work, Port Blakely also proposes to develop and operate rock quarries. Implementation of the conservation strategies as well as the spatial and temporal variability of road work throughout the Port Blakely landscape, no adverse effects to stream shade from road work will occur.

Road and Landing Construction/Reuse. New road construction permanently takes forestland out of production. Port Blakely will only construct a new road if it determines it is essential for conducting forest management and future timber harvest. The conservation strategies include measures to minimize road work effects on stream temperature. These measures include: placing roads t so that they will not contribute to the potential for slope failure, avoiding RMAs, and minimizing stream crossings. In a five-year period, Port Blakely would construct up to 35 miles of road (including on acquisition lands). But this is a conservative estimate because Port Blakely doesn’t anticipate needing to build roads to this extent, as road infrastructure is something maintained once built.

Port Blakely proposes to construct and reconstruct landings. Port Blakely did not provide an estimate of how many landings would be constructed; however, they provided measures that would minimize the effects on stream temperature, and would avoid locating landings in RMAs.

Given the conservation strategies associated with road and landing construction and reuse as well as the spatial and temporal variability of new road and landing construction across Port Blakley lands, there will not be an adverse effect to stream shade, and will not have an adverse effect on stream temperature.

Road Maintenance and Reconstruction. Port Blakey proposes to maintain and reconstruct roads, including the removal of small, understory vegetation, and small trees. The understory vegetation and small trees will not reduce stream shade, or cause a subsequent increase in stream temperature. This is because trees in the existing overstory will continue to provide stream shade.

As part of road maintenance and reconstruction, Port Blakely proposes to replace culverts and bridges to accommodate the 100-year flood, as approved by NMFS fish passage engineers. Culvert and bridge replacement may slightly reduce overstory vegetation in the immediate vicinity, but is unlikely to reduce the number or density of trees in the overstory sufficiently to cause a reduction in stream shade. This is because the remaining trees, and understory vegetation will continue to provide shade to the stream. In addition, there will be a spatial and temporal separation of culvert and bridge replacement across the action area which will prevent an aggregation of increases in stream temperature.

Given the conservation strategies associated with road maintenance and reconstruction as well as the spatial and temporal variability of road maintenance and reconstruction across Port Blakley lands, there will not be an adverse effect to stream shade, and will not have an adverse effect on stream temperature.

Road Decommissioning and Closure. Port Blakely proposes road deactivation where roads are not expected to be needed for 20-25 years. Port Blakely also proposes to abandon non-essential roads and decommission 1.9 miles of stream adjacent roads within 5 years of permit issuance. Decommissioning usually includes removal of stream culverts, ditch relief culverts, decompacting the roadbed, and sometimes includes recontouring cuts and fill slopes to their original contour.

The effects on stream temperature from road construction are discussed above, and similar effects would occur from road decommissioning and closure with the removal of small, overstory vegetation that could provide stream shade. The conservation elements required by Port Blakely for road decommissioning and closure, specifically reshaping the channel and streambanks at the stream crossing will allow for the reestablishment of overstory vegetation. Once the overstory vegetation is reestablished, there will be a recovery of stream shade, and a subsequent decrease in stream temperature.

Given the conservation strategies associated with road decommissioning and closure, as well as the spatial and temporal variability of road decommissioning and closure across Port Blakley lands, there will not be an adverse effect to stream shade, and will not have an adverse effect on stream temperature.

Rock Quarry Development and Operation. Rock quarry development and operation will include vegetation and soil removal, excavation, drilling and blasting, crushing, sorting, and piling of rock materials. Currently, there are 18 rock pits covering approximately 40 acres. These pits are entered, on average, once every three years. When abandoned, they are reclaimed to return the pits to forest production. Port Blakely anticipates the abandonment of eight rock pits over the next 50 years and replacing them with eight new rock pits approximately 1.5 acres in size, on average. New rock pits will be located near existing roads and away from streams All rock pits and quarrying activities will be located outside of stream channels and RMAs. Since there is no causal mechanism to affect stream shade, rock quarry operation will not have an adverse effect on stream temperature.

Fuels Treatment. Port Blakely proposes to use slash piling and burning, and prescribed burning. Slash will be piled with machines and will be placed outside of the no-cut buffers, with the exception material from pre-commercial thinning where material remains on the forest floor. Pile burning and prescribed broadcast burning will occur during high moisture conditions. The implementation of these conservation measures will likely prevent any damage to trees that could remove stream shade. Thus, fuels treatment is not likely to affect stream temperature by reducing shade.

2.5.1.1 Suspended sediments and substrate embeddedness

Forest activities can increase sediment supply to streams via increased mass wasting (primarily landslides) (Sugden 2018, Sidle and Ochiai 2006, Swanson and Dryness 1975, Swanston and Swanson 1976, Furniss et al. 1991, McClelland et al. 1997, Robison et al. 1999) or surface erosion (most commonly from road surfaces (Haupt 1959, Swanson and Dyrness 1975, Swanston and Swanson 1976, Beschta 1978, Megahan 1987).

Timber Felling and Yarding. Living tree roots help stabilize soil. Timber felling kills the roots, which increases the probability of slope failure (Swanston and Swanson 1976), particularly on steep slopes (i.e., more than 70% concave, more than 80% planar or convex slopes) (Robison et al. 1999). This also increases the potential of sediment delivery to the stream network. The occurrence probability is related to the harvest intensity, soil properties, geology, unit slope, and precipitation level. Depending on the prescription used, thinning will greatly reduce the number of living trees within the treated stands. As the roots of harvested trees die and decompose, their effectiveness in stabilizing soils will decrease over time.

Timber felling and yarding disturbs soils and increases their potential for transport to area stream channels. Logging alone does not appear to increase surface erosion significantly (Likens et al. 1970, Megahan et al. 1995), although use of heavy machinery to transport cut logs causes soil compaction, leading to increased surface erosion and increased fine sediment delivery to streams (Williamson and Neilson 2000). For all types of surface erosion, sediment delivery to streams is through direct surface water connections such as ditches, rills, or gullies (Bilby et al. 1989, Croke and Mocker 2001).

Streamside buffer strips are generally not as effective in preventing channelized flow, but are effective where sheet erosion occurs; however, the effectiveness of buffer strips for preventing sediment movement within the buffer increases with the presence of herbaceous vegetation and slash (Warrington et al. 2017, Belt et al. 1992). Several studies document the ability of buffer strips to reduce erosion and sediment delivery. Vegetated buffer areas ranging in width from 40 to 100 feet appear to prevent sediment from reaching streams (Burroughs and King 1989, Corbett and Lynch 1985, Gomi et al. 2005). Lakel et al. (2010) concluded that streamside management zones (buffers) between 25 and 100 feet were effective in trapping sediment before it could enter streams. Ground-based yarding can be accomplished with relatively little damage to the existing shrub and herbaceous ground cover, thus limiting the exposure of bare soil and maintaining important root structure that holds soil in place.

The ITP and associated HCP would require Port Blakely to implement the following conservation program measures to minimize suspended sediment from reaching streams:

- Maintain 75-100 feet no-harvest buffers for fish streams adjacent to harvest units, depending on stream type.
- Maintain 25-55 feet no-harvest buffers for non-fish streams adjacent to harvest units, with an additional 25 feet managed buffer, depending on stream type.
- Maintain a 30-100 feet equipment limitation zone depending on stream, lake or wetland type.
- At harvest, isolate potentially high hazard slopes and protect bedrock hollow, convergent headwalls and inner gorge features with greater than 70% slope with a 50’ no-harvest buffer.

The no-cut buffers and conservation strategies required by the ITP and associated HCP would ensure that most fine sediment generated by timber felling and yarding will not reach streams. This is because the size of the no-cut buffers of 25-100 feet on streams adjacent to and upstream of listed fish will prevent most sediment from entering stream (Burroughs and King 1989, Corbett and Lynch 1985, Gomi et al. 2005). For these reasons, the no-cut buffers, and conservation strategies will likely prevent suspended sediment due to timber felling and yarding from entering streams.

Road Management. The link between unpaved forest roads and increased fine sediment delivery into streams has been well-established over the past three decades (Sugden 2018, Warrington et al. 2017, Arismendi et al. 2017, Johnson and Bestcha 1980, Reid et al.1981, Montgomery 1994, Croke and Mockler 2001, Madej 2001). The effects of roads range from chronic and long-term contributions of fine sediment into streams to catastrophic mass failures of road cuts and fills during large storms (Gucinski et al. 2001). Road surface erosion rates are primarily a function of storm intensity, surfacing material, road slope, and traffic level (Reid et al. 1981, Bilby et al. 1989, MacDonald et al. 2001, Ziegler et al. 2001). The direct effects of roads, such as increased sedimentation and increased risk of slides and debris flows, are much affected by road design and placement on the landscape (Gucinski et al. 2001). For all types of surface erosion, sediment to streams is through direct surface water connections such as ditches, rills, or gullies (Bilby et al. 1989, Croke and Mockler 2001).

