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

Refer to NMFS No:
WCRO-2015-00006

July 29, 2020

Michelle Walker
Department of the Army
Seattle District, Corps of Engineers
P.O. Box 3755
Seattle, Washington 98124-3755

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Management Act and Essential Fish Habitat Response for the Northwest Alloys, Inc., Dock 1 Repair Project, Longview, Washington

Dear Ms. Walker:

Thank you for your letter of June 14, 2017, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for The Northwest Alloys, Inc. Dock 1 Repair Project. This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016).

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

In this opinion, we conclude that the proposed action is not likely to jeopardize the continued existence of Snake River (SR) fall Chinook salmon (*Oncorhynchus tshawytscha*), Lower Columbia River (LCR) Chinook salmon, Columbia River (CR) chum salmon (*O. keta*), or Upper Willamette River (UWR) Chinook salmon, or result in the destruction or adverse modification of their designated critical habitats. In section 2.12 of this document we concur with your conclusion that the proposed action is not likely to adversely affect Upper Columbia River (UCR) spring Chinook salmon, SR spring/summer Chinook salmon, LCR coho salmon (*O. kisutch*), LCR steelhead (*O. mykiss*), SR steelhead, UCR steelhead, Middle Columbia River (MCR) steelhead, UWR steelhead, SR sockeye salmon (*O. nerka*), green sturgeon (*Acipenser medirostris*), eulachon (*Thaleichtys pacificus*) or Southern Resident Killer Whales (*Orcinus orca*) or their designated critical habitat.

As required by section 7 of the ESA, we are providing an incidental take statement with the opinion. The incidental take statement describes reasonable and project measures we consider necessary or appropriate to minimize incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements that the Corps and any person who performs the action must comply with to carry out the reasonable and prudent measures. Incidental take from actions that meet these terms and conditions will be exempt from the ESA take prohibition.

Please contact Tom Hausmann, in Portland, Oregon, at 503-231-2315 or Tom.Hausmann@noaa.gov if you have any questions concerning this section 7 consultation, or if you require additional information.

Sincerely,

Kim W. Kratz, Ph.D
Assistant Regional Administrator
Oregon Washington Coastal Office

cc: Danette Guy, USACE

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

Northwest Alloys, Inc. Dock 1 Repair Project

NMFS Consultation Number: WCRO-2015-00006

Action Agency: U.S. Army Corps of Engineers

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 Chinook Salmon (*Oncorhynchu tshawytscha*)	Threatened	Yes	No	Yes	No
Snake River Fall Run Chinook Salmon (*O. tshawytscha*)	Threatened	Yes	No	Yes	No
Upper Willamette River fall Chinook Salmon (*O. tshawytscha)*	Threatened	Yes	No	Yes	No
Columbia River chum (*O. keta*)	Threatened	Yes	No	Yes	No
Upper Columbia River spring Chinook (O. *tshawytscha*)	Endangered	No	No	No	No
Snake River spring/summer Chinook *(O. tsawytscha*)	Threatened	No	No	No	No
Snake River steelhead (*O. mykiss*)	Threatened	No	No	No	No
Middle Columbia River steelhead (*O. mykiss*)	Threatened	No	No	No	No
Lower Columbia River steelhead (*O. mykiss*)	Threatened	No	No	No	No
Upper Columbia River steelhead (*O. mykiss*)	Threatened	No	No	No	No

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?
Upper Willamette River steelhead (*O. mykiss*)	Threatened	No	No	No	No
Lower Columbia River coho *(O. kisutch)*	Threatened	No	No	No	No
Snake River sockeye *(O. nerka)*	Endangered	No	No	No	No
Pacific eulachon *(Thaleichthys pacificus)*	Threatened	No	No	No	No
Green sturgeon *(Acipenser medirostris)*	Threatened	No	No	No	No
Southern Resident Killer Whales *(Orcinus orca)*	Endangered	No	No	No	No

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

Consultation Conducted By: National Marine Fisheries Service
West Coast Region

Issued By:
Kim W. Kratz, Ph.D
Assistant Regional Administrator
Oregon Washington Coastal Office

Date: July 29, 2020

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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

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

We 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 within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at Portland, Oregon.

1.2 Consultation History

The applicant for the proposed permit is Northwest Alloys, Inc. (NWA). The Biological Assessment was prepared by Grette and Associates. NMFS first received a consultation package from the Corps in 2015. The Corps provided additional information from the applicant on February 23, 2016. The NMFS consultation biologist retired and the consultation was not reassigned until June 20, 2017. NMFS requested no other additional information about or modifications to the proposed action and initiated consultation on June 21, 2017. Although the Corps determined that the proposed action would not adversely affect Pacific Coast Salmon EFH, impact pile driving sound pressure is an adverse effect on EFH water quality and included an MSA EFH response to the ESA consultation.

The Corps determined that the proposed action was not likely to adversely affect Lower Columbia River Chinook, Upper Columbia River spring-run Chinook salmon, Snake River spring/summer-run Chinook salmon, Upper Willamette river Chinook salmon, Snake River fall-run Chinook salmon, Columbia River chum salmon, Lower Columbia River coho salmon, Snake River sockeye salmon, Upper Columbia River steelhead, Lower Columbia River steelhead, Upper Willamette River steelhead, Middle Columbia river steelhead, Snake River basin steelhead, Southern DPS of green sturgeon, and Southern DPS of eulachon.

NMFS determined that the proposed action was likely to adversely affect Lower Columbia River Chinook salmon, Snake River fall Chinook salmon, Upper Willamette River Chinook salmon and Columbia River chum salmon because Chinook salmon could be exposed to sound exposure levels greater than 183 dBSEL from impact pile driving during the proposed work window and the proposed repair meaningfully extends the service life of this overwater structure and thereby causes future effects to Chinook salmon and chum salmon such as shade and migration obstruction which translate into predation risk. NMFS also analyzes the effect all proposed actions that adversely affects Columbia River salmon on the prey base of Southern Resident killer whales (SRKW) off the coasts of Washington and Oregon. NMFS informed the Corps project manager of this decision in an email on September 18, 2017.

NMFS used the following information sources and documents from the action agency to make its determination; the Biological Assessment provided by Corps, Status of Species summaries prepared by NMFS from papers and reports listed in the References section of this Opinion, the Washington Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plan (NMFS, 2013) and other scientific books, papers and reports listed in the References section of this Opinion or otherwise in the record for this consultation.

1.3 Proposed Federal Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02). 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 Corps proposes to issue a permit NWA under Section 10 of the Rivers and Harbors Act to remove and replace, or repair, deteriorating structural piles supporting the approach trestle, the approach platform between the trestle and the wharf and two dolphin catwalks of their dock (Dock 1) used to import alumina ore (Figure 1).

Figure 1. Approach trestle, approach walkway, dolphins and dolphin catwalks for Dock 1.

The proposed action involves removing 109 piles, installing 89 piles and repairing up to 38 piles. Of the piles to be installed, 70 piles will be installed using impact pile driving. These replacements and repairs are necessary to restore the trestle and dock to original design capacity and safety requirements.

Pile Replacement and Repair, Approach Trestle and Approach Platform: NWA will remove 66 of the 106 14-inch diameter, creosote treated, wooden piles that support the Dock 1 approach trestle and approach platform. The approach trestle piles are deteriorating (i.e., rotting off within the elevations of variable water levels) and are susceptible to damage from material and debris floating downstream in the river. The project engineer identified 92 piles in need of repair or replacement. NWA will remove these piles with a vibratory pile driver. NWA will install 54, 16-inch diameter, steel pipe pile that support the approach trestle and approach platform to Dock 1. NWA will install these piles with a vibratory pile driver and proof them with 750 strikes (each) by an impact pile driver using a bubble curtain to attenuate sound. NWA will repair 38 deteriorated wooden piles by cutting the old pile at the mudline and splicing the wooden pile stub to a steel pile with an 18 inch grouted pile repair sleeve.

Pile Replacement, Dolphin Catwalks: NWA will remove 24 of 24, 14-inch diameter, creosote treated, wooden piles that support the Dock 1 dolphin catwalks. NWA will remove these piles with a vibratory pile driver. NWA will install 16, 16-inch diameter, steel pipe piles with a vibratory pile driver and proof them with 750 strikes (each) by an impact pile driver using a bubble curtain to attenuate sound. For the pile replacement work on the dolphin catwalks and approach trestle and platform, NWA will proof 4 piles per day (3000 strikes per day) over 6 hours of impact driving per day; 70 piles at 4 per day indicates that we can reasonably expect 18 days of impact driving.

Other Non-Structural Repair and Replacement Work: NWA will replace 19 non-structural, timber fender pile with 19 16-inch diameter steel pile with vibratory pile driving only. NWA will also replace approach trestle and approach platform cross bracing elements that are partially submerged. NWA will replace timber pile caps, concrete decking and stringers and repair or replace timber decking that are all above OHW.

Best Management Practices

NWA will use the following best practices during the repair and replacement work:

- Typical construction BMPs for working over, in, and near water will be applied, including checking equipment for leaks and other problems that could result in discharge of petroleum-based products, hydraulic fluid, or other material to the Columbia River.
- Contractors conducting in-water and over-water work, including demolition, will be familiar with implementation of BMPs and permit conditions typical of working in the aquatic environment.
- The contractor will have a spill containment kit, including oil-absorbent materials, on site to be used in the event of a spill or if any oil product is observed in the water.
- The contractor will be responsible for the preparation and implementation of a Spill Prevent, Control, and Countermeasures (SPCC) plan to be used for the duration of the

project. The plan will be submitted to the Project engineer prior to the commencement of any Project activities. A copy of the plan with any updates will be maintained at the work site by the contractor.

- Equipment will have properly functioning mufflers, engine-intake silencers, and engine closures according to federal standards; the contractor will inspect fuel hoses, oil or fuel transfer valves, and fittings on a regular basis for drips or leaks in order to prevent spills into the surface water.
- Barges will not be allowed to ground out during construction.
- The contractor will be required to retrieve any floating debris generated during construction using a skiff and a net. Debris will be disposed of at an appropriate upland facility. If necessary, a floating boom will be installed to collect any floated debris generated during in-water operations.
- Vibratory pile driving/removal will be used to the extent possible to minimize potential injurious or disturbing noise levels on fish species.
- Pile will be removed slowly so as to minimize sediment disturbance and turbidity in the water column.
- Prior to extraction the operator will "wake up" pile to break the friction between the pile and substrate to minimize sediment disturbance.
- Where possible, extraction equipment will be kept out of the water to avoid "pinching" pile below the water line in order to minimize creosote release during extraction.
- The work surface on barge deck or pier shall include a containment basin for pile and any sediment removed during pulling. Any sediment collected in the containment basin will be disposed of at an appropriate upland facility, as will all components of the basin (e.g., straw bales, geotextile fabric) and all pile removed.
- Upon removal from substrate, the pile shall be moved expeditiously from the water into the containment basin. The pile shall not be shaken, hosed-off, stripped or scraped off, left hanging to drip or any other action intended to clean or remove adhering material from the pile.
- All pile removed will be disposed of at an appropriate upland facility.
- Impact driving during pile installation will be conducted using a confined bubble curtain.
- Project construction will be completed in compliance with Washington State Water Quality Standards WAC 173-201A, including but not limited to prohibitions on discharge of oil, fuel, or chemicals into state waters, proper maintenance of equipment to prevent spills, and appropriate spill response including corrective actions and reporting as outlined in permits an authorizations (USACE permit, HPA, 401 Water Quality Certification).

The work is proposed for October 1 through December 31 instead of the November 1 through February 28 in water work window.