Extensive research has demonstrated that improved design, building, and maintenance of roads can reduce road-related surface erosion at the scale of individual road segments (Arismendi et al 2017). Key factors are road location, particularly layout relative to stream systems (Sugden 2018, Warrington et al. 2017, Swift 1988, USDA FS 1999), road drainage (Sugden 2018, Arismendi et al. 2017, Warrington et al. 2017, Haupt 1959), surfacing (Burroughs and King 1989, Kochenderfer and Helvey 1987, Swift 1984), and cut slope and fill slope treatments (Burroughs and King 1989, Swift 1988). Many studies show that surfacing materials and vegetation measures can be used to reduce the yield of fine sediment from road surfaces (Sugden 2018, Beschta 1978, Burroughs et al. 1984, Kochenderfer and Helvey 1987, Swift 1984). In addition, moving sediment-laden water to depositional areas where water infiltrates into the soil, reduces the amount of sediment entering streams (Arismendi et al. 2017). Studies show that the placement of aggregate surface on roads reduced sediment production by 70-97% (Swift 1984, Burroughs et al. 1985), as cited by Burroughs and King (1989). Arismendi et al. (2017) found that the location, construction, maintenance, and especially the lack of hydrological connectivity have been shown to disconnect streams from road-related erosive processes.

The proposed road management consists of road construction and maintenance, road abandonment and deactivation, and quarrying. Road and landing construction/reuse includes the construction of new, temporary and permanent roads. Road maintenance and reconstruction includes adding spot rock, blading road surfaces, compacting the road surface, cleaning ditches, brushing road sides, clearing drainage structures, and dust abatement. Port Blakely will construct a maximum of 35 miles of road each 5-year period of their permit term. Decommissioning usually includes removal of stream culverts, ditch relief culverts, decompacting the road bed, and sometimes includes recontouring cuts and fill slopes to their original contour. Rock quarry development and operation will include vegetation and soil removal, excavation, drilling and blasting, crushing, sorting, and piling of rock materials.

Of the road work elements, there is a high probability that road construction will introduce sediment into ditch lines and in some instances, into streams because road construction can occur in RMAs adjacent to, and in close proximity to fish streams. The potential proximity of this project element means that it is likely to cause an increase in suspended sediment. The other road management activities are not as likely to introduce sediment into ditch lines and streams because they occur outside of RMAs and therefore not as hydrologically connected. At greatest risk of contributing sediment to listed-fish streams are road segments draining to listed-fish streams that includes stream culvert installation, replacement, and removal.

Road maintenance BMPs, including adding and maintaining cross drains and ditches were 93% effective in minimizing sediment to streams (Luce and Black 1999). Forest vegetation buffers flow and prevents sediment from reaching streams (Copstead and Johansen 1998). The integrity of the road surface can be enhanced during high runoff periods by gravel to produce well-aggregated surfaces. Roads that were well-graded and graveled did not show signs of surface runoff during storm events (Copstead and Johansen 1998).

The HCP incorporates some of these BMPs into the conservation measures to minimize the amount of fine sediment from roads reaching streams, in particular, the construction and spacing of cross drains and ditches (Luce and Black 1999), adding aggregate surface to roads (Copstead and Johansen 1998), retaining ground cover in ditch lines, and conducting in-water work during the ODFW in-water work window. Adding and spacing cross drains appropriately ensures that only a small portion of the road (less than 200 feet) is capable of routing water and sediment through the ditch lines to streams. The placement of aggregate on roads reduces sediment production. Retaining ground cover in ditch lines traps and stores the majority of sediment and minimizes the amount of sediment reaching streams. Conducting in-water work during the ODFW in-water work window minimizes the amount of sediment mobilized in the stream because this occurs during low water periods in the streams, and dry weather in the summer.

The application of these conservation measures for road related activities would minimize the amount of suspended sediment from reaching streams. The exception is for the construction of roads. This is because road construction can occur in RMAs adjacent to, and in close proximity to fish streams. Therefore, road construction is likely to cause an increase in suspended sediment to fish streams.

Fuels Treatment. Under the HCP, Port Blakely would use slash piling and burning, and prescribed burning on its lands. Port Blakely will pile slash with machines and place it outside of the no-cut buffers, with the exception of material from pre-commercial thinning. Port Blakely will conduct pile burning and prescribed broadcast burning during high moisture conditions. The placement of the piles outside the no-cut buffers, and burning in high moisture conditions will prevent any sediment from reaching the stream as soil moisture repellency is greater during dry summer seasons. Therefore, there will not be an increase in suspended sediment and substrate embeddedness from fuels treatment.

Chemicals spills and nutrients

The operation of machinery near streams related to timber harvest activities and road management has the potential to affect the chemicals and nutrients habitat indicator. Spills or leaks of fluids from machinery has the potential to release chemicals into the environment. However, conservation measures in the HCP address these risks by limiting where refueling equipment may occur to only those locations where spills cannot enter water. They also limit where equipment may be located along all waterways. These measures will make it unlikely that the aquatic habitat would be contaminated by a spill or leak from machinery.

Deforestation can cause a release of carbon, nitrogen, phosphorus, and sulfur through timber harvest, burning of slash, accelerated decomposition, decreased production of wood and roots, and erosion (Vitousek 1983). Riparian forests have been found to be effective filters for nutrients from agriculture runoff, including nitrogen, phosphorus, and sulfur. Stream buffers as small as 62 feet have shown a decrease of nutrients from 48 to 95% (Lowrance et al 1984, Jordan et al. 1993, Snyder et al. 1995).

Buffers greater than 25 feet would be sufficient to prevent nutrients from entering the stream, however, the 25 foot no cut buffers may not be adequate to prevent nutrients from entering streams. But these buffers only occur on perennial streams upstream of fish. Although there will be some spatial separation of the perennial and seasonal non-fish streams from the fish-bearing streams, there will likely be a small increase in nutrients to the stream from timber felling from downstream movement of material. Nutrient inputs to streams will be minimized by the conservation strategies that Port Blakely would implement under the ITP and associated HCP. In addition, actions that cause an increase in nutrient inputs will be spatially and temporally separated, which will help ameliorate some of these effects.

2.5.1.2 Large wood and wood recruitment

Large living and dead wood provide important habitat for the covered species in the action area. Large wood in streams provides channel roughness and interacts with streamflow to create log jams, pools, and slow water areas; interacts with water to modify stream flow paths activating side channels and off-channel areas; and improves floodplain connectivity, all of which are important habitat features that support juvenile salmonid resting, predator avoidance, and feeding. Large riparian trees that die and fall into and near streams, such as within floodplains and wetlands, regulate sediment and flow routing, influence stream channel complexity and stability, increase pool volume and area, and provide hydraulic refugia and cover for fish (Bisson et al. 1987, Gregory et al. 1987, Hicks et al. 1991, Ralph et al. 1994, Bilby and Bisson 1998). Large wood affects stream channel morphology in low gradient streams at both the individual pool and reach scale (Carroll and Robison 2007). Large wood can provide cover for fish in pools by creating shadows, covering the surface, velocity refugia, and three-dimensional partitions within the water column (Harmon et al. 1986). At the reach scale, large wood also creates habitat partitions by increasing pool distribution and habitat unit diversity (Carroll and Robison 2007). Large wood also plays an important role in floodplain connectivity as if decreases flow velocity (Davidson and Eaton 2013) and increases water inundation in adjacent floodplains (Collins and Montgomery 2002). Greater wood abundance in streams increases the number of pools (Beechie and Sibley 1997, Montgomery et al. 1999), pool area (Beechie and Sibley 1997), and residual pool depth (Collins et al. 2002) and can change the overall channel morphology of a stream from plane bed to forced pool riffle channels (Buffington and Montgomery 1999, and Montgomery et al. 1996).

Sediment retention is particularly important because it helps to create and maintain alluvial aquifers, which in turn help to modulate stream temperatures through the process of hyporheic exchange, while sediment storage in upstream reaches reduces fine sediment that reduces substrate quality and the quantity and quality of spawning habitat. The ability of large wood and other obstructions to attenuate peak flows also helps to reduce bed scour, which can also reduce the quantity and quality of spawning habitat. Within spawning areas, large wood also helps to reduce bed mobility, which also helps to keep spawning habitat intact and minimize loss of it through the movement of the spawning substrate during high flows.

Wood in streams comes primarily from the riparian zone, although in-stream wood occurs because of several processes including mortality and tree fall, bank erosion, and debris flows or landslides (Martin and Benda 2001, Reeves et al. 2003, Seo et al. 2010, Ruize-Villanueva et al. 2014). Near-stream wood recruitment tends to be more evenly distributed throughout a drainage network, whereas episodic landslides tend to create large concentrations of wood at tributary junctions, which contributes to habitat complexity and ecological productivity (Bigelow et al. 2007). For near-stream riparian inputs, empirical and modeling studies suggest that stream wood input rates decline exponentially with distance from the stream and varies by stand type and age (McDade et al. 1990, Van Sickle and Gregory 1990, Gregory et al. 2003) (Figure 10). For example, 95% of the total instream wood inputs in these studies came from distances that ranged between about 25 and 45 m (about 82 to 148 feet) depending on the stand conditions. Near-stream recruitment is the dominant source (up to 100%) in low gradient streams with floodplains. Upslope, episodic delivery can account for a substantial portion (up to 80%) of the large wood in small to mid-sized streams (Reeves et al. 2003, Bigelow et al. 2007) in mountainous settings. Topographic features of a watershed influence the relative contribution of upslope sources of wood. Steeper, more highly dissected watersheds will likely have a greater proportion of wood coming from upslope sources than will watersheds that are less dissected or steep (Martin and Benda 2001). The majority of the wood recruited to a stream channel from adjacent riparian areas comes from within 30 meters (98 ft) of the channel (McDade et al. 1990, Van Sickle and Gregory 1990, Spies et al. 2013) (Figure 3). However, in any watershed only a subset of the upslope channels will deliver wood to valley floors and fish-bearing streams via debris flows. Both types of wood delivery are necessary for functioning and productive stream ecosystems.

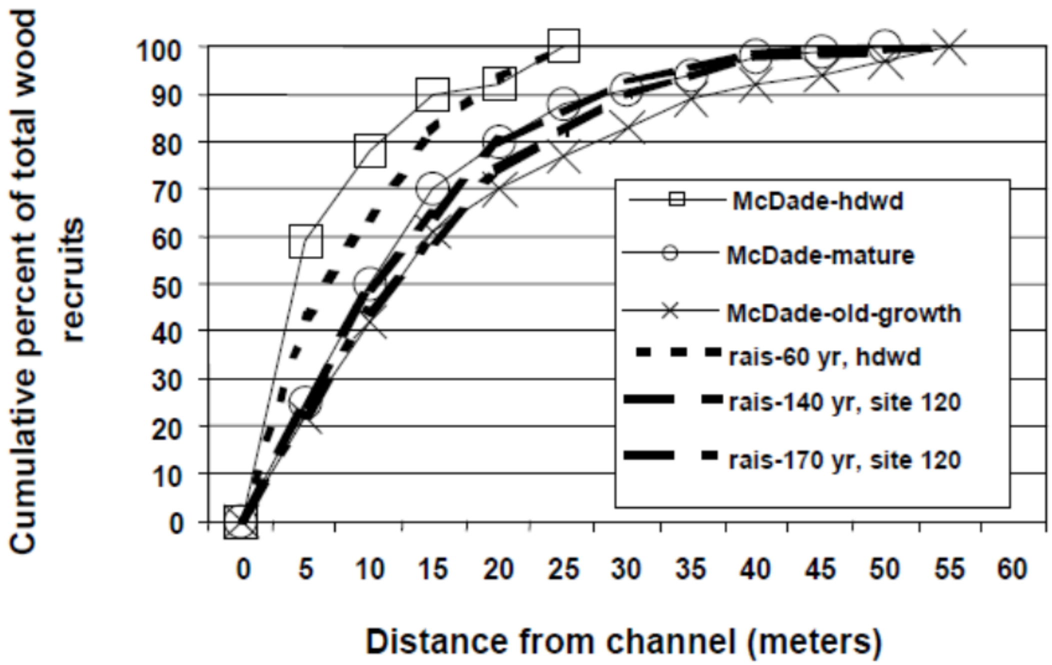


Figure 3. Comparison of predictions of total wood accumulation with distance from channel using the Organon forest growth model and RAIS instream wood recruitment model versus the observations of McDade et al. (1990) for streams in the Cascade Mountains of Oregon and Washington (as cited in Spies et al. 2013, page 18).

Timber harvest. We evaluated the effects of the covered activities on wood recruitment for each stream type with regards to near-stream and landslide and debris flow inputs. Under the ITP, Port Blakely will implement conservation measures that affect how they implement management activities related to timber harvest, which will affect natural large wood production and recruitment to streams. Port Blakely will also conduct stream enhancement activities that will add wood to streams in the plan area. The elements of the conservation measures relative to large wood production and recruitment including the following:

- Maintain 75-100 feet no-harvest buffers for fish streams adjacent to harvest units, depending on stream type.
- Maintain 25-55 feet no-harvest buffers for non-fish streams adjacent to harvest units, with an additional 25 feet managed buffer, depending on stream type.
- At regeneration harvest: where LWD is minimal or does not exist in medium and small fish streams, placement of up to 1 tree per 300', on average, rounding up to 4 per 1000' each side of streams, from within the riparian buffer.

Outside of special management areas and RMAs, Port Blakely will manage stands for timber production, which focuses on growing stands that generate a product mix of predominantly large and medium sawtimber. Though their conservation strategy includes no-harvest buffers for fish and non-fish streams, harvest prescriptions won't fully protect large wood loading to all streams, decreasing this habitat indicator.

Site-scale reductions in stream channel wood loads due to timber harvest are reasonably likely to occur. The wood reduction would primarily occur on streams with fish and streams in close proximity to fish, particularly on those streams that have the potential to deliver wood to fish streams. These effects will continue for decades until the vegetation reestablishes. Timber harvest would be spatially and temporally separated throughout the action area, and will be up to 6,250 acres in annually over a 5-year period spread out over the Port Blakely landscape. This will ameliorate some, but not all of the effects of reduction of in-stream wood recruitment in fish habitat.

Road management. The HCP includes management standards that limits tree removal in the action area and RMAs that will result from construction of roads. These include:

- Temporary and permanent roads, trails, and landings will be located on stable locations, e.g., ridge tops, stable benches, or flats, and gentle to moderate side slopes.
- Roads will be located away from streams, wetlands, unstable areas, and sensitive resource sites, including sensitive habitats.
- Road development within the RMA will only occur when other alternatives are not operationally/economically feasible.
- New rock quarries will be located outside of stream channels and RMAs.
- Vegetation removal, soil disturbance, and clearing and grubbing will be limited to the minimum needed to construct the road.

Because these management standards limit road construction to areas where no operational feasible and economic viable alternatives exist, we assume that construction of new roads in RMAs will be limited. Notwithstanding, within the action area, we expect there will be some decrease in wood recruitment potential from the removal of riparian vegetation, especially when roads are located adjacent to streams. This will result in a minor reduction of trees available for wood recruitment to the stream. The effects will continue as long as the road is in place for permanent roads and trails, and continue for several decades for temporary roads until the trees recover. The volume of these trees is limited to the width of the entire roadway length with stream adjacent roads, and the width for 100' both sides of a roadway stream crossing. Again, we only expect limited new road and construction in RMAs due to the biological goals and objectives of the HCP and the conservation measures and management standards it requires Port Blakely to implement as part of their conservation strategy. This reduction in wood volume within the fifth field HUC watershed will be minor and the spatial and temporal separation of the activities throughout the action area will ameliorate these minor effects.

Large wood placement. As a measure to offset the effects of the covered activities on covered species, the ITP and associated HCP would require Port Blakely to implement large wood placement from the RMA on medium and small fish streams adjacent to harvest units at a rate of 1 tree per 300' (or 4 trees per 100') of stream. This will give a slight increase to the amount of instream wood and improve wood transport in streams in the action area.

2.5.1.3 Forest Management effects on Pool frequency and quality, off-channel habitat, refugia, width to depth ratio, streambank condition, and floodplain connectivity

Changes in these channel-associated habitat indicators are dependent on changes to the physical processes that shape and develop these features (i.e., suspended sediment, substrate character, woody material). Large pools, off-channel habitat, refugia, streambank condition, and floodplain connectivity are habitat features related to woody material and the process of in-stream wood recruitment. From the analysis above, the amount of wood recruitment affected by the proposed action is small, mainly caused by timber harvest, and new road construction. However, these effects will be minor, and the spatial and temporal separation of the activities throughout the action area will ameliorate any effects on these habitat indicators.

Pool quality and width to depth ratio are habitat features related to suspended sediment. Because there will be a negative effect in the form of increased sediment, as described in the roadwork section, there will be an adverse effect to these indicators. Pool quality will be degraded from suspended sediment filling pools. Increased suspended sediment can also cause a negative effect on width to depth ratios. In areas where excessive sediment aggradation occurs, the channels could widen, causing a wider, shallower stream channel. As described above, in the sections that describe effects from suspended sediment, sediment inputs to streams will be minimized by the conservation strategies that Port Blakely would implement under the ITP and associated HCP. In addition, actions that cause an increase in suspended sediment will be spatially and temporally separated, which will help ameliorate some of these effects.

2.5.1.4 Peak and base flows

Timber Felling and Yarding. Timber felling may result in winter flows with higher peak volumes, and potentially result in earlier peak discharge times (Satterlund and Adams 1992, Jones and Grant 1996). Forest management activities can affect the rate that water is stored or discharged from a watershed. Total water yield typically increases due to reduced evapotranspiration (Harr et al. 1975, Harr 1976, Hetherington 1982, Duncan 1986, Keppler and Zeimer 1990, Jones 2000), and decreased water interception (Reid and Lewis 2007). Elevated peak flows occur when a high proportion of timber basal area has been removed by forest harvest, particularly within rain-on-snow (ROS) watersheds (Grant et al. 2008). Studies suggest that flow changes are not measurable when <19% of the watershed is clearcut (Grant et al. 2008). Where there is no snow component, water yield still increases and flood peaks will increase if rainfall is more rapidly transferred to the stream via reduced interception or more rapid routing (Harr et al. 1975, Zeimer 1981, Jones and Grant 1996). In rain dominated hydroregions, increased flows appear to be proportional to increased acreage harvested (i.e., more timber harvest = more water) (Bosch and Hewlett 1982, Keppler and Zeimer 1990). Stednick (1996) suggests that flow changes are not measurable when <25% of the watershed is clearcut. Experimental subwatershed studies in hydrology demonstrate elevated peak flows during flood-producing storms when a high proportion of timber basal area has been removed by forest harvest (Figure 4) particularly within rain-on-snow watersheds (Grant et al. 2008). Changes in peak flows in the snow-dominated zone rarely occur until more than 20 % of the basin is harvested, with a highly variable response after that threshold is exceeded. Peak flows increased

20-90 % in study catchments where 20-40 % of the trees were harvested (Troendle and King 1985, King 1989), while in another study, 100 % clearcutting resulted in a 50 % change in peak flow (Van Haveren 1988). Grant et al. (2008) also found that the percentage change in peak flow generally decreases with time after harvest (Jones 2000, Jones and Grant 1996, Thomas and Megahan 1998. Peak flow effects seem to diminish over the first 10-20 years (as the stand grows).