We considered whether or not the proposed action would cause any other activities and determined that it would cause the following activities. The jurisdictional reach of the action agency is not part of the test for whether the proposed action causes other activities. The other activity caused by the proposed action is vessel use in and around the dock by private operators for the extended service life of the dock. Certain vessel traffic currently occurs because of the existence of the dock. Since the dock is expected to exist on the landscape for a longer time period as a result of the proposed action, the vessel traffic associated with the dock is similarly expected to occur for a longer period of time as a result of the proposed action. Thus, that vessel traffic for an extended period is caused by the proposed action. Many of the piles that will be repaired or replaced under the proposed action are structural. Dock 1 was constructed in the 1960s and the Corps has previously authorized repairs of this structure. The BE for the proposed action states that repairs are necessary to restore the trestle and dock to original design capacity and safety requirements. By replacing these piles, the proposed action meaningfully extends the life of Dock 1. The BE for the proposed action also states that the proposed dock repairs are necessary to support continued receipt of alumina ore. The various repairs identified above have resulted from sustained degradation of the portions of the dock that will require repair and/or replacement to ensure safe working operations. If the proposed action were not carried out, Dock 1 would eventually be incapable of receiving cargo from OGVs. This may not happen immediately, but given the age of the structure and the stated need for repair, Dock 1 would likely become unusable within the next decade.

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 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 non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

The Corps determined the proposed action is not likely to adversely affect Upper Columbia River (UCR) spring Chinook, Snake River spring/summer Chinook salmon, Lower Columbia River coho salmon, Snake River steelhead, Middle Columbia River steelhead, Lower Columbia River steelhead, Upper Columbia River steelhead, Snake River sockeye salmon, Upper Willamette River steelhead, , eulachon, or green sturgeon or their critical habitat. Our concurrence with these determinations and our analysis of Southern Resident killer whale critical habitat prey is documented in the "Not Likely to Adversely Affect" Determinations Section 2.12.

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 CFR402.02). 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 designation(s) of critical habitat for (species) use(s) the term primary constituent element (PCE) or essential features. The 2016 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 2019 regulations define effects of the action using the term “consequences” (50 CFR 402.02). As explained in the preamble to the regulations (84 FR 44977), that definition 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 would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species’ likelihood of both survival and recovery. The species status section also helps to inform the description of the species’ “reproduction, numbers, or distribution” as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the function of the essential PBFs that help to form that conservation value.

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. The largest hydrologic responses are expected to occur in basins with significant snow accumulation, where warming decreases snow pack, increases winter flows, and advances the timing of spring melt (Mote, 2016; Mote et al., 2014). Rain-dominated watersheds and those with significant contributions from groundwater may be less sensitive to predicted changes in climate (Mote et al., 2014; Tague et al., 2013).

During the last century, average regional air temperatures in the Pacific Northwest increased by 1-1.4°F as an annual average, and up to 2°F in some seasons (based on average linear increase per decade; (Abatzoglou et al., 2014; Kunkel et al., 2013). Recent temperatures in all but two years since 1998 ranked above the 20th century average (Mote et al., 2013). Warming is likely to continue during the next century as average temperatures are projected to increase another 3 to 10°F, with the largest increases predicted to occur in the summer (Abatzoglou et al., 2014).

Decreases in summer precipitation of as much as 30% by the end of the century are consistently predicted across climate models (Abatzoglou et al., 2014). Precipitation is more likely to occur during October through March, less during summer months, and more winter precipitation will be rain than snow (ISAB (editor), 2007) (Mote et al., 2013; Mote et al., 2014). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB (editor), 2007; Mote et al., 2014). Models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events), in the western United States (Dominguez et al., 2012). The largest increases in winter flood frequency and magnitude are predicted in mixed rain-snow watersheds (Mote et al., 2014).

The combined effects of increasing air temperatures and decreasing spring through fall flows are expected to cause increasing stream temperatures; in 2015 this resulted in 3.5-5.3ºC increases in Columbia Basin streams and a peak temperature of 26ºC in the Willamette (NWFSC, 2015a). Overall, about one-third of the current cold-water salmonid habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (Mantua et al., 2009).

Higher temperatures will reduce the quality of available salmonid habitat for most freshwater life stages (ISAB (editor), 2007). Reduced flows will make it more difficult for migrating fish to pass physical and thermal obstructions, limiting their access to available habitat (Isaak et al., 2012; Mantua and Hamlet, 2010). Temperature increases shift timing of key life cycle events for salmonids and species forming the base of their aquatic foodwebs (Crozier et al., 2008; Tillmann and Siemann, 2011; Winder and Schindler, 2004). Higher stream temperatures will also cause decreases in dissolved oxygen and may also cause earlier onset of stratification and reduced mixing between layers in lakes and reservoirs, which can also result in reduced oxygen (Meyer et al., 1999; Raymondi et al., 2013; Winder and Schindler, 2004). Higher temperatures are likely to cause several species to become more susceptible to parasites, disease, and higher predation rates (Crozier et al., 2008; Raymondi et al., 2013; Wainwright and Weitkamp, 2013).

As more basins become rain-dominated and prone to more severe winter storms, higher winter stream flows may increase the risk that winter or spring floods in sensitive watersheds will damage spawning redds and wash away incubating eggs (Goode et al., 2013). Earlier peak stream flows will also alter migration timing for salmon smolts, and may flush some young salmon and steelhead from rivers to estuaries before they are physically mature, increasing stress and reducing smolt survival (Lawson et al., 2004; McMahon and Hartman, 1989).

In addition to changes in freshwater conditions, predicted changes for coastal waters in the Pacific Northwest as a result of climate change include increasing surface water temperature, increasing but highly variable acidity, and increasing storm frequency and magnitude (Mote et al., 2014). Elevated ocean temperatures already documented for the Pacific Northwest are highly likely to continue during the next century, with sea surface temperature projected to increase by 1.0-3.7oC by the end of the century (IPCC, 2014). Habitat loss, shifts in species' ranges and abundances, and altered marine food webs could have substantial consequences to anadromous, coastal, and marine species in the Pacific Northwest (Reeder et al., 2013; Tillmann and Siemann, 2011).

Moreover, as atmospheric carbon emissions increase, increasing levels of carbon are absorbed by the oceans, changing the pH of the water. A 38 percent to 109 percent increase in acidity is projected by the end of this century in all but the most stringent CO_2 mitigation scenarios, and is essentially irreversible over a time scale of centuries (IPCC, 2014). Regional factors appear to be amplifying acidification in Northwest ocean waters, which is occurring earlier and more acutely than in other regions and is already impacting important local marine species (Barton et al., 2012; Feely et al., 2012). Acidification also affects sensitive estuary habitats, where organic matter and nutrient inputs further reduce pH and produce conditions more corrosive than those in offshore waters (Feely et al., 2012; Sunda and Cai, 2012).

Global sea levels are expected to continue rising throughout this century, reaching likely predicted increases of 10-32 inches by 2081-2100 (IPCC, 2014). These changes will likely result in increased erosion and more frequent and severe coastal flooding, and shifts in the composition of nearshore habitats (Reeder et al., 2013; Tillmann and Siemann, 2011). Estuarine-dependent salmonids such as chum and Chinook salmon are predicted to be impacted by significant reductions in rearing habitat in some Pacific Northwest coastal areas (Glick et al., 2007). Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances, and therefore these species are predicted to fare poorly in warming ocean conditions (Scheuerell and Williams, 2005; Zabel et al., 2006). This is supported by the recent observation that anomalously warm sea surface temperatures off the coast of Washington from 2013 to 2016 resulted in poor coho and Chinook salmon body condition for juveniles caught in those waters (NWFSC, 2015a). Changes to estuarine and coastal conditions, as well as the timing of seasonal shifts in these habitats, have the potential to impact a wide range of listed aquatic species (Reeder et al., 2013; Tillmann and Siemann, 2011).

The adaptive ability of these threatened and endangered species is depressed due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation. Without these natural sources of resilience, systematic changes in local and regional climatic conditions due to anthropogenic global climate change will likely reduce long-term viability and sustainability of populations in many of these ESUs (NWFSC, 2015a). New stressors generated by climate change, or existing stressors with effects that have been amplified by climate change, may also have synergistic impacts on species and ecosystems (Doney et al., 2012). These conditions will possibly intensify the climate change stressors inhibiting recovery of ESA-listed species in the future.

2.2.1 Status of the Species

For Pacific salmon, steelhead, and certain other species, we commonly use the four "viable salmonid population" (VSP) criteria (McElhany et al., 2000) to assess the viability of the populations that, together, constitute the species. These four criteria (spatial structure, diversity, abundance, and productivity) encompass the species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. When these parameters are collectively at appropriate levels, they maintain a population's capacity to adapt to various environmental conditions and allow it to sustain itself in the natural environment.

"Spatial structure" refers both to the spatial distributions of individuals in the population and the processes that generate that distribution. A population's spatial structure depends on habitat quality and spatial configuration, and the dynamics and dispersal characteristics of individuals in the population.

"Diversity" refers to the distribution of traits within and among populations. These range in scale from DNA sequence variation in single genes to complex life history traits (McElhany et al., 2000).

"Abundance" generally refers to the number of naturally-produced adults (i.e., the progeny of naturally-spawning parents) in the natural environment (e.g., on spawning grounds).

"Productivity," as applied to viability factors, refers to the entire life cycle (i.e., the number of naturally-spawning adults produced per parent). When progeny replace or exceed the number of parents, a population is stable or increasing. When progeny fail to replace the number of parents, the population is declining. (McElhany et al., 2000) use the terms "population growth rate" and "productivity" interchangeably when referring to production over the entire life cycle. They also refer to "trend in abundance," which is the manifestation of long-term population growth rate.

For species with multiple populations, once the biological status of a species' populations has been determined, we assess the status of the entire species using criteria for groups of populations, as described in recovery plans and guidance documents from technical recovery teams. Considerations for species viability include having multiple populations that are viable, ensuring that populations with unique life histories and phenotypes are viable, and that some viable populations are both widespread to avoid concurrent extinctions from mass catastrophes and spatially close to allow functioning as metapopulations (McElhany et al., 2000).

The summaries that follow describe the status of the four ESA-listed species, and their designated critical habitats, that occur within the geographic area of this proposed action and are considered in this opinion. More detailed information on the status and trends of these listed resources, and their biology and ecology, are in the listing regulations and critical habitat designations published in the Federal Register (Table 1).

Table 1. Listing status, status of critical habitat designations and protective regulations, and relevant Federal Register (FR) decision notices for ESA-listed species considered in this opinion. Listing status: 'T' means listed as threatened; 'E' means listed as endangered; 'P' means proposed for listing or designation.

Species	Listing Status	Critical Habitat	Protective Regulations
Chinook salmon *(Oncorhynchus tshawytscha)*			
Lower Columbia River	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Upper Willamette River	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Snake River	T 6/28/05: 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Chum salmon *(O. keta)*			
Columbia River	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160

Lower Columbia River Chinook Salmon

The LCR Chinook salmon ESU includes all naturally-produced populations of Chinook salmon from the Columbia River and its tributaries from its mouth at the Pacific Ocean upstream to a transitional point between Washington and Oregon east of the Hood River and the White Salmon River. The ESU includes the Willamette River to Willamette Falls, Oregon, with the exception of spring-run Chinook salmon in the Clackamas River. ESU life histories (run and spawn timing) includes spring, fall and late fall runs and the ESU spans three distinct ecological regions: Coastal, Cascade, and Gorge. Recovery plan targets for this species are tailored for each life history. Within each life history, specific population VSP targets are identified (NMFS, 2013a). Of the 32 demographically independent populations (DIPs) in this ESU, only the 2 late-fall run populations (Lewis River and Sandy River) could be considered viable or nearly so (NWFSC, 2015a). Late fall Chinook salmon recovery requires maintenance of the North Fork Lewis population, which is comparatively healthy, and increasing the probability of persistence of the Sandy population from its current status of "high" to "very high." Improving the status of the Sandy population depends largely on harvest and hatchery changes. Habitat improvements to the Columbia River estuary and tributary spawning areas are also necessary. All Spring Chinook populations are affected by habitat loss and degradation. Four of the nine Spring Chinook populations require significant reductions in every limiting factor. Protection and improvement of tributary and estuarine habitat are specifically noted. Fall Chinook salmon, recovery requires restoration of the Coast and Cascade strata to high probability of persistence. Most fall Chinook salmon populations require large VSP improvements by ensuring habitat protection and restoration.

Spatial Structure and Diversity. The ESU consists of 32 historical populations. Populations exhibit three different life history types base on return timing and other features. There are 21 fall-run (or "tules") populations, 2 late-fall-run (or "brights") populations, and 9 spring-run populations. Distinct run times within each ecological regions are organized into 6 major population groups (MPGs). Fall-run Chinook salmon hatchery programs have released 50 million fish annually. Spring-run and upriver bright (URB) programs release a total of 15 million fish annually. As a result of this high level of hatchery production and low levels of natural production, many of the populations contain over 50 percent hatchery fish among their naturally spawning assemblages.