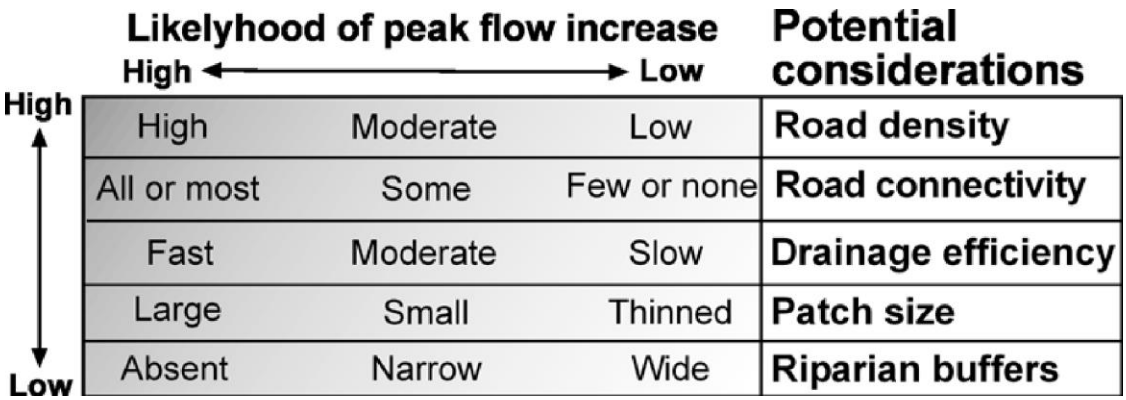


Figure 4. Site conditions and treatments for risk of peak flow increase. Source: (Grant et al. 2008 PNW-GTR-760 p. 40)

In order for peak flows to affect listed-fish streams, the flows must be sufficient to affect channel morphology and stream ecology. Increased peak flows may result in an increase in channel substrate movement, potentially damaging developing eggs and alevins in redds (Hooper 1973, Hicks et al. 1991). Increased flow may negatively affect juvenile salmonids by displacing them from preferred habitat, and may negatively affect smolts by triggering them to migrate to the ocean at a time that is less than optimum for growth and survival.

Although Port Blakely did not provide the specific hydroregions for the individual watersheds in the action area, we determined that there is a low likelihood that the removal of trees from a specific timber management activity would exacerbate the risk of a detectable peak flow increase sufficient to erode channel beds, impact channel form, and thereby negatively impacting instream, and riparian habitat conditions for ESA-listed fish species at the sub-watershed scale or larger. We based that determination on the low level of regeneration harvest Port Blakely will conduct on an annual basis across its current ownership.

Port Blakely will conduct regeneration harvest on a maximum of 750 acres annually across 38,516 acres in 8 HUC4 watersheds. Studies suggest that flow changes are not measurable when <19% of the watershed is clearcut (Grant et al. 2008). Troendle et al. (2006) stated that at least 20% of the basal area in a drainage must be removed before a change in water yield could be detected. Spence et al. (1996) recommend that for salmonid conservation, no more than 15-20% of a watershed be in a hydrologically immature state at any given time. Stednick (1996) suggests that flow changes are not measurable when <25% of the watershed is clearcut. Church and Eaton (2001) suggested that a rate-of-cut (clearcut harvest) not exceeding 1% of watershed area in each year, on average, over a ten-year period, would result in less than adverse effects on flows. Given the level of Port Blakely's annual harvest, it is unlikely that these projects will create enough forest openings to affect peak and base flows.

Road Work. Roads can affect the rate that water is discharged and routed to a stream. Compaction of soils from construction of new access roads or skid trails results in less infiltration and greater overland flow (Grant et al. 2008). When this increased flow is intercepted by road networks that cross subsurface flowpaths and change flow routing, both the peak magnitude and time of peak concentration can change in a watershed (Grant et al. 2008). This effect should roughly scale with percentage of area compacted or length of road network that is directly connected to streams or both (Wemple et al. 1996) but is highly dependent on the location of roads in the landscape (Wemple and Jones 2003). Routing is predominantly affected by road and ditch networks (Harr et al. 1975, Jones and Grant 1996).

The ITP and associated HCP require Port Blakely to implement the following conservation strategies, which would minimize the amount of runoff to streams:

- Ditches will be built and maintained to assure proper drainage (vegetation retention, debris clearing).
- New road placement so roads will not contribute to the potential for slope failure, to avoid RMAs, and to minimize stream crossings.
- Ensure that new road construction will not increase the stream drainage network. New roads will be out-sloped, or the outflow of new ditch relief drainage structures will drain to well-vegetated areas.

Luce and Black (1999) found that incorporating design features such as cross-drains and ditch-relief culverts into roads reduced the hydrological connection of these structures. Forest vegetation buffers flow and prevents sediment from reaching streams (Copstead and Johansen 1998). The proposed action includes design criteria, in particular, the construction and spacing of cross drains and ditches (Luce and Black 1999), that will reduce the amount of runoff to streams. This is because adding and spacing cross drains appropriately ensures that only a small portion of the road is capable of routing water to streams. In addition, the proposed action includes conservation strategies that would direct runoff from cross drains to the forest floor, minimizing the likelihood of ditchline runoff reaching the stream. This is because the vegetated forest floor would buffer the flow and prevent runoff from reaching the stream (Copstead and Johansen 1998).

Road decommissioning can ameliorate the effect of increases in peak flows to the streams caused by new road construction by disconnecting runoff from previous roads to streams. Roads that receive full decommissioning (decompacting the road surface) will have the most beneficial effect of reducing runoff to streams. The fully decommissioned roads will provide a long-term benefit of decreasing peak flows to streams by disconnecting these roads from the stream. Given this, road work will not have an adverse effect on peak/base flows.

2.5.1.5 Drainage network increase

The drainage network consists of a connected set of surface water drainage channels or features that are oriented in the downhill direction with the flow of water. This network can be increased by forest management related disturbances including roads and trails construction and maintenance, soil compaction, and impervious surfaces.

Implementation of no-harvest buffers, large wood placement, and fish passage improvement conservation strategies will contribute to improved watershed processes including riparian function (shading and wood recruitment), sediment sorting and transport, floodplain connectivity, and natural stream temperature regulation. When these processes are functioning properly, they contribute to water quality by preventing thermal loading (shade) (Johnson 2004); improve water cooling mechanisms including hyporheic flow (Story et al. 2003, Arrigoni et al. 2008, Hester et al. 2009) and groundwater and tributary mixing (Brown 1985, Mellina et al. 2002; Moore et al. 2003, Moore et al. 2005, Mellina 2006, Wilkerson et al. 2006); sediment storage capacity, and uptake of contaminants and nutrients. It is reasonably certain that implementation of the conservation strategies will reduce the duration, magnitude, severity, intensity, and frequency of instances of reductions in water quality from the covered activities throughout the action area over the life of the permit term.

*Road Density and Location***.**

Port Blakely proposes to construct two types of roads: System roads (permanent), and non-system roads (temporary). It did not provide an estimate of how many roads would be constructed; however all non-system roads associated project activities will be decommissioned after completion of those activities. The road construction will generate a short-term increase in road density; however, these will not translate into negative effects to LFH due to the conservation strategies implemented (no hydrologic connection of roads to the stream network through surface flows).

*Disturbance History and Disturbance Regime***.**

The proposed action will disturb stands and riparian features, and thereby affect the history and disturbance regime indicators. These are watershed condition analysis indicators associated with spawning, rearing, and migration of salmon and steelhead. The effects of the proposed action on disturbance history and disturbance regime indicators will be minor because (1) The majority of the timber harvest treats managed stands; (2) includes meaningful no-cut buffers; (3) uses road reconstruction to reduce the adverse impacts of previously constructed roads; and (4) the new road construction will be either temporary and will have no hydrological connections to the stream network through surface flow.

*Riparian Reserves***.**

The proposed project will cause an adverse effect to this watershed condition indicator. The magnitude of effect can be assessed by referring to the likely effects on related individual habitat indicators (*e.g*., temperature, wood recruitment). However, the proposed logging will only affect a small proportion of the riparian reserves and, most impacts of the proposed logging will be minimized before they can reach the stream. This is because the no-cut buffers will minimize the effects of shade loss and in-stream wood recruitment, and these functions will continue to be provided by the unlogged areas. In addition, the majority of sediment and nutrients will be intercepted and immobilized by the undisturbed soil and vegetation on the forest floor within the no-cut buffers.

2.5.2 Effects on Listed Species.

The effects of the HCP on habitat indicators was discussed in the section, above. Of those habitat indicators, five (increased steam temperature; increased suspended sediment and substrate embeddedness; decreased large wood; and decreased pool quality and width to depth ratio because of increased suspended sediment) will cause an adverse effect on listed species. The HCP will not cause an adverse effect on the following the habitat indicators, and therefore will not cause an adverse effect on ESA-list species considered in this Opinion: Chemical spills and nutrients; off-channel habitat, refugia; streambank condition and floodplain connectivity; change in peak/base flow; drainage network increase; physical barriers, road density and location; disturbance history/regime; and riparian reserves.

2.5.2.1 Increase in Suspended Sediments.

Road management activities will cause an increase in suspended sediment. Likely effects from project-related increases in suspended sediment on ESA-listed species include, but are not limited to: (1) reduction in feeding rates and growth, (2) physical injury, (3) physiological stress, (4) behavioral avoidance, and (5) reduction in macroinvertebrate populations.

The exposure of juvenile and adult salmon and steelhead to increased turbidity and changes in substrate character from sediment generated by the proposed action is reasonably certain to elicit significant responses from a relatively small number of salmon and steelhead occupying the area. Salmon and steelhead would likely respond to the increased suspended sediment by attempting to move to locations with lower concentrations of fine sediment. Failure to avoid increased suspended sediment is likely to result in gill irritation or abrasion, which can reduce respiratory efficiency or lead to infection, and a reduction in juvenile feeding efficiency due to reduced visibility. Compromised gill function is likely to increase juvenile mortality.

An increase in turbidity from suspension of fine sediments can adversely affect fish and filter-feeding macro-invertebrates downstream from the action area. At moderate levels, turbidity has the potential to reduce primary and secondary productivity; at higher levels, turbidity may interfere with feeding and may injure and even kill both juvenile and adult fish (Berg and Northcote 1985, Spence et al. 1996). However, Bjornn and Reiser (1991) found that adult and larger juvenile salmonids appear to be little affected by the high concentrations of suspended sediments that may be experienced during storm and snowmelt runoff episodes.

Exposure duration is a critical determinant of the occurrence and magnitude of physical or behavioral effects caused by turbidity (Newcombe and Jensen 1996). Salmonids have evolved in systems that periodically experience short-term pulses (days to weeks) of high suspended sediment loads, often associated with flood events, and are adapted to such seasonal high pulse exposures. However, research indicates that chronic exposure can cause physiological stress responses that can increase maintenance energy and reduce feeding and growth (Servizi and Martens 1991). In a review of 80 published reports of fish responses to suspended sediment in streams and estuaries, Newcombe and Jensen (1996) documented increasing severity of ill effects with increases in dose (concentration multiplied by exposure duration).

Migrating and spawning adult salmon and steelhead, and rearing and migrating juveniles could be exposed to increased suspended sediment. Effects from suspended sediment are likely to be small on incubating eggs and pre-emergent fry. This is because conservation strategies for timber harvest, timber hauling, and road work will minimize the amount of sediment reaching streams.

Rearing and migrating juvenile salmon and steelhead will likely be affected as habitat for these life stages overlaps with the effects from suspended sediment. These negative effects would be limited in duration, lasting several months during the wet season which overlaps with spawning and egg incubation. Although increased suspended sediment would cause interruption of essential behavior, it would not likely reach levels sufficient to kill or permanently injure juvenile and adult salmon and steelhead.

Pool Quality, and Width to Depth Ratio

As stated in the ‘Forest Management effects on Pool Frequency and quality, off-channel habitat, refugia, width to depth ratio, streambank condition, and floodplain connectivity’ section, above, suspended sediment can cause pools to fill in with sediment, and cause wider, shallower streams. However, Port Blakely would implement a variety of conservation measures that minimize the amount of suspended sediment. Additionally, the actions that would increase suspended sediment will be spatially and temporally separated, thus there would not be enough suspended sediment to cause pools to fill in, or cause wider, shallower streams. Because of these factors, there will not be adverse effects to ESA-listed fish from effects to these habitat indicators.

Increased Stream Temperatures.

Juvenile salmon and steelhead will be exposed to a very small increase in stream temperatures from timber harvest, typically in July and August. The increases in stream temperature will increase the risk of reduced growth, reduced competitive success of juveniles in relation to non-salmonid fish, increased disease virulence, and reduced disease resistance (Reeves et al. 1987, McCullough et al. 2001, Marine 1992, Marine and Cech 2004). A small percentage of the juveniles in each affected stream will suffer a reduction in size upon out-migration, which makes fish more vulnerable to predation, or a reduction in fitness, which reduces the likelihood of long-term survival of individual fish.

Decreased Large Wood.

Reduced instream large wood recruitment due to the timber harvest activities is likely to adversely affect the covered species. Instream wood (tree trunks and root wads) enhances the habitat quality for salmonids. Riparian trees that die and fall into streams and/or their floodplains and wetlands influence stream channel complexity and stability. They help retain sediments, and create pools, undercut banks, and off-channel habitat. They deflect and slow stream flows and increase hydraulic complexity. They also stabilize stream channels, improve productivity, and provide cover for fish (Bilby and Bisson 1998; Bisson *et al.* 1987; Gregory et al. 1987; Hicks *et al.* 1991; Murphy 1995; Ralph *et al.* 1994).

Streamside large wood recruitment to streams tends to be relatively even throughout a drainage network, whereas episodic landslides tend to create large concentrations of wood at tributary junctions. Streamside-derived wood can provide the largest key pieces to streams, and contribute to gravel storage that converts bedrock reaches to alluvial reaches, creates smaller, more numerous pools, and increases habitat complexity (Bigelow *et al.* 2007; Montgomery *et al.* 1996). LWD in episodic landslides also contributes to habitat complexity and ecological productivity (Bigelow *et al.* 2007). It also reduces the speed and run-out distance of debris flows on valley floors (Lancaster *et al*. 2003). Both types of LWD delivery are necessary for functioning and productive stream ecosystems.

Coarse sediment retention by large wood is also important, because it helps to create and maintain alluvial aquifers that moderate stream temperatures through hyporheic exchange. In addition, sediment storage in upstream reaches reduces the downstream transport of fine sediments that can embed gravels and smother redds. Large wood and other obstructions attenuate peak flows, which reduces the movement of spawning substrate and bed scour that can destroy redds.

Although the HCP may accelerate the growth of large diameter trees over the long term (Spies *et al.* 2013), the timber harvest activities are likely to reduce overall large wood recruitment and movement to streams in the action area.

The reduced large wood recruitment to streams related to timber harvest activities is also likely to sufficiently reduce habitat quality for rearing juvenile salmonids, such that some individuals would experience fitness impacts that may reduce their likelihood of survival. The reduced large wood recruitment is also likely to reduce spawning habitat quality sufficiently enough to reduce the spawning success for some adults, and/or to cause the loss of some eggs and alevin. The annual numbers of individuals that would be affected by reduced large recruitment is unquantifiable with any degree of certainty. However, based on the relatively small amount of occupied habitat that may be affected, and the expectation that the density of the covered species within the action area is very low (13% of streams in Port Blakely’s current ownership pare known SSBT streams), the numbers of fish and eggs that would be annually affected by this stressor would comprise only small subsets of their respective cohorts..

2.5.3 Effects on Critical Habitat

Designated critical habitat within the action area for salmon and steelhead considered in this opinion consists of freshwater spawning sites, freshwater rearing sites, and freshwater migration corridors and their essential PBFs as listed below. The effects of the proposed action on these features are summarized as a subset of the habitat-related effects of the action that were discussed more fully above.

1. <u>Freshwater spawning sites</u>
    a. Substrate – Substrate embeddedness downstream of sediment generating activities described in the Suspended Sediment and Substrate Embeddedness section is likely to result in temporary decreases in available spawning areas because embedded substrate makes it more difficult for fish to dig redds, clogs interstitial spaces, reduces intergravel velocities, and reduces dissolved oxygen concentrations in redds.

Roads contribute a large percentage of the forestry related sediment. Proposed design criteria related for hydrology and road conservation measures will reduce sediment to the stream through dry season hauling, relief ditches to disconnect the road drainage from the streams, and conservation measures such as water barring and ditchlines maintenance.

Sediment from timber harvest and timber yarding is greatly reduced through the no-cut buffers of 75-100 feet buffers on fish stream, and 25-55 feet (with 25 feet managed zone) on other perennial streams. These buffers will provide vegetation and large wood such to filter and hold sediment from reaching the streams.