Abundance and Productivity. The two historical populations in the Spring-run Gorge MPG are extirpated or nearly so. Many of the populations in the Fall-run Gorge MPG have limited spawning habitat available. No Chinook salmon were observed in Scappoose Creek in 2012 and 2013 surveys. Of the seven spring-run DIPs in the Cascade MPG only the Sandy River spring-run population appears to be currently self-sustaining. The Fall-run Cascade MPG exhibits stable population trends at low abundance levels, and most populations have hatchery contribution exceeding the recovery plan target of 10 percent (NMFS, 2013b). The two populations in the Late-Fall-run Cascade MPG are the most viable of the ESU. The Lewis River late-fall DIP has the largest natural abundance in the ESU and has a strong short-term positive trend and a stable long term trend, suggesting a population near capacity. The Sandy River late-fall run has not been directly monitored in a number of years but the most recent estimate was 373 spawners in 2010 (Takata, 2011). The populations in the Coastal fall-run MPG are dominated by hatchery-origin spawners. Natural-origin returns for most populations are in the hundreds of fish.

Limiting factors. Limiting factors for this species include NMFS (2013a):

- 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
- Contaminants

Upper Willamette River Chinook salmon

Upper Willamette River (UWR) Chinook salmon were listed as threatened on June 28, 2005 (70 FR 37160). A recovery plan is available for this species (ODFW and NMFS, 2011a). There are a number of general considerations that affect some or all of the UWR Chinook populations, including high levels of prespawning mortality, lack of access to historical habitat, high levels of total dissolved gases (TDG), and a reduction in returning adult abundance between Willamette Falls and census points in the main tributaries (NWFSC, 2015b). Prespawning mortality levels are generally high in the lower tributary reaches where water temperatures and fish densities are the highest. Access to historical spawning and rearing areas is restricted by large dams in the four historically most productive tributaries, and in the absence of effective passage programs will continue to confine spawning to more lowland reaches where land development, water temperatures, and water quality may be limiting. Areas immediately downstream of high head dams may also be subject to high levels of total dissolved gas (TDG), which could affect a significant portion of the incubating embryos, in-stream juveniles, and adults in the basin

(NWFSC, 2015b). Shortfalls in counts of returning adults between Willamette Falls and upper tributary reaches also indicate additional prespawning mortality or spawning in lower quality habitat in lower tributary reaches could be limiting the recovery of these populations (Jepson et al., 2015; Jepson et al., 2013).

Spatial Structure and Diversity. This species includes all naturally spawned populations of spring-run Chinook salmon originating from the Clackamas River; from the Willamette River and its tributaries above Willamette Falls; and from six artificial propagation programs (NMFS, 2016; USDC, 2014a). All seven historical DIPs of UWR Chinook salmon identified by the WLC-TRT occur within the action area and are contained within a single ecological subregion, the western Cascade Range (Table 2).

Table 2. Scores for the key elements (A&P, diversity, and spatial structure) used to determine current overall viability risk for UWR Chinook salmon (ODFW and NMFS, 2011b). All populations are in the Western Cascade Range ecological subregion. Risk ratings included very low (VL), low (L), moderate (M), high (H), and very high (VH). The current general directions of population viability scores based on data reviewed in the 2015 status update are also shown (NWFSC 2015).

Population (Watershed)	A&P	Diversity	Spatial Structure	Overall Extinction Risk	Current VSP Score Trend
Clackamas River	M	M	L	M	Declining
Molalla River	VH	H	H	VH	Increasing
North Santiam River	VH	H	H	VH	Increasing
South Santiam River	VH	M	M	VH	Increasing
Calapooia River	VH	H	VH	VH	Stable
McKenzie River	VL	M	M	L	Declining
Middle Fork Willamette River	VH	H	H	VH	Increasing

Abundance and Productivity. Abundance levels for five of the seven DIPs in this ESU remain well below their recovery goals. Of these, the Calapooia River may be functionally extinct and the Molalla River remains critically low (although perhaps only marginally better than the 0 VSP score estimated in the Recovery Plan; (ODFW and NFMS 2011). Abundances in the North and South Santiam rivers have risen since the 2010 review, but still range only in the high hundreds of fish. The proportion of natural origin spawners improved in the North and South Santiam basins, but was still well below identified recovery goals. Improvement in the status of the Middle Fork Willamette River relates solely to the return of natural adults to Fall Creek, however the capacity of the Fall Creek basin alone is insufficient to achieve the recovery goals for this DIP. The Clackamas and McKenzie Rivers have previously been viewed as natural population strongholds, but have both experienced declines in abundance despite having access to much of their historical spawning habitat. Fish passage improvements made at dams and numerous habitat restoration projects completed in upper Willamette River tributaries are expected to eventually provide benefit to the UWR Chinook salmon ESU, however, the scale of improvements needed is greater than the scale of habitat actions implemented to date (NMFS 2016c). Overall, populations appear to be at either moderate or high risk, there has been likely little net change in the VSP score for the ESU since the last review, so the ESU remains at moderate risk (NWFSC 2015).

Limiting Factors. Limiting factors for this species include (ODFW and NMFS 2011):

- Degraded freshwater habitat, including floodplain connectivity and function, channel structure and complexity, incubation gravels, riparian areas, and gravel and large wood recruitment
- Degraded water quality including elevated water temperature and toxins
- Increased disease incidence
- Altered stream flows
- Reduced access to spawning and rearing habitats due to migration barriers, impaired fish passage, and increased pre-spawn mortality associated with conditions below dams
- Altered food web due to reduced inputs of microdetritus
- Predation by native and non-native species, including hatchery fish
- Competition related to introduced races of salmon and steelhead
- Altered population traits due to fisheries, bycatch, and natural origin fish interbreeding with hatchery origin fish

Snake River Fall-run Chinook Salmon

We adopted a recovery plan for this species in November 2017. (NMFS 2017b). The long term recovery goal for natural origin fish is 14,360 average annual returns of natural-origin fall Chinook salmon (adults and jacks) above Lower Monumental Dam. The long term goal for hatchery origin fish is average annual return goal is 24,750 hatchery-origin fish above Lower Monumental Dam.

Spatial Structure and Diversity. This species includes all naturally-spawned populations of fall-run Chinook salmon originating from the mainstem Snake River below Hells Canyon Dam; from the Tucannon River, Grande Ronde River, Imnaha River, Salmon River, and Clearwater River subbasins; and from four artificial propagation programs (USDC, 2014b).

The IC-TRT identified three populations of this species, although only the lower mainstem population exists at present, and it spawns in the lower main stem of the Clearwater, Imnaha, Grande Ronde, Salmon and Tucannon rivers. The extant population of Snake River fall-run Chinook salmon is the only remaining population from an historical ESU that also included large mainstem populations upstream of the current location of the Hells Canyon Dam complex (IC-TRT, 2003; McClure et al., 2005). The population is at moderate risk for diversity and spatial structure (Ford, 2011).

Abundance and Productivity. While the 10-year geometric mean natural-origin abundance level has been high, the abundance/productivity margin is insufficient to rate the population as very low risk with high confidence (i.e., an 80 percent or higher probability of exceeding the 1 percent viability curve). The probability that the true underlying abundance and productivity being estimated from the samples falls above the 5 percent viability curve (with minimum abundance threshold) is, however, greater than 80 percent. As a result, the Lower Snake River fall Chinook salmon population is rated at low risk for abundance and productivity.

Limiting Factors. Limiting factors for this species include (NOAA Fisheries, 2011):

- Degradation of floodplain connectivity and function and channel structure and complexity
- Harvest-related effects
- Loss of access to historical habitat above Hells Canyon and other Snake River dams
- Impacts from mainstem Columbia River and Snake River hydropower systems
- Hatchery-related effects
- Degraded estuarine and nearshore habitat.

Columbia River chum salmon

Columbia River chum salmon are included in the Lower Columbia River Recovery Plan (NMFS, 2013a). Recovery targets described in the Plan for this species focus on improving tributary and estuarine habitat conditions, and re-establishing populations where they may have been extirpated, in order to increase all four viability parameters. Specific recovery goals are to restore Coast and Cascade chum salmon strata to a high probability of persistence, and to improve persistence probability of the two Gorge populations by protecting and restoring spawning habitat, side channel, and off channel habitats alcoves, wetlands, floodplains, etc.

Spatial Structure and Diversity. This ESU includes naturally-spawned chum salmon originating from the Columbia River (CR) and its tributaries in Washington and Oregon, and progeny of two artificial propagation programs. The WLC-TRT identified 17 historical populations of CR chum salmon and aggregated these into four strata (Myers et al., 2006) (Table 3). CR chum salmon spawning aggregations identified in the mainstem Columbia River were included in the population associated with the nearest river basin. Although hatchery production of chum salmon has been limited and hatchery effects on diversity are thought to have been relatively small, diversity has been greatly reduced at the ESU level because of presumed extirpations and the low abundance in the remaining populations (fewer than 100 spawners per year for most populations) (Lower Columbia Fish Recovery Board 2010; NMFS 2013a).

Abundance and Productivity. The very low persistence probabilities or possible extirpations of most chum salmon populations are due to low abundance, productivity, spatial structure, and diversity. The Lower Gorge population meets abundance and productivity criteria for very high levels of viability, but the distribution of spawning habitat (i.e., spatial structure) for the population has been significantly reduced (Lower Columbia Fish Recovery Board 2010); spatial structure may need to be improved, at least in part, through better performance from the Oregon portion of the population (NMFS 2013a). Even with the improvements observed during the last five years, the majority of populations in this ESU remain at a high or very high risk category and considerable progress remains to be made to achieve the recovery goals (NWFSC, 2015b).

Table 3. CR chum salmon strata, ecological subregions, run timing, populations, and scores for the key elements (A&P, spatial structure, and diversity) used to determine current overall net persistence probability of the population (NMFS 2013a). Persistence probability ratings are very low (VL), low (L), moderate (M), high (H), to very high (VH).

Ecological Subregion	**Run Timing**	**Spawning Population (Watershed)**	**A&P**	**Diversity**	**Spatial Structure**	**Overall Persistence Probability**
Coast Range	Fall	Young's Bay (OR	*	*	*	VL
		Grays/Chinook River (WA)	VH	M	H	M
		Big Creek (OR)	*	*	*	VL
		Elochoman/Skamakowa Rivers (WA)	VL	H	L	VL
		Claskanie River (OR)	*	*	*	VL
		Mill, Abernathy and Germany Creeks (WA)	VL	H	L	VL
		Scappoose Creek (OR	*	*	*	VL
Cascade Range	Summer	Cowlitz River (WA)	VL	L	L	VL
	Fall	Cowlitz River (WA)	VL	H	L	VL
		Kalama River (WA)	VL	H	L	VL
		Lewis River (WA)	VL	H	L	VL
		Salmon Creek (WA)	VL	L	L	VL
		Clackamas River (OR)	*	*	*	VL
		Sandy River (OR)	*	*	*	VL
		Washougal River (WA)	VL	H	L	VL
Columbia Gorge	Fall	Lower Gorge (WA & OR)	VH	H	VH	H
		Upper Gorge (WA & OR)	VL	L	L	VL

Of the 17 populations that historically made up this ESU, 15 of them (six in Oregon and nine in Washington) are so depleted that either their baseline probability of persistence is very low or they are extirpated or nearly so (Lower Columbia Fish Recovery Board 2010; ODFW 2010; NW Fisheries Science Center 2015; NMFS 2013a). All three strata in the ESU fall significantly short of the WLC-TRT criteria for viability. Currently almost all natural production occurs in just two populations: the Grays/Chinook and the Lower Gorge. The Grays/Chinook population has a moderate persistence probability, and the Lower Gorge population has a high probability of persistence (Lower Columbia Fish Recovery Board 2010; NMFS 2013a). Since the 2010 review (Ford et al. 2010), likely improvements include the Big Creek demographically independent population, the Washougal River (positive abundance trend over 10-year period), and the Grays River (may be at or near viable status). The Lower Gorge has experienced population abundance declines (NMFS 2016)

Limiting Factors include (NOAA Fisheries 2011; NMFS 2013a; NWFSC 2015):

- Degraded estuarine and nearshore marine habitat

- Degraded freshwater habitat
- Degraded stream flow as a result of hydropower and water supply operations
- Reduced water quality
- Current or potential predation
- An altered flow regime and Columbia River plume
- Reduced access to off-channel rearing habitat in the lower Columbia River

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 below. More complete information is available in the cited documents and other documents in the consultation record, and they are incorporated here by reference.

Lower Columbia River Chinook Salmon

Critical habitat was designated for LCR Chinook Salmon on Sept 2, 2005 in 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 PBFs 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.

Columbia River chum salmon

Critical habitat was designated for CR chum salmon on September 2, 2016 in 70 FR 52630. Critical habitat encompasses six subbasins in Oregon and Washington containing 19 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs 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 16 watersheds, and medium for three watersheds.

Snake River Fall-run Chinook salmon

Critical habitat was designated for SR Fall-run Chinook salmon on October 25, 1999 in 64 FR 57399. Critical habitat of river reaches of the Columbia, Snake, and Salmon rivers, and all tributaries of the Snake and Salmon rivers (except the Clearwater River) presently or historically accessible to this ESU (except reaches above impassable natural falls and Hells Canyon Dam). Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar et al., 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in this area have been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.

Upper Willamette River Chinook salmon

Critical habitat was designated for UWR Chinook salmon on September 2, 2005 in 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 PBFs 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.

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).

The upriver extent of the action area is defined by the distance from the source that sound from impact pile driving of 16 inch diameter steel pipe piles exceeds 120 dB_{RMS}. The BE calculated this distance using the Practical Spreading Loss model. The calculated radius is 8.1 miles but as shown in Figure 2, the longest line of sight distance between the sound source and land is 4.5 miles upriver. The downriver extent of the action area is the mouth of the Columbia River. The downriver extent reflects the effects of wake stranding from barge traffic and, in particular, the potential from long period wake wave stranding salmon smolts on certain flat beaches distributed from the mouth of the Columbia River to the NWA dock.

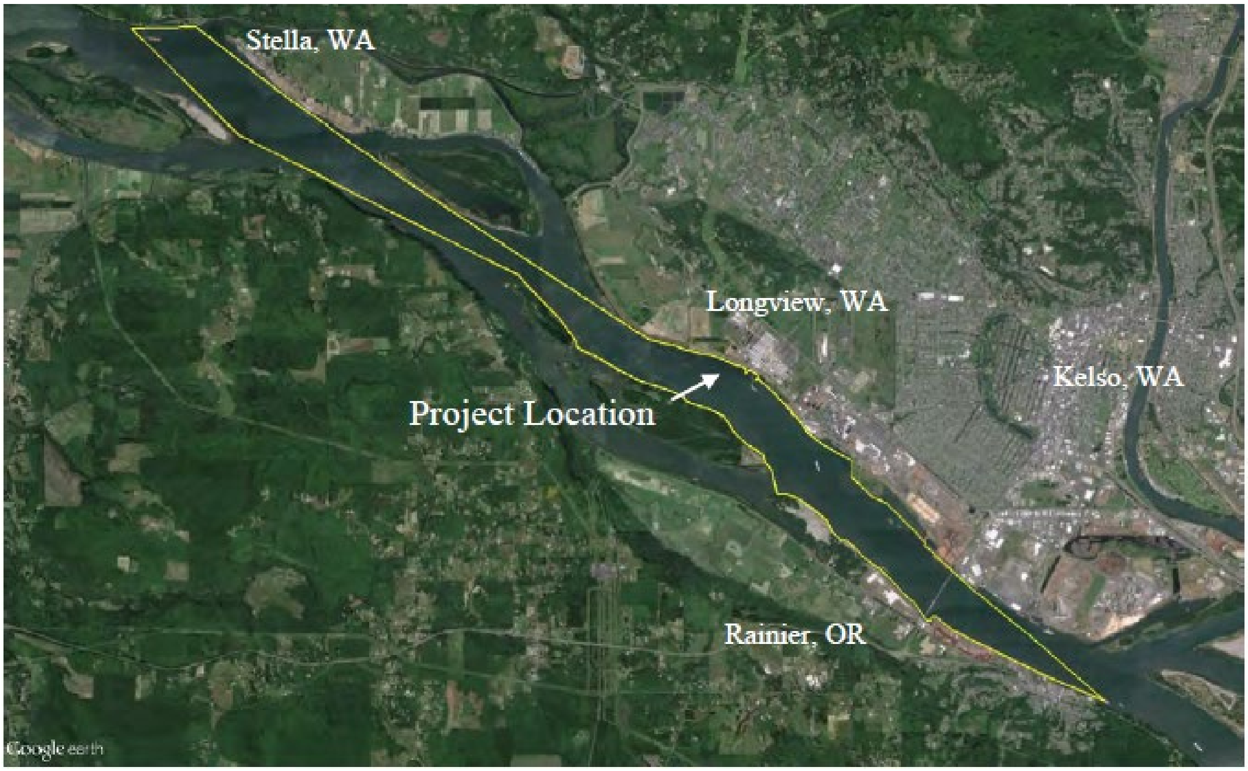

Figure 2. Area where sound pressure from impact pile driving exceeds 120 dB_{RMS}

The action area is in the Lower Columbia River estuary. The estuary is migration and rearing critical habitat for Lower Columbia River Chinook, Upper Willamette River Chinook salmon, SR Fall-run Chinook salmon, and Columbia River chum salmon. The Physical and Biological Features (PBFs) for freshwater salmon and steelhead critical habit in the action area include: 1) Rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams, and beaver dams, aquatic vegetation, large rocks and boulders, side channels and undercut banks. 2) Migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

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 NWA dock is at Columbia River mile 57. Approximately four of the 12 miles of Washington Columbia River shoreline closest to and spanning the NWA dock is developed with heavy industry and commercial uses, including the Port of Longview. Approximately two of the 12 miles of Oregon Columbia River shoreline spanning the NWA dock is similarly used for industry and commercial uses, but is less developed. The rest of the 24 miles of shoreline in Washington and Oregon is residential, agricultural and undeveloped areas with shoreline roadways on both sides of the river. Habitat elements including shallow water areas and vegetation are more commonly present in the residential/agricultural/undeveloped areas than in the main commercial industrial area in the upstream portion of the action area. The rest of the Washington shoreline to mouth of the Columbia River includes natural beach stretches interspersed between shoreline stretches modified by the U.S. Highway 14 revetment, a few residential docks, and marinas in the small towns of Cathlamet and Ilwaco. The Columbia River is a busy shipping waterway. In 2015, ocean-going vessels (OGV) made 1,121 calls to the Ports of Longview, Kalama, Vancouver and Portland.

The action area is included in the much larger action areas of other consultations and may also have been affected by the actions analyzed in those consultations. In particular, "Supplemental Biological Opinion, Consultation on Remand for Operations of the Federal Columbia River Power System (FCRPS)" (NWR-2018-0152) analyzes the effects of the alteration of the natural magnitude and timing of Columbia River flows by the FCRPS. Timing of peak and low water volumes in the action area have been affected by the construction and operation of dams, negatively affecting rearing habitat. The development of hydropower and water storage projects within the Columbia River Basin altered water quality (reduced spring turbidity levels), water quantity (seasonal changes in flows and consumptive losses resulting from use of stored water for agricultural, industrial, or municipal purposes), water temperature (including generally warmer minimum winter temperatures and cooler maximum summer temperatures), water velocity (reduced spring flows and increased cross sectional areas of the river channel), food (alteration of food webs, including the type and availability of prey species), and safe passage (increased mortality rates of migrating juveniles) (Ferguson et al., 2005; Williams et al., 2005).

Of particular relevance to the proposed action is the NMFS programmatic biological opinion 2011-5585 (SLOPES IV In water Over-water Structures) which covers the repair of overwater structures on the Oregon side of the Columbia River. The SLOPES IV action requires compensatory mitigation to fully offset the impacts of any action that will permanently displace riparian or aquatic habitats or otherwise prevent development of properly functioning condition of natural habitat processes. Thus, structures that have proceeded under the SLOPES IV Opinion in the action area have been subject to this requirement including the Tounge Point Piling Replacement, Tounge Point Seaplane Ramp Reinforcement, RSG Forest Products Sandy Island Dolphin Repair, Columbia River Bar Pilots Ramp and Dredging, and the Melchiori Boat Dock.

Historically and currently the dock that is the subject of the proposed action has functioned as a shipping and receiving hub for raw materials used by Alcoa's Wenatchee Works smelter, located in Malaga, WA. The alumina arrives on 6 to 7 large OGV per year. Previous consultations at the dock include NWR 2011-4156 (removal of seven piles and dredge removal of 30,300 cubic yards of sediment), WCR 2014-1663 (contaminated sediment dredge cleanup), WCR 2015-3036 (pier maintenance), and WCR 2015-3476 (maintenance dredging).

The aquatic habitat of the Columbia River within the action area provides habitat for a variety of benthic, epibenthic, and water column organisms. The benthic topography is in a state of relatively constant change in the Columbia River estuary due to natural sediment transport processes. Substrate within both subtidal and intertidal benthic environments consists largely of silts and medium-to-coarse alluvial sands.

Anadromous fish are exposed to high rates of predation during all life stages. Fish, birds, and marine mammals, including harbor seals, sea lions, and killer whales all prey on juvenile and adult salmon in the action area. The Columbia River Basin has a diverse assemblage of native and introduced fish species, some of which prey on salmon, steelhead, and eulachon. The primary resident fish predators of salmonids in many areas of the Columbia River inhabited by anadromous salmon are northern pikeminnow (native), smallmouth bass (introduced), and walleye (introduced). Other predatory resident fish in the action area include channel catfish (introduced), Pacific lamprey (native), yellow perch (introduced), largemouth bass (introduced), and bull trout (native). Increased predation by non-native predators has and continues to decrease population abundance and productivity (NMFS, 2013b).

Avian predation is a factor limiting salmonid recovery in the Columbia River Basin. Throughout the basin, piscivorous birds congregate in the estuary near manmade islands and structures. Avian predation has been exacerbated by environmental changes associated with river developments. Water clarity caused by suspended sediments settling in impoundments increases the vulnerability of migrating smolts to avian predation. Dredge spoil islands, associated with maintaining the Columbia River navigation channel, provide habitat for nesting Caspian terns and other piscivorous birds. Caspian terns, double-crested cormorants, glaucous winged/western gull hybrids, California gulls, and ring-billed gulls are the principal avian predators in the basin. As with piscivorous predators, predation by birds has and continues to decrease population abundance and productivity (NMFS, 2013b).

Anadromous fish in the action area are also affected by water quality. Columbia River water quality is degraded by legacy hot spots and stormwater. Hot spots are usually associated with urban areas where sediment has been contaminated by recalcitrant, toxic organic compounds and metals that entering the river as industrial waste or spills, sequestered to the sediment and is slowly transported downstream and re-released to the water column. One example of legacy contamination are creosote treated piles that slowly re-release polycyclic aromatic hydrocarbons (PAH) to the water column. Stormwater becomes contaminated by organic and metals as it flows over impervious surfaces. These contaminants are to varying degrees removed by natural and engineered treatment processes before stormwater is discharged to the Columbia River but stormwater almost always transports some contaminants to the river. Although the concentrations of organic compounds and metals from hot spots and stormwater are dilute, there many stormwater outfalls and hot spots in the Lower Columbia River so that small migrating fish are likely to be exposed to several sources as they move downstream.

Salmon and steelhead reside in or migrate through the action area. The action area includes shallow water shoreline habitat. Subyearling LCR, SR, and UWR fall-run Chinook salmon migrate along the shoreline in shallow water. Most subyearling fall Chinook migrate through the action area in the late summer and early fall, before the in water work window. However, some subyearling Fall Chinook reach the estuary late in the year and may reside in the estuary over the winter to feed and grow before entering the ocean in the spring (NMFS, 2013b). Subyearling Fall Chinook are expected to be in the action area before, during and after the in water work window. Adult Fall Chinook salmon migrate past the action area from August through November, before and during the start of the in water work window but do not migrate in shallow water along the shoreline and travel rapidly upstream to their natal tributaries (NMFS, 2013b).