Critical habitat in the action area within sub-watersheds with the greatest road miles are at greatest risk, located throughout the action area where commercial timber harvest would occur. The proposed action will introduce sediment to streams through road runoff and will pulse through the stream reach with each storm event. Although sediment will reach stream reaches, and the overall accumulation may impact spawning grounds and associated bedloads; the effects of sediments would be spatially and temporally separated with the annual construction and decommissioning of temporary roads and landings and any reduction of spawning for ESA-listed salmonids will not appreciably reduce the amount of juveniles rearing in the summer or winter since spawning is not a limiting factor.

b. Water quality – Water quality would be temporarily and locally degraded by increases in suspended sediment from roadwork. Increased suspended sediments in streams can temporarily degrade aquatic habitat that support the ESA-listed species covered in this opinion. Increases in suspended sediments associated with the proposed action would occur periodically during the rainy season and would be temporally and spatially separated throughout the action area. We described the sediment effects on the substrate section above.

   The proposed action will also cause an increase in stream temperature from timber harvest. The increase in temperature would likely affect listed fish in the warmer months of July and August. Timber harvest would occur on up to 6,250 acres over a 5-year period.

c. Water quantity – Effects are limited to any increased peak flow in the winter due to timber harvest and road work. Elevated peak flows occur when a high proportion of timber basal area has been removed by forest harvest, particularly within rain-on-snow watersheds (Grant et al. 2008). This action’s design criteria will limit timber harvest and road construction to avoid increases in peak flow as described in Change in Peak/Base Flows discussions above. Therefore, only a very small localized effect is expected near harvest areas above snow elevation and located high in the watershed. This increase in peak flow will not be measurable as it travels downstream because it will join additional stream confluences and the effect will become absorbed in those greater flows. Therefore, change in peak flow from harvest and road construction will not preclude or significantly delay development of the critical habitat function to conserve listed species.

2. Freshwater rearing sites

   a. Floodplain connectivity – The proposed action will not affect floodplain connectivity with the construction of new roads, maintenance of existing roads, and road decommissioning. Any effects will be limited because Port Blakely will ensure that there will be no net increase in system roads after completion of project activities, and road decommissioning is likely to result in improvements to this indicator. The Port Blakely will avoid the construction of new system roads in RMAs and minimize stream crossings.

      The overall affect to floodplain connectivity with the John Franklin Eddy forest management activities are therefore minimal and will not preclude or significantly delay development of the critical habitat feature and its ability to conserve ESA-listed fish.

   b. Forage – Increases in suspended sediment from roadwork and road use will cause small reductions in the production and abundance of macroinvertebrates. Suspended sediment fills in interstitial spaces in the streambed that is habitat for macroinvertebrates, reducing the habitat for the salmon and steelhead prey organisms. The proposed action will result in a localized reach scale reduction (small) in prey organism abundance for salmon and steelhead for 5 to 10 years. Small reach scale reductions in prey organism abundance will be spread out across the landscape. In some cases, increase in solar radiation to the stream, and concurrent increase in understory vegetation, may cause an increase in the insect populations at that site, and balance forage abundance for juvenile salmon and steelhead. Thus, the overall effect on forage is small, but will slightly reduce the quality and function of the forage PBF to support salmon and steelhead in the action area.

   c. Natural cover – Reductions in wood recruitment potential are expected to occur from timber harvest. Decreases of in-stream wood recruitment will be minimized through the no-cut buffers of 75-100 feet buffers along fish streams and 25-55 feet on other perennial streams. These buffers will provide the majority of available wood recruitment to streams. Conservation strategies required by the ITP and associated HCP will limit the amount of new road construction in RMAs, however, it is still expected to occur on a small scale.

   d. Water quality – Same as described in Freshwater spawning.
   e. Water quantity – Same as described in Freshwater spawning.

3. Freshwater migration corridors

   a. Free of artificial obstruction – Delays in adult upstream passage from suspended sediment are unlikely to occur because adults are highly mobile with the ability to avoid these localized and temporary effects. Similarly, out-migrating juveniles are also likely to avoid localized and temporary water quality degradation events with only a slight delay in migration due to their mobility. The ITP and associated HCP would require Port Blakely to design all bridges and culvert to accommodate 100-year flood events and will fix any known fish passage barriers within 5 years of permit issuance. Therefore, the proposed action will not preclude or significantly delay development of the critical habitat feature and its ability to provide free passage.

b. Natural cover – Same as described in Freshwater rearing.
c. Water quality – Same as described in Freshwater spawning.
d. Water quantity – Same as described in Freshwater spawning.

2.6 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02 and 402.17(a)). 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 ESA.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described earlier in the discussion of environmental baseline (Sections 2.2 and 2.4).

The contribution of non-Federal activities to the current condition of ESA-listed species and designated critical habitats within the program-level action area was described in the Status of the Species and Critical Habitats and Environmental Baseline sections, above. Among those activities were agriculture, forest management, road construction, urbanization, water development, and river restoration. Those actions were driven by a combination of economic conditions that characterized traditional natural resource-based industries, general resource demands associated with settlement of local and regional population centers, and the efforts of social groups dedicated to the river restoration and use of natural amenities, such as cultural inspiration and recreational experiences.

Resource-based industries caused many long-lasting environmental changes that harmed ESA-listed species and their critical habitats, such as state-wide loss or degradation of stream channel morphology, spawning substrates, instream roughness and cover, estuarine rearing habitats, wetlands, riparian areas, water quality (*e.g.*, temperature, sediment, dissolved oxygen, contaminants), fish passage, and habitat refugia. Those changes reduced the ability of populations of ESA-listed species to sustain themselves in the natural environment by altering or interfering with their behavior in ways that reduce their survival throughout their life cycle. The environmental changes also reduced the quality and function of critical habitat PBFs that are necessary for successful spawning, production of offspring, and migratory access necessary for adult fish to swim upstream to reach spawning areas and for juvenile fish to proceed downstream and reach the ocean. Without those features, the species cannot successfully spawn and produce offspring. As noted above, however, the declining level of resource-based industrial activity and rapidly rising industry standards for resource protection are likely to reduce the intensity and severity of those impacts in the action area in the future.

The economic and environmental significance of natural resource-based economy is currently declining in absolute terms and relative to a newer economy based on mixed manufacturing and marketing with an emphasis on high technology (Brown 2011). Nonetheless, resource-based industries are likely to continue to have an influence on environmental conditions within the program-action area for the indefinite future. However, over time those industries have adopted management practices that avoid or minimize many of their most harmful impacts, as is evidenced by the extensive conservation measures included with the proposed action, but which were unknown or in uncommon use until even a few years ago.

The Oregon Private Forest Accord is a compromise agreement between members of Oregon's private timber industry, conservation and fishing organizations to modify parts of the OFA. The Accord proposed state legislation in 2021, and it passed in 2022 (Oregon Senate Bills 1501 and 1502 and House Bill 4055). The Oregon Board of Forestry adopted new rules in October 2022. These rules implement a number of changes which will come into effect in 2023 and 2024, including expanding some types of stream buffer requirements for large private forestland owners (owning 5,000ac or more of forestland), which become effective on July 1, 2023. However, SB 1501 includes contingent provisions under which the Oregon State Board of Forestry would repeal these new rules if certain criteria are met (e.g. an ITP is not issued by Dec. 31, 2027 or is issued, but revoked for the Oregon Private Forest Accord HCP; or the Board finds that the Accord HCP imposes more than a de minimis difference in economic or resource impacts, at the landscape level).

Pesticides, including herbicides, are commonly applied to forest lands in Oregon. Forest landowners primarily use herbicides to prepare sites for tree planting and to control competing weeds that hinder survival and growth of young, commercial-important tree species. Herbicides are also used to control invasive weeds such as Himalayan blackberry (*Rubus armeniacus*). Herbicides are applied by aerial (helicopter, fixed-wing or drone, ground equipment or by hand. Forest landowners are responsible for about 4 percent of all pesticides (including herbicides), by weight, used every year in Oregon.[1]

Application of herbicides must follow federal and state laws and regulations, including label restrictions. Additionally, Pesticide users on forestland must also follow FPA rules on pesticide application, including some restrictions on the application of herbicides near streams. These restrictions reduce, but likely do not prevent, herbicides from entering streams. Once these chemicals enter streams, they can have a host of negative effects on water quality, invertebrate ecology, and fish physiology.

1 Herbicide Use in Forestry, an Oregon Department of Forest Publication. Available at: https://www.oregon.gov/odf/Documents/workingforests/HerbicideFacts.pdf
(accessed November 2022)

While natural resource extraction within the action area may be declining, general resource demands are increasing with growth in the size and standard of living of the local and regional human population (Metro 2010, Metro 2011). Population growth is a good proxy for multiple, dispersed activities and provides the best estimate of general resource demands because as local human populations grow, so does the overall consumption of local and regional natural resources. Between 2000 and 2010, the combined population of Oregon and Washington grew from 9.3 to 10.5 million, an increase of approximately 13.3%. Washington grew somewhat faster than Oregon, 14.1% and 12.0%, respectively (U.S. Census Bureau 2010). By 2020, the population of Oregon and Washington is projected to grow to 11.8 million (Oregon Office of Economic Analysis 2011, Washington Office of Financial Management 2010). Most of the population centers in Oregon and Washington occur west of the Cascade Mountains. The NMFS assumes that future private and state actions will continue within the action areas, and will continue to increase as the population rises.

Recreational fishing within the action area is expected to continue to be subject to ODFW regulations. The level of take of ESA-listed salmon and steelhead within the action area from angling is unknown, but is expected to remain at current levels. Most streams within the action area closed to harvest of salmon and steelhead and are subject to catch-and-release restrictions for juvenile salmonids.