CR Chum fry migrate downstream almost immediately after emergence in April and May and spend the summer in the freshwater and upper estuarine zones of the estuary above the action area before migrating to the ocean (NMFS 2013). Juvenile chum salmon are not expected to be in the action area during the in water work window but will migrate past the action area at other times of the year. Returning adult chum salmon migrate past the action area from October through December, overlapping part of the in water work window. Adult chum are swimming rapidly past the action area to spawning sites in Lower Columbia River Gorge tributaries (NMFS, 2013b).

As described above in the Status of the Species and Critical Habitat sections, factors that limit the recovery of salmon and steelhead vary with the overall condition of aquatic habitats on private, state, and Federal lands. Within the action area, the riparian area has been degraded by the effects of land use resulting in degradation of estuarine rearing habitats, wetlands, and riparian areas, impeded fish passage, and the loss of habitat refugia.

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. 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 50 CFR 402.17(a) and (b).

The effects of the proposed action and related activities are: 1) Degrading habitat water quality with contaminated suspended sediment and sound pressure waves during pile driving (temporary construction effects), 2) Degrading shallow water habitat with predator habitat during the extended lifespan of the over-water structure (permanent structural effects), and 3) wake stranding from OGV traffic.

The proposed action is required because there are structural integrity concerns with the current structure. NWA intends to and expects to restore the structural integrity of the structure and thus meaningfully extend the life of the structure. The dock is over 50 years old and so we estimate that major structural repairs could extend its service life by up to 40 years.

As a result, the effects of the structure will now occur for longer into the future, affecting many additional cohorts of listed fish. These additional effects result from the structures being replaced or repaired, i.e., are caused by the proposed action, are thus properly construed as effects of the action. Because the structure was built in the late 1960s, the effects of the structure itself have never been consulted on under the ESA so the analysis is not duplicative of an existing effort.

Effects to Critical Habitat

Degrading water quality with suspended sediment and sound pressure waves during pile driving will impair features of rearing and migration habitat. Extending the presence of an obstruction in the shallow water habitat represents a prolonged hazard to safe passage in migration, and prolonged structure-associated habitat impacts in rearing habitat (e.g. shade).

<u>Construction Effects.</u>

Sediment and Toxic Compounds

Water quality for subyearling Chinook salmon smolts will be temporarily degraded by sediment associated with pile removal and installation. The vibratory removal of 90 piles and the vibratory installation of 70 new piles will create 160 suspended sediment plumes. Once in the water column, the Columbia River will transport and disperse suspended sediment will downstream. In an evaluation of turbidity generated by vibratory pile removal at Jimmycomelately Creek, suspended sediment concentrations from activation of the vibratory hammer to loosen the pile from the substrate ranged from 13 to 42 milligrams per liter and averaged 25 milligrams per liter. A 10- to 16- foot diameter plume extended at least 15 to 20 feet from the actual pulling event (Weston Solutions, 2006). We expect areas of turbidity and suspended sediment concentrations associated with the proposed action will be similar in scale for each of the 160 plumes.

The existing wooden piles were treated with creosote. Creosote is a wood preservative that contains a mixture of hydrophobic organic compounds. Some of these compounds are toxic to fish but are not bioavailable when they are sequestered in the creosote in the pile (Stratus Consulting, 2006). Over time, these compounds will slowly partition from the wooden piles to the organic carbon in the sediment surrounding the piles until they reach an equilibrium determined by the fraction of organic carbon in the sediment. When this surrounding sediment becomes suspended by pile driving, a very small fraction of these chemicals may undergo phase transfer to suspended or dissolved organic matter in the water column. Once the compounds are in suspended or dissolved organic matter in the water column they are more bioavailable to fish than they are when sequestered in the piles or in the sediment around the piles (Johnson et al., 2007b).

In principle, the action of the vibratory pile driver removing the piles increases the bioavailability of toxic compounds in creosote treated piles. However, since the mass of organic matter in the receiving medium (i.e. the water column) for each phase transfer is much less than the mass of organic carbon in the source (i.e. piles), the mass of transferred compound is many orders of magnitude lower than the mass in the source. Thus, the actual mass of compounds transferred to the flowing water column is likely much too small to actually be acutely toxic to fish.

Sound Pressure

Impact pile driving also degrades the rearing and migration critical habitat PBF of water quality by generating sound pressure waves that have the potential to injure and kill fish. The 70 new 16 inch diameter piles installed by impact driving will require 750 strikes each to be proofed. NMFS estimates that the maximum worst-case sound pressure levels resulting from impact driving 16-inch diameter steel pilings will be 200 dBPeak (re: 1µPa), 191 dBRMS (re: 1µPa), and 174 dBSEL (re: 1µPa2·sec) 9 meters from the source (Laughlin, 2004). A bubble curtain will reduce underwater sound pressure wave energy (Longmuir and Lively, 2001; Reyff, 2003; Wursig et al., 2000) and the likelihood of fish injury (Keevin, 1998). However, the extent to which bubble curtains can lower sound pressure is highly variable (Oestman et al., 2009; Reyff, 2003; Rodkin and Reyff, 2007) and bubble curtains may not bring the sound pressure levels below biological thresholds for death or injuries of ESA-listed salmonids. Based on studies they reviewed, (Oestman et al., 2009) concluded that an air bubble curtain used on a steel or concrete piling with a maximum cross-section dimension of 24 inches or less will provide about 5 dB of noise reduction. When these parameters are used in NMFS pile driving model, the radial distance from the pile to the point where sound exposure level (SEL) is below 187 dBSEL is 27 meters. The radial distance to the point where SEL is below 183 dBSEL is 87 meters and the radial distance to the point where sound pressure is below 150 dBRMS is 2261 meters.

Since these water quality degradations only exists during pile driving, the effect to critical habitat depends entirely on the presence, proximity, size, and anatomy of fish relative to the concentration and duration of the suspended sediment (Newcombe and Jensen, 1996) and the intensity and characteristics of the sound (Popper and Hastings, 2009; Yelverton et al., 1975).

Structural Effects.

The NWA Dock 1 and the vessels moored at the dock are over-water structures that both obstruct salmonids, and attract salmon predators to the shallow water migration critical habitat of subyearling salmon that travel through the LCR estuary along the shoreline. Because this project is the repair of an existing structure, the effect that is caused by the proposed action is the extended duration of these impacts into the future – beyond the lifespan of the existing, deteriorating structure. Although it is not easy to precisely parse the effects between those two timeframes (near term and future/permanent), it should be assumed that the effects we describe here as effects of the action do not include effects of the structure in the near term.

The NWA dock and moored vessels create a shaded zone that salmon are reluctant to enter and that creates favorable ambush habitat for piscine predators of juvenile salmon such as pike minnow[1], smallmouth bass and largemouth bass. The shade and reduced river flow velocity in the wake behind the piles are exploited by piscine predators. Martinelli and Shively (1997) found pike minnow in all of the Columbia River locations that they studied with water velocities of less than 1 meter per second. Faler et al. (1988) monitored the movements of 23 pike minnows below

[1] Pike minnow use water with less than 8 ppt salinity which exists in the Columbia River above RM 28 (http://www.ldeo.columbia.edu/~orton/salt_intrusion.html).

McNary Dam and found them to use habitats with velocities ranging from 0 to 0.70 meter per second. Smallmouth bass in McNary reservoir also preferred slow-velocity habitats (Tabor et al., 1993) and Pribyl et al. (2005) report that smallmouth bass in the nearshore utilized pilings and floating structures. Rondorf et al. (2010) cites studies that pike minnows and smallmouth bass seek out low velocity habitats and utilize overwater structures for cover. Therefore NMFS assumes that the NWA dock and vessels will be used by piscine predators to ambush juvenile salmon. In addition, migrating salmon smolts that select to swim around the NWA dock will be more vulnerable to avian predators that perch on the dock or on moored vessels. Piscivorous birds that feed on juvenile salmon in the Columbia River Basin include Caspian terns, Double Crested cormorants, California gulls and ring billed gulls. The extended life of the NWA dock and vessels extends conditions that encourage the presence of avian predators that degrade the passage PBF and extends the displacement of benthic communities by piles.

Effects to Listed Fish.

The effects of the proposed action on listed species are: 1) Exposure of rearing or outmigrating Chinook salmon smolts to the temporary effects on water - suspended sediment from pile removal and installation and sound pressure waves from pile driving, and 2) Roughly 4 decades[2] of additional exposure of future rearing and outmigration cohorts of Chinook and chum salmon smolts to shade from the repaired overwater structure and predators taking advantage of the repaired overwater structure.

A third effect to listed fish is from the consequences of the proposed action, namely the extended duration of vessel activity associated with the dock and in particular, wake stranding of Chinook and chum salmon smolts by ships transiting to and from the dock in the future.

1) Exposure and Response to Construction Effects.

Although the outmigration of most juvenile salmon does not coincide with the in water work window, a fraction of emigrating juvenile fall Chinook from the SR, LCR and UWR overwinter in the lower Columbia River before completing their migration in the spring (Connor et al., 2005) and it is likely that a small number of these fish will be in the action area during the work window. The out-migration time of each fall Chinook ESU spreads out over time and these fish migrate along the shorelines so some will have to pass near the pile driving. Thus, we assume that some listed SR, LCR and UWR Chinook salmon will be present during the work window to be exposed to the construction effects of the proposed action. Using the approach described in Appendix 1, the steady, lineal density of fish at the NWA dock is 20 fish per kilometer or about 1.3×10^{-4} fish per square meter in a 1,000 meter long by 150 meter wide control volume centered on the NWA dock.

<u>*Direct Injury from Impact Pile Driving Sound*</u>

<u>Likelihood of Exposure</u>: For impact pile driving in rearing habitat, accumulated SEL is a measure of the risk of injury from exposure to multiple pile strikes over pile driving work periods separated by 12 hours (sufficient time for fish to recover from sub-injurious exposure to high noise levels). For an impact pile driving in migration habitat, fish are moving past the pile

[2] NMFS estimate of the average time between major repair events for overwater structures.

driver without stopping and are exposed to just a fraction of the total impacts for the day. Subyearling Chinook in the Lower Columbia River between October and December are a mixture of smolts that are migrating to the Ocean and juveniles that have paused downstream migration to overwinter in the estuary. Some fish will be exposed to a whole workday of pile driving impacts while other fish will only be briefly exposed to pile driving impacts as they travel past the pile driving. We anticipate that on average a fish would likely only be exposed to approximately 750 strikes during a 15 minute window of time. Proofing a single pile would require 750 strikes over an approximately 15 minute period. This period would be followed by a 45 to 100 minute pause in driving while the next pile is prepared for installation. A fish in the vicinity of construction area would be able to move far downstream during this 45 to 100 minute pause, thus limiting their likely exposure to a maximum of 750 strikes over 15 minutes.

Proofing each 16 inch diameter pile with 750 strikes creates a 24,000 square meter zone around the pile where fish less than 2 grams would accumulate sound pressure greater than 183 dB_{SEL} and become injured or killed. Each impact pile driving will expose 0.00013 fish per square meter times 24,000 square meters equals 3 fish being exposed to sound pressure levels greater than 183 dB_{SEL}. Impact pile driving 70 piles will expose 3 fish per pile times 70 piles equals 210 fish to sound pressure levels greater than 183 dB_{SEL}.

Magnitude of Response: An accumulated sound exposure level (SEL) of 183 dB (re: 1µPa2·sec) for fish with swim bladders weighing less than 2 grams will result in harm or injury. Fish with swim bladders, such as salmonids and sturgeon, can be injured by sounds with the sharp pressure peak (Caltrans 2001) created during impact pile driving because the corresponding longitudinal, mechanical waves mechanically squeeze and then expand the fish swim bladder, causing it to rupture and damage other organs (Halvorsen et al., 2012). Fish exposed to these waveforms show blood in the abdominal cavity and maceration of their kidney tissues (Caltrans, 2001; Yelverton et al., 1975). Other injuries include hemorrhage and rupture of internal organs and damage to the auditory system. Death can be instantaneous, happen within minutes or happen several days after exposure. Fish without swim bladders, such as eulachon, have been shown to be much less affected by pile-driving noise.

Consequence of Exposure and Response to Individual Fitness: It is reasonably certain that Chinook smolts will be exposed to impact pile driving sound pressure waves with sufficient amplitude and frequency to injure or kill individual fish.

Behavioral Effects from Impact Pile Driving Sound

Impact pile driving affects fish behavior at lower noise levels than levels that injure fish (183 $dB_{SEL}$for fish with swimbladders weighing less than 2 grams). The root mean square (RMS) of sound pressure levels (SPLs) is commonly used in behavioral studies. The FHWG (2008) presumes that SPLs in excess of 150 dB_{RMS} (re: 1µPa) are likely to elicit temporary behavioral changes, such as a startle response, or other behaviors indicative of stress and recommends this value as a threshold for possible behavioral effects.

Likelihood of Exposure: Proofing each 16 inch diameter pile with 750 strikes creates a 2.2 kilometer long zone upstream and downstream of the pile where fish will be exposed to sound greater than 150 dB_{RMS}. Each impact pile driving will expose 20 fish per kilometer times 4.4 kilometers equals 88 fish exposed to sound pressure levels greater than 150 dB_{RMS}. Impact pile driving 70 piles will expose 88 fish per pile times 70 piles equals 6,160 fish to sound pressure levels greater than 150 dB_{RMS}.

Magnitude of Response: While SPLs between 150 dB_{RMS} and 183 dB_{SEL} are unlikely to lead to permanent injury, they can still result in lethal effects by increasing the vulnerability of individual fish to predation. Feist et al. (1996) noted that juvenile pink and chum salmon exposed to pile driving noise were less likely to startle and flee when approached by an observer. Popper (2003) suggests that behavioral response of fishes to loud sounds may include swimming away from the sound source, thereby decreasing potential exposure to the sound, or "freezing" (staying in place), thereby becoming vulnerable to possible injury. Based on the above information, NMFS uses an SPL of 150 dB_{RMS} (re: 1μPa) as a guideline for when behavioral effects can be expected.

Consequence of Exposure and Response to Individual Fitness: It is reasonably certain that the exposure of 6600 fish to sound pressure greater than 150 dB_{RMS}, the alteration of behavior will cause some fraction of these fish to behave in a way that they may be injured or killed by predators.

Effects from Vibratory Pile Activities

Underwater noise from vibratory pile driving and extraction is not expected to have measurable effects on the species considered in this consultation. Vibratory pile driving produces a low level continuous noise (Duncan et al., 2010) that has not been linked to injury to fish. While noise levels from vibratory pile driving have been shown, in some circumstances, to exceed the behavioral threshold of 150 dB_{RMS} (re: 1μPa) they generally do not exceed the injury threshold of 206 dB_{peak} (re: 1μPa) (Caltrans, 2007; Rodkin and Reyff, 2007). Moreover, as reported by (Caltrans, 2007), the loudest SPLs produced by vibratory driving of 72 inch steel piles yielded underwater sound levels of 180 dB_{RMS} (re: 1μPa) and 195 dB_{peak} (re: 1μPa). Here, the pile sizes are significantly less than 72 inches. Thus, considering these data (Caltrans, 2007), vibratory installation of up to eight pilings (16-inch diameter hollow, steel and 14-inch H-type steel) per day between sunrise and sunset are expected to produce SPLs below the NMFS agreed upon injury threshold and are not expected to exceed (or only marginally so) the 150 dB_{RMS} (re: 1μPa) threshold for behavioral effects.

We estimated above that the average suspended sediment concentration from vibratory pile driving pile driving will be about 25 milligrams per liter and that there will be suspended sediment plumes created and dispersed by river currents throughout the work day as piles are removed. We expect that suspended sediment plumes will exist as long as the vibratory pile driver is operating and that they will dissipate within a few minutes after the vibratory pile driver stops.

Likelihood of exposure: Because we postulate a small Chinook salmon density around the work site, it is likely that some fish will be exposed to these suspended sediment plumes.

Magnitude of response: Newcombe and Jensen (1996) show that the response of juvenile salmon to a suspended sediment concentration of 25 milligrams per liter will be a decrease in foraging success while the plume exists. Since the plumes are intermittent, juvenile salmon rearing around the work site will likely take up less food than salmon rearing farther away from the work site.

Consequence of exposure and response: Fish rearing around the work site could experience a slight decrease in growth from their exposure and response to suspended sediment from vibratory pile driving relative to fish in the river at the same time farther from the work site. However, this effect will be minimal.

We estimated above that vibratory removal of creosote treated piles increases the bioavailability to fish of the polynuclear aromatic hydrocarbon (PAH) compounds that have undergone phase transfer from the pile creosote to the sediment surrounding the pile because vibratory pile driving transfers some of this sediment up into the water column. Low molecular weight PAHs are acutely toxic to fish. High molecular weight PAHs are not acutely toxic to fish but can cause cancer and reduced disease resistance in the exposed fish or mutations in their offspring (Johnson et al., 2007a).

Likelihood of exposure: Because we postulate a small Chinook salmon density in the water column around the work site, it is likely that some of these fish will be exposed to PAH compounds in the water column during vibratory pile extraction.

Magnitude of response: We expect that the concentration of low molecular weight PAH in the water column from creosote pile removal will be too low to cause acute toxicity in exposed salmon. Over decades the supply of low molecular weight PAHs in creosote piles is reduced by leaching and it is unlikely that the two phase transfer exposure pathway (creosote to sediment to dissolved sediment) described here can supply acutely toxic concentrations of low molecular weight PAHs in flowing water (Johnson et al., 2007b). We expect that fish exposed to high molecular weight PAHs in the water column will take up some molecules sorbed to dissolved organic matter that passes through their gills or eaten with their prey. Fish can metabolize and excrete PAHs so they don't bioaccumulate but fish exposed to high molecular weight PAHs will have a slightly increased risk of developing cancer or of producing offspring with mutations that affect their survival if they to spawn (Johnson et al., 2007a).

Consequence of exposure and response: The PAH from removal of creosote piles slightly increases the risk of that exposed salmon will die from cancer or decreased resistance to another disease at a later time in their lives or that they will produce offspring with mutations that decrease their likelihood of survival. However, these effects will be minimal.

2) Exposure and Response to Effects of the Structure.

Permanent effects of the proposed action on listed species are caused by the temporal extension of an overwater structure that provide advantages to piscine and avian predators over their juvenile salmon prey and a slight increase in energy expenditure and vulnerability for salmon that select to swim around rather than beneath the structure. These advantages are shade (from the structure and associated vessels) and a flow wake on the back side of piles where predators can hide and ambush juvenile salmon. The reduced light regime under and around overwater structures and vessels improve hunting conditions for ambush predators like the pike minnow. Reduced light allows the predator to hide in shaded and lower velocity water from prey and ambush juvenile salmonids swimming around as well as under the dock. Swimming from light to shade decreases visual ability in juvenile salmon and steelhead so they are less likely to see ambush piscine predators. Petersen and Gadomski (1994) found the rate of predation by northern pikeminnow on subyearling Chinook salmon was inversely related to light intensity in laboratory studies, and five times more salmon were eaten in the darker setting than in the lighter conditions examined. These predator advantages decrease the likelihood that individual juvenile outmigrant salmonds will survive their migration to saltwater. In general sub-yearling Chinook salmon and chum salmon rear and migrate in the stream channel margins (Bottom et al., 2011; Dauble et al., 2003; Dawley et al., 1986; McCabe et al., 1986; Weitkamp et al., 2012) whereas yearling Chinook, coho and sockeye salmon and juvenile steelhead generally travel between Bonneville and the ocean in the faster flowing water of the main channel (Roegner et al., 2012). This effect will be a persistent condition for the life of the structures, and the increased risk of predation will affect all future cohorts of the SR fall Chinook, LCR Chinook, UWR Chinook and CR chum ESUs/DPSs,, but it is difficult to estimate how many individuals from among these species in each out-migration will become prey to the piscivores that rely on these structures.

A related effect is that the NWA dock and moored vessels will divert some migrating smolts away from the shore where they are more vulnerable to avian predators that perch on the dock. Although the detour is small for each individual, there are many overwater structures in the Lower Columbia River, each adding to the length of the migration path of an entire ESU resulting in a significant increase overall in the total amount of energy that the ESU must find in order to complete migration. Piscivorous birds that feed on juvenile salmon in the Columbia River Basin include Caspian terns, Double Crested cormorants, California gulls and ring billed gulls. Piscivorous bird predation is primarily a problem in the estuary where LCR salmon and steelhead smolts migrate in spring pulses during tern and cormorant breeding. Colonies with more than 100 breeding pairs of California gulls, ring-billed gulls, glaucous winged western gull hybrids, Caspian terns or Double Crested cormorants are on East Sand Island (river mile 5), Rice Island (river mile 21). Caspian terns disproportionately consume smolts in the estuary within 19 miles of their breeding colony (Lyons et al., 2007). Double-crested cormorants have a foraging range of around 18 miles (Anderson et al., 2004). Fortunately, the NWA dock is approximately at Columbia River mile 80, outside the range of nesting terns on Rice Island and Miller Sand Spit. Therefore, we do not expect SR fall Chinook, LCR Chinook, UWR Chinook and CR chum to be caught by avian predators from the NWA dock.

Ship Wake Stranding

A consequence of the proposed action is the continuation of baseline ocean going vessesl (OGV) traffic on the Columbia River to and from the NWA dock into the future. OGVs produce long period wake waves that can entrain small fish near the shoreline, carry them onto beaches and leave them stranded above the point where normal waves would return them back to the channel. Ship wake stranding is a primary contributor to a low-priority limiting factor for ocean type LCR Chinook salmon and Columbia River chum (NMFS 2011d).

Plas Newydd LLC sponsors the Wapato Valley Mitigation and Conservation Bank at the mouth of the Lewis River (upstream of the NWA dock). They monitored ship wake wave stranding along the Columbia River shoreline at river mile 87 for the past two years. Their data shows a pattern of stranding events during lower Columbia River water surface elevations from early January through early April. This time coincides with juvenile fish presence (specifically 30 – 50 mm fall Chinook salmon fry). On average, 27.3 percent of OGVs stranded an average of 10 salmonids per OGV passage (ranging from 2 to 300 fish) (K. Jorgensen pers. comm, Plas Newydd LLC unpublished data 2020). Pearson et al. (2006) reported that 36 percent, 53 percent and 15 percent of 126 deep-draft vessels in the Lower Columbia River in the spring and summer of 2004 and the winter and spring of 2005 stranded fish at County Line Park, Barlow Point and Sauvie Island respectively. They noted different wave draw down and surge from different vessel size, speed and bow configurations and concluded that fish stranding most often occurred with larger vessels such as bulk carriers, container ships, oil tankers, and car carriers. Pearson et al. (2008) identified beach locations with a likelihood of fish stranding by using GIS to combine of channel width, distance from the navigation channel, shielding features, slope, submerged berms in the navigational channel, and fine scale beach. They determined that stranding of juvenile salmonids is likely at approximately 33 miles of beaches upstream of the NWA and very likely at about 8 miles of shoreline upstream of river mile 25.

Likelihood of exposure: Few juvenile Chinook and chum salmon are likely to be exposed to and stranded by long period wake waves from OGVs traveling to and from the NWA dock. Most stranding beaches are upstream of the NWA dock. County Line Park is about 10 miles downstream from the NWA dock and Barlow Point is just one mile downstream from the NWA dock. OGV speeds range from 9 to 15 knots in the Lower Columbia River and 6 to 9 knots while approaching terminals (ICF et al, 2016) so OGVs traveling to the NWA dock will pass County Line Park at 9-15 knots and slow to 6 to 9 knots while passing Barlow Point. Pearson (2006) estimated that decreasing a 77-foot long beam ship's speed from 14 knots to 12 knots decreased wake wave height by 63 percent and that ships moving less than 8 knots did not cause wake stranding. OGVs unload aluminum ore at the NWA dock about eight times per year. We expect Chinook and chum salmon off County Line Park will continue to be exposed to long period wake waves from about 3 (36 percent) of the NWA OGVs per year. We do not expect any Chinook or chum salmon near Barlow point to be exposed to stranding waves from NWA dock OGVs.