When considered together, these cumulative effects are likely to have a small negative effect on salmon and steelhead population abundance, productivity, and some short-term negative effects on spatial structure (short-term blockages of fish passage). Similarly, the condition of critical habitat PBFs will be slightly degraded by the cumulative effects.

2.7 Integration and Synthesis

The Integration and Synthesis section is the final step in assessing the risk that the proposed action poses to species and critical habitat. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

The proposed action is the issuance of an ITP and implementation of HCP by Port Blakely, which involves a suite of activities associated with forestland management. These associated actions, including timber harvest, silviculture and road management are all implemented under the direction of conservation strategies to protect water quality and ecological processes and function. The action area includes 8 HUC4 watersheds.

In this document, we analyzed the effects of the proposed action, including the conservation program, taking into account the landscape distribution, intensity of the covered activities, as well as the HCP reporting that will ensure regular implementation and compliance monitoring.

As described in more detail above in Section 2.2, climate change is likely to increasingly affect the abundance and distribution of the ESA-listed species considered in the Opinion. It is also likely to increasingly affect the PBFs of designated critical habitats. The exact effects of climate change are both uncertain, and unlikely to be spatially homogeneous. However, climate change is reasonably likely to cause reduced instream flows in some systems, and may impact water quality through elevated in-stream water temperatures and reduced DO, as well as by causing more frequent and more intense flooding events.

Climate change may also impact coastal waters through elevated surface water temperature, increased and variable acidity, increasing storm frequency and magnitude, and rising sea levels. The adaptive ability of listed-species is uncertain, but likely reduced due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation. The proposed action will cause direct and indirect effects on the covered species and critical habitats considered in the Opinion well into the foreseeable future. However, the covered activities' effects on water quality, substrate, and the biological environment are expected to be of such a small scale that no detectable effects on covered species through synergistic interactions with the impacts of climate change are expected.

2.7.1 ESA Listed Species

Issuing an ITP and implementing the HCP would affect the following covered species populations in the action area:

LCR Chinook salmon. The Clackamas River population has a very low persistence probability rating. The recovery plan target for this population is to increase persistence to Medium (NMFS 2013).
LCR Coho salmon**.** The Clackamas River population has a moderate persistence probability rating. The recovery plan target for this population is to increase persistence probability to Very High (NMFS 2013).
LCR Steelhead**.** The Clackamas River population has a moderate persistence probability rating. The recovery plan target for this population is to increase persistence to High (NMFS 2013)
UWR Chinook **salmon.** The Clackamas River population has a moderate risk of extinction; and the Molalla River population that has a very high risk of extinction. The recovery plan target for these populations is to decrease risk to Very Low and High Risk, respectively (NMFS 2011)
UWR Steelhead**.** The Molalla River population has a low extinction risk. The recovery plan target for this population is to decrease risk to Very Low (NMFS 2011).

The environmental baseline is degraded by natural disturbances such as wildfires, forest insect and disease outbreaks, landslides, glacial debris flows, and floods. The watersheds in the action area have also been negatively impacted by a history of human-caused disturbances, such as logging, road construction, hydro-power development, irrigation and municipal water diversions, and wildfire suppression.

Cumulative effects on the covered species in the action area would continue from unmanaged recreation, wildfire suppression, and urbanization. As population continues to grow in and surrounding the action area, so does the overall consumption of local and regional natural resources. Future private and state actions would likely continue within the action areas, increasing as population rises. Because of this, adverse effects on salmon and steelhead would likely continue from these cumulative effects.

Effects from the proposed action considered in this consultation include increases in suspended sediment from road management and increased stream temperature from timber harvest and the associated shade and large wood reduction. We do not expect any significant aggregate effects of activities occurring under this proposed action because effects would be spatially and temporally separated such that this is little to no spatial overlap of effects in the action area. This is because the HCP includes projections and assumptions about the aggregate numbers and limits of timber harvest acres, no-cut buffers for timber harvest, and conservation strategies. Although there are no annual limits for road work in the HCP, the conservation program will minimize the effects from these activities, in particular the restrictions on new system roads and the requirements for road decommissioning. We do not expect any significant aggregate effects of activities occurring under this HCP because the harvest unit sizes are small compared to the available habitat, and because of the projected spatial separation of timber harvest across the Port Blakely landscape at any one time. offset the adverse effects of forest management activities within the action area.

The proposed action is likely to cause a slight decrease in the rate of egg and fry survival, and injury in juveniles and adults because of sediment run-off from road management in close proximity to ESA-listed fish streams, a decrease in large wood recruitment, and increased stream temperature from commercial regeneration harvest. However, these effects are not expected to cause a biologically meaningful effect at the species scale. This is due to narrow limits on the volume of annual timber harvest will be separate the effects in time and space among the 8 watersheds in the action area, and the relatively short duration of the anticipated effects. Because of this, there will likely be only a small number of fish affected at any one time, and thus will not affect a population level. This is because the area affected is a very small portion of habitat available to any one population. Therefore, the proposed action is not likely to appreciably reduce the likelihood of survival and recovery for LCR Chinook salmon, LCR coho salmon, LCR steelhead, UWR Chinook salmon and UWR steelhead, even when combined with a degraded environmental baseline, and additional pressure from cumulative effects and climate change.

2.7.2 Critical Habitat

As described in the Section 2.5, the proposed action is likely to adversely affect designated critical habitat for:

***LCR Chinook salmon*.** The Clackamas Sub-basin is designated as critical habitat. The CHART gave Clackamas Basin critical habitat PBF conditions a ‘high’ conservation value.
***LCR Coho salmon*.** There are 2 watersheds designated as critical habitat that are used by LCR coho salmon. The CHART rated Upper Clackamas River and Middle Clackamas River, and the Eagle Creek critical habitat PBF conditions as “high” for LCR coho salmon.
***LCR Steelhead*.** There is one watershed designated as critical habitat that are used by LCR steelhead, the Clackamas Sub-basin. The CHART rated the Clackamas Basin as having a ‘high’ conservation value.

***UWR Chinook salmon*.** There are four watersheds designated as critical habitat that are used by UWR Chinook salmon. The CHART rated the Upper Molalla River watershed critical habitat PBF conditions as "fair to poor" for UWR Chinook salmon. The CHART rated the Upper Clackamas River, Oak Grove Fork Clackamas River, and the Middle Clackamas River critical habitat PBF conditions as "fair to good".
***UWR Steelhead*.** There is one watershed designated as critical habitat that is used by UWR steelhead. The CHART rated the Upper Molalla River watershed critical habitat PBF conditions as "fair to good" for UWR steelhead

Climate change is likely to adversely affect the overall conservation value of the covered species designated critical habitats. The adverse effects from forest management on freshwater spawning, and freshwater rearing habitat include an increase in substrate embeddedness from road management; and increased stream temperature from regeneration harvest. The adverse effects on freshwater migration corridors include a temporary delay in migration from increased suspended sediment, from road management. The magnitude and severity of these effects will vary from year to year. The effects of the HCP will last for years to decades and will overlap with the effects of climate change listed above. However, the HCP would be unlikely to exacerbate the effects of climate change in the action area. This is because conservation measures in the HCP will minimize the effects of the proposed action to the stream reach scale, and the effects will be temporally and spatially separated throughout the action area such that there is little to no overlap of effects from different activities in the action area.

The environmental baseline is degraded by a history of human-caused disturbances, such as logging, road construction, hydro-power development, irrigation and municipal water diversions, and wildfire suppression. Each of these activities has contributed to a myriad of interrelated factors for the decline in quality and function of critical habitat PBFs essential for the conservation of the covered species. Limiting factors for populations of the covered species affected by the proposed action include reduced habitat complexity and water quality. Adverse effects to the quality and function of critical habitat PBFs affected by this action would be minor to moderate intensity in the action area due to the small to moderate magnitude of suspended and depositional sediment, and increase in stream temperature is likely to occur. However, at the designation level, the effects to critical habitat PBFs are small. The effects would be spatially and temporally separated throughout the action area such that there is little to no spatial overlap of effects from different projects in the action area. The effects of the proposed action would not reduce the quality and function of the critical habitat features and their ability to conserve salmon and steelhead in the action area.

Cumulative adverse effects on critical habitat would continue from unmanaged recreation, wildfire suppression, and urbanization. As population continues to grow in and surrounding the action area, so does the overall consumption of local and regional natural resources. NMFS assumes that future private and state actions would continue within the action area, increasing as population rises.

The effects of the proposed action, when added to the environmental baseline, cumulative effects, and status of critical habitat considered in this Opinion will not appreciably reduce the quality and function of critical habitat in the action area. Therefore, the action will not impair the ability of this critical habitat to play its intended conservation role of supporting populations of LCR Chinook salmon, LCR coho salmon, LCR steelhead, UWR Chinook salmon, and UWR steelhead in the action area.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of LCR Chinook salmon, LCR coho salmon, LCR steelhead, UWR Chinook salmon, UWR steelhead, or destroy or adversely modify their designated critical habitat.