Magnitude of response: The response of virtually every Chinook and chum salmon stranded by OGV wake waves is death because the waves transport them farther up the beach than normal waves travel so they have no way to be transported back to the channel.

Consequence of exposure and response: We expect that three NWA OGVs will transport a total of 30 Chinook and chum salmon onto the County Line Park beach per year if the Plas Newydd LLC monitoring data is representative of other beaches[3].

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.

[3] We acknowledge there are potential problems with this approach. There is considerable uncertainty about the frequency, location, and severity of stranding events. Therefore, any quantitative estimate of wake stranding is likely to be associated with large confidence intervals, and is as likely to overestimate stranding as it is likely to underestimate stranding. We are also aware that the authors of some of the studies we considered warned against projecting their results to other sites or other circumstances. However, given the lack of a better alternative, we think a quantitative approach based on the results of previous studies is the best method to estimate the impact of wake stranding.

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 in the environmental baseline (Section 2.4).

Non-Federal activities are reasonably certain to contribute to climate effects within the action area. It is difficult 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. However, it is reasonably certain that over the additional service life of the project, that climate effects such as modified water temperatures, altered river hydrograph, and shifting salinity will all exert more influence on the habitat quality and related carrying capacity.

The NMFS expects State and private activities near and upriver from the proposed action will contribute to cumulative effects in the action area. Therefore, our analysis considers: 1) effects caused by specific future non-federal activities in the action area. 2) effects in the action area caused by future non-federal activities in the Columbia basin.

Development trends indicate that upland private and public actions that affect the action area will continue. NMFS looked for but did not find any proposals for specific, local projects proposals within or adjacent to the action area that would not require a Federal permit consultation. However, as the population in and around Longview grows, demand for residential development and infrastructure in the upland and riparian zones is also likely to grow. We believe the majority of environmental effects related to future growth will be linked to land-use changes and increased impervious surface that can affect shallow water habitat quality and deliver contaminants to substrates near the action area. State, county and city regulations should minimize and mitigate for the adverse effects of this development so that the overall environmental quality of the action area remains constant, albeit degraded relative to its restored condition.

Similar activities outside of the action area will influence conditions in the action area. Approximately 1.13 million people live along the Lower Columbia River, concentrated largely in urban parts of the Lower Columbia River (U.S. Census Bureau 2017). The legacy of resource-based industries (e.g., agriculture, hydropower facilities, timber harvest, fishing, and metals and gravel mining) caused long-lasting environmental changes that harmed ESA-listed species and their critical habitats. Stream channel morphology, roughness and cover, estuarine rearing habitats, wetlands, floodplains, riparian areas, water quality, fish passage, and habitat refugia has been degraded throughout the Lower Columbia River basin. Those changes reduce 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.

While widespread degradation of aquatic habitat associated with intense natural resource extraction is no longer common, ongoing land management actions are likely to continue to adversely affect the estuary and retard natural recovery of aquatic habitat in the Columbia River basin including the action area. This trend is somewhat countered by non-federal aquatic habitat restoration occurring in the Lower Columbia River. The Lower Columbia River Partnership has over 100 regional partners in the Lower Columbia River and has completed 199 projects with a total of 22,685 acres. Projects include land acquisitions and conservation easements, adding large logs to streams to create fish habitat, planting trees to shade and cool streams, and removing barriers to fish passage (LCEP 2017). Still, when considered together, the net cumulative effects are likely to have an adverse effect on salmon and steelhead.

2.7 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. 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.

All of the species affected by the proposed action are threatened with extinction, and conditions throughout their designated critical habitat, including within the action area, are diminished quantitatively and qualitatively, in a manner that inhibits their recovery. The environmental baseline of the Columbia River estuary is degraded. Estuarine and nearshore habitat, floodplain connectivity and function, channel structure, riparian areas, stream substrates, streamflow, fish passage, water quality are all degraded. Predation on salmon smolts, facilitated by overwater structures, is a limiting factors to the recovery of CR chum and UWR Chinook salmon. The natural recovery of aquatic habitat PBFs important to the survival and recovery of listed species continues to be inhibited by the anthropogenic changes motivated by economic demands on the estuary.

Climate change affects the Lower Columbia River. Direct effects of higher temperature include mortality from heat stress, changes in juvenile growth and development rates, decreased disease resistance and shifts in seasonal timing of important life history events (adult migration, spawning, fry emergence timing, and the juvenile migration). Indirect effects on salmon mortality, growth rates and movement behavior stem from changes in the estuarine habitat structure, the invertebrate and vertebrate food supply and abundance of predation. Both direct and indirect effects of climate change will vary among Pacific salmon ESUs and among populations in the same ESU. Adaptive change in any salmonid population will depend on the local consequences of climate change as well as ESU-specific characteristics and existing local habitat characteristics (NWFSC, 2015b).In this context we consider the added effects of the proposed action on habitat, and on species.

<u>Effects on Critical Habitat</u>

The critical habitat effects of the proposed action are; 1) The generation of suspended sediment contaminated with PAH from creosote and sound pressure waves by approximately 18 days of pile driving, and 2) Extending the presence of an obstruction in the shallow water habitat represents a prolonged hazard to safe passage in migration, and prolonged structure-associated habitat impacts in rearing habitat (e.g shade).

1) Vibratory pile driving at will generate a suspended sediment concentration averaging 25 mg/L. The suspended sediment is likely contaminated with PAHs that transferred from the creosote treated piles. Although the PAH concentration in sediment is likely low and the suspended sediment concentration is also low, PAHs in the water column are more bioavailable to fish than PAHs in creosote or the sediment around the piles. Suspended sediment will be advected and dispersed downstream as a plume by the current. Impact pile driving will produce a 15 minute long, 24,000 square meter SEL area around each pile. Both aspects of water quality/ aquatic habitat will recover to the baseline level of habitat conditions within minutes to hours after construction ceases, indicating that overall, these features of critical habitat are not degraded in a manner that reduces conservation value of the action area.

2) Because this project is the repair of an existing structure, the effect that is caused by the proposed action is the extended duration of these impacts into the future -- beyond the lifespan of the existing, deteriorating structure. The overwater structure is man-made habitat that affects the migration of smolts which travel along the shoreline, or that extends their migration path length by forcing them to swim around the structure. In addition, the overwater structure provides ambush habitat to pikeminnow and bass predators of juvenile fall Chinook and chum salmon and avian predators. These permanent effects will occur during the extended duration of the structure, which is attributable to the proposed action and they diminish safe juvenile passage throughout the action area. Conservation value will be maintained at a functional, but suboptimal level.

<u>Species Exposure to Temporary Effects</u>.

Juvenile fall Chinook salmon rear in and migrate through the action area as subyearlings during the in water work window. Juvenile Chinook salmon in the action area during fall are the only fish likely to be exposed to the temporary effects of vibratory and impact pile driving because, as explained below, other Chinook life stages and chum salmon will not be in the action area during construction.

Lower Columbia Chinook Salmon. Juvenile fall chinook salmon comprise 23 of the 32 populations of this ESU. Most of these populations are at very high risk of extinction and only a few populations are viable. LCR Chinook salmon are present in the action area during the in water work window, thus they will exposed to the temporary effects of the proposed action.

The Upper Willamette River Chinook salmon ESU is comprised of 7 populations, most at a very high risk of extinction. UWR Chinook are spring Chinook but some subyearlings from the populations migrate to the estuary in the fall and overwinter in the estuary before entering the ocean in the spring (NMFS 2011). Only these atypical fish are likely to experience the temporary effects of the proposed action.

The Snake River fall Chinook ESU is one extant population at moderate risk for extinction. This population will experience the temporary effects of the proposed action because some juveniles pause migration to overwinter in the LCR before resuming migration in the spring.

Columbia River Chum. Juvenile Columbia River chum salmon migrate past the action area as subyearlings outside of the in-water work window. CR chum salmon are therefore not likely to be exposed to the temporary effects of pile driving. The Columbia River chum salmon ESU is comprised of 17 populations. Most are at a high or very high risk of extinction.

Impact pile driving will produce a 15 minute long, 24,000 square meter SEL area around each pile. Any subyearling salmon in that area during the time is expected to be injured or killed. Given the size of the SEL zone around impact driven piles where accumulated sound pressure is greater than 183 dB and the number of piles proposed to be impact driven, it is likely that a small number of subyearling Chinook will be killed or injured. If we extrapolate that this will occur at each pile being proofed with impact driving, about 210 subyearling fish are likely to be injured or killed during construction. This single episode of about 210 total fish injured or killed is likely to be dispersed across multiple Chinook salmon populations. Even if all injured or killed fish were from the same population, the number is small enough that no discernible effect will result in the returning cohort of adult fish, so that productivity will not be impaired by this reduction in abundance. Impact pile driving is expected to only affect fish at the tail of fall Chinook migration time distribution and the SR and UWR Chinook salmon that overwinter in the estuary.

A fraction of PAHs from creosote treated piles transfers from the pile to the sediment surrounding the pile. Removing these piles with a vibratory pile driver causes the PAH contaminated sediment around the pile to become suspended in the water column. Given the estimated lineal density of subyearling Chinook salmon in the LCR, it is likely that some fish will be exposed to this suspended sediment but it is unlikely that suspended sediment concentration or the PAH concentration will reach levels and durations that harm these fish. Too few fish from any one population will be exposed to suspended sediment and PAHs to affect the population viability characteristics of any ESU.

<u>Species exposure to permanent effects.</u>

The proposed action is intended to, and expected to, restore the structural integrity of the structure and thus meaningfully extend the life of the structure. As a result, the effects of the structure will now occur for longer into the future, affecting many additional cohorts of listed fish. These additional effects result from the structures being repaired, i.e., are caused by the proposed action, and thus are effects of the action.

All populations of all four species will occasionally experience effects from the structure and vessels during their rearing and outmigration. The structure and vessels produce shade that can impair salmonid vision so that they are less able to detect the predatory fish and the juvenile migrating fish also respond to the structure by delaying migration when they encounter the structure and also by migrating around the structure in deeper water, all of which makes them more susceptible to predators that rely on the structure for ambush habitat. The structure's presence in the aquatic environment into the future therefore reduces abundance per population for the same duration as the structures extended lifespan. However, too few fish from any one population will be injured or killed as a result of the structure to affect population viability characteristics of the ESU as a whole. As a limiting factor to recovery, piscine predation is just one component of salmonid predation distributed over the entire length of the Columbia and Snake Rivers.

Under some river conditions OGVs traveling in the Columbia River produce long period wake waves that travel far up low slope beaches. Small fish in the nearshore, including subyearling Chinook and chum salmon, are carried by these waves up onto the beach and left stranded when the wave recedes. Just as the proposed action will (temporally) extend the useful life of Dock 1, it will relatedly extend the duration of OGV travel in the Columbia River to the Dock 1. It will thereby extend the number of fish cohorts subject to stranding and death. All populations of all four species will occasionally experience the effects of vessel use of the structure during their outmigration, but the fish most likely to experience episodes of wake stranding from the continued vessel use of the structure are again, juvenile fall Chinook salmon and CR chum. Nevertheless, too few fish from any one population will be killed as a result of wake stranding associated with the proposed action to affect the population viability characteristics of the ESU.

The cumulative effects include restoration and recovery actions, so that we can reasonably anticipate that some beneficial effects will improve habitat and juvenile to adult survival over the life of the project, however we also reasonably expect contemporaneously negative habitat pressures from climate change and continued and intensifying upland development. Taken together, we expect the negative cumulative effects may outweigh the positive effects.

Considering the current status of all salmon and steelhead populations the degraded environmental baseline within the action area, and cumulative effects the proposed action itself is not expected to affect their distribution, diversity, or productivity of any of the populations or further degrade baseline conditions or limiting factors. The effects of the action will be too small in scale and too minor to have a measurable impact on the affected populations. Because the proposed action will not reduce the productivity, spatial structure, or diversity the affected populations, the action, even when combined with additional pressure from cumulative effects, the project and its interrelated activities will not appreciably affect the status of any of the listed species considered in this opinion.

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, UWR Chinook salmon, SR fall-run Chinook salmon, or Columbia River chum salmon 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). "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 incidental take is reasonably certain to occur as follows:

1) Incidental take from temporary effects: Juvenile Chinook salmon in the action area in the fall will be harmed by SEL from impact pile driving. Quantifying the number of juvenile Chinook salmon that will be harmed by SEL is not practicable because the distribution and abundance of fish in the action area changes over time, and because not all fish respond to habitat impacts the same. Because of the high variability in fish presence, determining the number of juvenile Chinook that will be in the action area and exposed to SEL during pile driving is extremely difficult, NMFS therefore uses a surrogate that serves the same role as an estimate of the actual number of Chinook harmed or killed in that it is a) quantifiable b) can be monitored in real time so that it serves its role as a meaningful reinitiation trigger and c) is causally related to the harm/death. In this case the surrogate is the total number of piles proofed for the project. Because this number is directly related to the size of the SEL zone where subyearling salmon will be injured or killed, and juvenile Chinook salmon are presumed to be migrating or rearing in the estuary at all times, the number of impact pile driving blows is directly related to the Chinook salmon are exposed to and harmed or killed by impact pile driving. If the number of piles proofed exceeds 70 the take limit is exceeded and the Opinion must be reinitiated. Although this surrogate is somewhat coextensive with the proposed action, it nevertheless serves as an effective reinitiation trigger because, pile numbers can be tracked on an ongoing basis and if they installed 70 and more piles were needed then, by definition, the project would not be complete and reinitiation could meaningfully occur.

2) Incidental take from permanent effects. As explained above, as a result of the proposed action, the effects of the structure will occur for longer into the future (approximately 40 years), affecting many additional cohorts of SR fall Chinook LCR Chinook, UWR Chinook and CR chum. More specifically, over the next 40 year period following the completion of this action, it is reasonably certain that these species of juvenile Chinook and chum salmon migrating beneath the dock will be harmed (harm is a habitat modification that results in injury or death) when they are killed by piscine predators. Quantifying the number of juvenile Chinook and chum that will be killed over the next 40 years is not practicable because the annual abundance of cohorts cannot be accurately predicted, and the number that are successfully preyed upon is impossible to determine. Instead, NMFS uses a surrogate that serves the same role as an estimate of the actual number of Chinook and chum salmon killed in that it is quantifiable, can be monitored in real time so that it serves its role as a reinitiation trigger, and is causally related to the harm. In this case the surrogate is the 1,200 square meter surface area of the dock over water less than 20 feet deep. If the surface area of the NWA dock over water less than 20 feet deep exceeds 1,200 square meters, the take limit is exceeded and the Opinion must be reinitiated. This surrogate is causally related to the expected take because the surface area correlates to the number of predators that use the dock to ambush juvenile salmon. Although this surrogate is somewhat coextensive with the proposed action, it nevertheless serves as an effective reinitiation trigger because it can be readily monitored and if exceeded, the Corps can seek compliance post construction.

3) Incidental take from OGV vessel traffic. OGVs traveling to and from the NWA dock over the next 40 years will produce long period waves that may cause injury and death to Chinook and chum salmon from ship wake stranding. At this time, the limited data associated with wake stranding is considered insufficient to provide an exact take estimate, as the conditions that cause stranding wakes depends on a large number of variables, and the numbers stranded depends on the timing of the wakes and the variable number of fish that may be present. NMFS analysis and no jeopardy determination were both based on the fact that the number of OGVs traveling to and from the dock are and will continue to be a very small fraction of OGV traffic in the Lower Columbia River. NMFS is using the product of an average of eight loaded NWA OGV trips per year past County Line Park for 40 years as a surrogate for quantifying take consistent with 50 CFR § 402.14(i)(2). Using 320 loaded NWA OGV trips past County Line Park as a surrogate establishes a clear standard for determining when the level of anticipated take has been exceeded. For example, if the number of loaded NWA OGV trips past County Line Park exceeds 320 in less than 40 years, we expect that anticipated effects and resulting take would also be exceeded. Thus, even though the surrogate mirrors the average amount of assumed vessel traffic, it nevertheless functions as an effective check on the ongoing validity of the jeopardy analysis (which underpins the take exemption) because it is an annual measurement that can be monitored by the applicant. That means there is an opportunity each year to check whether the assumption of a total of 320 loaded NWA OGV trips past County Line Park over 40 years has been exceeded. Thus, we believe that OGV trips is an easily assessed, effective and reliable take surrogate that meets the legal standards as they relate to a reinitiation trigger.

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

1) Minimize incidental take from impact pile driving.

2) Minimize incidental take from piscine predation.

3) Ensure completion of a monitoring and reporting program to confirm that the take exemption for the proposed action is not exceeded, and that the terms and conditions in this incidental take statement are effective in minimizing incidental take.

2.9.4 Terms and Conditions

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

1) The following terms and conditions implements reasonable and prudent measure 1: The applicant shall:

a) Use a bubble curtain to attenuate sound pressure during impact pile driving.

b) Use impact pile driving to proof no more than 4 piles per day and no more than 70 total steel pipe piles. Monitor the number of impact blows delivered to each piles each day.

2) The following term and condition implements reasonable and prudent measure 2):

a) Ensure that the surface area of the dock over water less than 20 feet deep is less than 1,200 square meters.
b) The applicant shall ensure that the replacement of timber piles with stronger steel pipe piles reduces ambush habitat for piscine predators of juvenile salmon by decreasing the total number of piles supporting the dock by at least 11 piles.

3) The following term and condition implements reasonable and prudent measure 3):

a. Reporting. USACE and the applicant shall report all monitoring items, to include, at a minimum, the following:
    ii. Pile installation. Report the number of strikes per pile, the number of piles installed, the type of piles installed, the type and use of sound attenuation device, and type of hammer used. Report if pile driving occurs for more than a 12 hour consecutive period.
    iii. Overwater structure. Report the surface area of the part of the structure that is over water less than 20 feet deep.
    iv. Dredge area. Report the final area dredged does not exceed 41.5 acres.
    v. Wake Stranding. Report the annual number of loaded NWA OGV trips past County Line Park.

    Send this report electronically to: projectreports.wcr@noaa.gov; Attention: Tom Hausmann. Include the NMFS Tracking Number WCRO-2015-00006 on the report.

2.9 Conservation Recommendations

No conservation recommendations are identified for this proposed action.

2.10 Reinitiation of Consultation

This concludes formal consultation for the Northwest Alloys, Inc. Dock 1 Repair Project.

As 50 CFR 402.16 states, 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 if: (1) The amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the 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 (4) a new species is listed or critical habitat designated that may be affected by the action.

2.11 "Not Likely to Adversely Affect" Determinations

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the listed species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action (50 CFR 402.02). The applicable standard to find that a proposed action is not likely to adversely affect listed species or critical habitat is that all of the effects of the action are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or critical habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur.

Impact pile driving projects acoustic pressure waves into the Columbia River. The timing of adult salmon upstream migration and juvenile salmon downstream migration is summarized in Table 5. Adult and juvenile SR spring/summer Chinook, UCR steelhead, SR steelhead, MCR steelhead and SR sockeye migrations take place outside of the in water work window so the effects of pile driving to these species are discountable. Eulachon migration and green sturgeon presence in the Lower Columbia River is also outside the in water work window and the effects of the proposed action on these species is discountable.

Adult UCR spring Chinook, SR steehead, MCR steelhead and LCR steelhead migrations may overlap the work window but adult salmon are not likely to be adversely affected by pile driving pressure waves should they swim close to the pile driver, and their migration behavior is not likely to be affected by pile driving noise because they rapidly ascend the Lower Columbia River to reach their natal streams (Groot and Margolis, 1998). Therefore, the effects of pile driving on adults of these four species is expected to be insignificant.

Juveniles and smolts of all nine species (UCR Chinook spring salmon, SR spring/summer Chinook salmon, UCR steelhead, SR steelhead, MCR steelhead, SR sockeye salmon, LCR coho salmon and LCR steelhead) that migrate past the NWA dock won't be affected by impact pile driving because the in water work window makes it extremely unlikely that such migrating smolts would overlap in time and therefore be exposed to the impact pile driving sound pressure waves, thus the effect is discountable.

The proposed action may affect southern resident killer whales indirectly by reducing availability of their primary prey, Chinook salmon. The proposed activities are not expected to produce a measurable effect on the abundance, distribution, diversity, or productivity of Chinook salmon at either the population or species level. Given the total quantity of prey available to southern resident killer whales throughout their range, this reduction in prey is extremely small, and is not anticipated to be different from zero by multiple decimal places (based on NMFS previous analyses of the effects of in-river salmon harvest on Southern Resident killer whales, e.g. NMFS No. WCR-2017-7164). Because the reduction is so small, there is also a low probability that any juvenile Chinook salmon killed by the proposed activities would have later (in 3-5 years' time) been intercepted by the killer whales across their vast range in the absence of the proposed activities. Therefore, the anticipated reduction of salmonids associated with the proposed action would result in an insignificant reduction in adult equivalent prey resources for southern resident killer whales and an insignificant effect on proposed southern resident killer whale critical habitat.

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

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. The MSA (section 3) defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Adverse effect means any impact that reduces quality or quantity of EFH, and may include 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) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH.

This analysis is based, in part, on the EFH assessment provided by the the Corps 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 and action area for this consultation are described in the Introduction section to this document. The action area includes areas designated as EFH for various life history stages of Chinook and coho salmon.

3.2 Adverse Effects on Essential Fish Habitat

We conclude that the proposed action will have the following adverse effects of EFH designated for coho and Chinook salmon.

- Short term increase and noise and suspended sediment during pile driving.
- Long term increase in predation from in and overwater structure.

3.3 Essential Fish Habitat Conservation Recommendations

Ensure that applicant implements ESA Term and Condition 1a.

Ensure that the applicant implements ESA Term and Condition 2.

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in section 3.2, above, approximately 1600 acres of designated EFH for Pacific Coast salmon.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, [*insert agency name*] 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 NMFS’ EFH Conservation Recommendations unless NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of 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 with NMFS 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

The Corps must reinitiate EFH consultation with NMFS 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 for NMFS' 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 the Corps. Other interested users could include NW Alloys. Individual copies of this opinion were provided to the Corps. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

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6. APPENDIX 1

To estimate the likelihood of exposure to sound pressure waves, NMFS used the steady state solution; $\frac{C}{C_{IN}} = \frac{4\beta_D exp\left(0.5\frac{v_x L}{\mathcal{D}_d}\right)}{(1+\beta_D)^2 exp\left(0.5\beta_D\frac{v_x L}{\mathcal{D}_d}\right)-(1-\beta_D)^2 exp\left(0.5\beta_D\frac{v_x L}{\mathcal{D}_d}\right)}$, $\beta_D = \left(1+4\frac{kL}{v_x}\frac{\mathcal{D}_d}{v_x L}\right)^{0.5}$, to the advection-dispersion equation: $\mathcal{D}_d\frac{\partial^2 C}{\partial x^2} - v_x\frac{\partial C}{\partial x} + kC = 0$ with a continuous source term to estimate the density of subyearling Chinook in the vicinity of the NWA dock impact pile driving. The Fish Passage Center (FPC, http://www.fpc.org/) reported an average of 85 subyearling Chinook per day passing Bonneville Dam in September and October from 2012 to 2016. NMFS guessed that half of these fish would migrate along the Washington shoreline and pass the NWA dock[4] and then multiplied by 3 to include subyearlings from the Lower Columbia River tributaries. Zabel and Anderson, (1997) report the range of advection and dispersion coefficients for subyearling Chinook in the Snake River. The values assigned to the steady state solution parameters are summarized in Table A1.

Table A1. Advection diffusion solution parameters

Source	C_{in}	120 fish per day (FPC)
Advection coefficient	v_x	5 kilometers/day (Zabel and Anderson, 1997)
Length from Bonneville to Longview	L	125 kilometers
Dispersion coefficient	D_d	100 (Zabel and Anderson, 1997)
Die off rate	k	.01 (set small to minimize influence)

[4] Roegner captured 56 fingerlings between September and November at the Cowlitz River Tributary confluence. 50 percent were natural fish and 50 percent were hatchery fish. 94 percent were West Cascade tributary fall Chinook.