2.9 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Harass" is further defined by interim guidance as to "create 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." "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

2.9.1 Amount or Extent of Take

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

- Increase in suspended sediment from road management activities.
- Increase in stream temperature from removal of trees in the riparian area.
- Decrease of instream wood recruitment from removal of trees in the riparian area.

The proposed action is likely to result in the following types of incidental take for LCR Chinook salmon, LCR coho salmon, LCR steelhead, UWR Chinook salmon and UWR steelhead:

Adults

- Harm (injuries, reduced reproductive success) due to increased suspended sediment, increased stream temperatures, and decreased in-stream wood recruitment.

Juveniles

- Harm (injuries, impairment of essential migration and feeding behaviors) due to increased suspended sediment, increased stream temperatures, and decreased in-stream wood recruitment.

Habitat-related incidental take

Habitat-related incidental take cannot be accurately quantified as a number of ESA-listed fish because the distribution and abundance of fish that occur within the action area are affected by habitat quality, competition, predation, and the interaction of processes that influence genetic, population, and environmental characteristics. Additionally, there is no practicable means to count or observe the number of fish exposed to the increased water temperature, increased suspended sediment or decrease in instream wood recruitment because fish will move in and out of an affected area over the period of time during which these effects will occur (annually) and harm to these fish is not necessarily visible. Because NMFS cannot directly determine the amount of take, we instead use indicators of the extent of take that will serve as surrogates for incidental take. Each of these surrogates is proportionally related to the numbers of fish expected to be taken, is quantifiable and measurable, and may be effectively monitored, and thus will serve as a meaningful reinitiation trigger. Because Port Blakely's monitoring program includes reporting their harvest implementation and road construction to NMFS *at a minimum* of once every 5 years, we correlate this reporting with an extent of take that equals a summation of acres harvested and miles of road constructed for each 5-year period of reporting (year one beginning in 2023 occurring every 5 years from that point). Table 6 summarizes the extent of take for the habitat-related effects.

Table 6. Extent of take for the habitat-related effects.

Treatment Type.	Habitat Effect.	Amount for a 5-year Period.
Timber Harvest	Increase in stream temperature, decrease in large wood loading.	6,250 acres
Road Construction	Increase in suspended sediment.	35 miles

Increase in Stream Temperature and Decrease in Large Wood Loading.

- For harm associated with increased stream temperatures and decreased wood loading to salmon and steelhead, the best available indicator for the extent of take is the total number of acres of timber harvest. This indicator is casually linked to the incidental take from increased stream temperatures because the amount of take is proportional to the effects from timber harvest. As more timber harvest units have trees removed within 150 feet of streams, there would be more reductions in shade that contributes to increases in stream temperature, which could significantly modify behavior for ESA-listed fish, or harm fish.
- The extent of take for increased stream temperatures effects is a maximum of 6,250 acres over 5 years. If this amount is exceeded, reinitiation would be triggered. This indicator

functions as valid reinitiation trigger because it is a clear measurable metric that is measured with a 5-year reporting requirement in the HCP, and if the extent of take is exceeded, Port Blakely can alter plans for future years to reduce the amount of acres harvested.

Increase in Suspended Sediment

- For harm associated with increased suspended sediments to salmon and steelhead, the best available indicators are the amount of roads constructed. These indicators are appropriate because roads deliver some amount of fine sediment to streams even if they are properly designed and maintained. These indicators are casually linked to incidental take from increased suspended sediments because although there is likely not a linear relationship between amount road and increases in fine sediment, we know that in general, the amount of sediment delivered increases as the amount of roads on the landscape increases.
- The extent of take for increased suspended sediments effects are a maximum of 35 miles of roads reconstructed over a 5-year period. If this amount is exceeded, reinitiation would be triggered. This indicator functions as valid reinitiation triggers because it is a clear measurable metric that is measured with a 5-year reporting requirement in the HCP and Port Blakely can restrict additional road reconstruction if yearly estimates indicate that this extent of take may be exceeded.

2.9.2 Effect of the Take

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

2.9.3 Reasonable and Prudent Measures

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

The proposed HCP and its associated documents clearly identify anticipated impacts to affected species likely to result from the proposed taking and the measures that are necessary and appropriate to minimize those impacts. All conservation measures described in the proposed HCP, together with the terms and conditions of the associated section 10(a)(1)(B) permit issued with respect to the HCP, are hereby incorporated herein by reference as reasonable and prudent measures and terms and conditions within this ITS as stated in 50 CFR 402.14(i). The amount or extent of incidental take anticipated under the HCP and the associated reporting requirements are as described in the HCP and its accompanying section 10(a)(1)(B) permit.

1. Minimize the extent of take incidental to implementation of the covered activities according to the Conservation Strategy included in the HCP.
2. Conduct monitoring and reporting as instructed in the HCP, to confirm that the take exemption for the covered activities is not exceeded, and biological goals are being met.

2.9.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. The NMFS or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

To implement reasonable and prudent measure #1, "Minimize the extent of incidental take from exposure to covered activities," Port Blakely shall adhere to the following:

1. Consistent with the language in Section 2.9.3., Port Blakely will implement all conservation measures described in the proposed HCP, together with the terms and conditions of the associated section 10(a)(1)(B) permit.

To implement reasonable and prudent measure #2, "Conduct monitoring and reporting as described in the HCP, to confirm that the take exemption for the covered activities is not exceeded," Port Blakely shall:

1. Submit a monitoring report to NMFS that describes Port Blakely's efforts to carry out the HCP. Port Blakely shall monitor the surrogates identified in Section 2.9.1. (total number of acres of timber harvest and total miles of road constructed over a 5-year period) and report to NMFS immediately if there is or anticipated to be an exceedance of take.
2. As part of the HCP implementation and compliance reports that are submitted to NMFS, the following information shall be provided:
    a. Forest management activities, including thinning and regeneration harvests that occurred;
    b. Any new data on covered species occurrences and/or habitat use and protective measures implemented;
    c. The occurrence and location of road construction, deactivation, and maintenance;
    d. The occurrence and location of fish passage structure improvements; and
    e. The contribution towards watershed restoration projects including the location, recipient, and type of support (in-kind, monetary, or product).
    f. The results of the stream habitat effectiveness monitoring program.

2.10. Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, "conservation recommendations" are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

1. NMFS suggests, when possible, to allow beavers to exist in the landscape undisturbed, and coordinate removal and relocation with NMFS if necessary. Doing so would promote floodplain connection and access to off channel habitat.
2. Limit recreational use of forest lands near sensitive fish bearing streams by using educational signage, relocating or blocking informal trails, reverting dispersed campsites to a natural state if located near rivers or streams.

2.11. Reinitiation of Consultation

This concludes formal consultation for NMFS' proposed issuance of an ESA section 10(a)(1)(B) incidental take permit for the Port Blakely Habitat Conservation Plan for the John Franklin Eddy Forestlands.

Under 50 CFR 402.16(a): "Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and: (1) If the amount or extent of taking specified in the incidental take statement is exceeded; (2) If new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion or written concurrence; or (4) If a new species is listed or critical habitat designated that may be affected by the identified action."

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA, EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the physical, biological, and chemical properties that are used by fish (50 CFR 600.10). Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) of the MSA also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH [CFR 600.905(b)]

This analysis is based, in part, on the EFH assessment provided by NMFS and Port Blakely and descriptions of EFH for Pacific Coast salmon (PFMC 2014) contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

The proposed action (*i.e.*, covered activities) for this consultation is described in the Section 1.3 of this document. The Action Area is described in Section 2.3 of this document. The Action Area includes areas designated as EFH for various life history stages of Pacific Coast salmon in the Clackamas and Molalla River basins.

3.2 Adverse Effects on Essential Fish Habitat

The ESA portion of this document (Sections 1 and 2) describes the adverse effects of the proposed action on ESA-listed species and critical habitats, and is relevant to the effects on EFH for Pacific Coast Salmon. Based on the analysis of effects presented in Section 2.5, the proposed action will cause small-scale, long-term adverse effects on EFH for Pacific salmon through direct or indirect physical alteration of the water and substrate. It would also alter habitat conditions at the sites in a manner that slightly alters migratory behaviors and reduces natural cover and forage resources for juvenile salmonids. It may also increase the risk of predation, and exposure to increased water temperatures.

3.3 Essential Fish Habitat Conservation Recommendations

NMFS determined that the following conservation recommendation is necessary to avoid, minimize, mitigate, or otherwise offset the impact of the proposed action on EFH.

1. NMFS and Port Blakely shall follow Term and Condition #1 above in the ESA portion of this document to offset adverse effects to EFH from Forest Management Activities

Fully implementing this EFH conservation recommendation would protect, by avoiding or minimizing effects described in Section 3.2, above, for Pacific Coast salmon.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, NMFS must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of these EFH Conservation Recommendations unless NMFS decides to use alternative time frames for the Federal agency response. The response must include a description of the measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)).

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5 Supplemental Consultation

NMFS must reinitiate EFH consultation if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis these EFH Conservation Recommendations (50 CFR 600.920(l)).

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

4.1. Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are NMFS and Port Blakely. Other interested users could include USFWS. The document will be available at the NOAA Library Institutional Repository (https://repository.library.noaa.gov/welcome). The format and naming adheres to conventional standards for style.

4.2. Integrity

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

4.3. Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

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