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-2019-02762

February 20, 2020

Michelle Walker
Chief, Regulatory Branch
U.S. Army Corps of Engineers, Seattle District
Regulatory Branch CENSW-OD-RG
Seattle, Washington 98124-3755

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Seattle Marina Project in Seattle, Washington (Corps No. NWS-2019-540)

Dear Ms. Walker:

Thank you for your letter of September 23, 2019, 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 Seattle Marina 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 Salmon essential fish habitat (EFH). Therefore, we have included the results of that review in Section 3 of this document.

The enclosed document contains the biological opinion (Opinion) prepared by the NMFS pursuant to section 7(a)(2) of the ESA on the effects of the proposed action. In this Opinion, the NMFS concludes that the proposed action is not likely to jeopardize the continued existence of Puget Sound (PS) Chinook salmon and PS steelhead, or to result in the destruction or adverse modification of designated critical habitat for PS Chinook salmon.

As required by section 7 of the ESA, the NMFS has provided an incidental take statement with this Opinion. The incidental take statement describes reasonable and prudent measures the NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action, and sets forth nondiscretionary terms and conditions that the Corps must comply with to meet those measures. Incidental take from actions that meet these terms and conditions will be exempt from the ESA's prohibition against the take of listed species.

This document also includes the results of our analysis of the action's likely effects on EFH pursuant to Section 305(b) of the MSA. The NMFS reviewed the likely effects of the proposed action on EFH, and concluded that the action would adversely affect designated EFH for Pacific Coast Salmon. Therefore, we have included the results of that review in Section 3 of this document.

Please contact Melaina Wright in the North Puget Sound Branch of the Oregon Washington Coastal Office at 206-526-6155, or by email at Melaina.Wright@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

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

cc: Colleen Anderson, Corps
Juliana Houghton, Corps
Matthew Bennett, Corps

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

Seattle Marina Project, Seattle, Washington
(Corps No. NWS-2019-540)

NMFS Consultation Number: WCRO-2019-02762

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?
Puget Sound steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	N/A	N/A
Puget Sound Chinook (*O. tshawytscha*)	Threatened	Yes	No	Yes	No

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

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

Issued By:

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

Date: February 20, 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 the Oregon Washington Coastal Office.

1.2 Consultation History

On September 23, 2019, NMFS received a request to initiate ESA section 7 consultation from the U.S. Army Corps of Engineers (Corps). The initiation package included an ESA section 7 consultation initiation letter, a Memorandum for the Services (MFS), a biological evaluation (BE), and a set of project drawings. The Corps determined the action may affect, likely to adversely affect (LAA) Puget Sound (PS) Chinook salmon and their critical habitat, and PS steelhead. The Corps also determined that the project will adversely affect Pacific salmon EFH. NMFS requested additional information on September 26, 2019. The applicant modified the project and provided sufficient information to initiate consultation on October 9, 2019. Formal consultation was initiated on that date.

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). For EFH consultation, 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 is proposing to authorize the Seattle Marina Construction Project in Lake Union located at 2401 North Northlake Way, Seattle, Washington (47.650585, -122.329625; Figure 1, Figure 2, and Figure 3). The vessels that moor at the existing piers are primarily recreational (i.e., pleasure craft). The applicant is proposing to remove two existing fixed piers, a float, overwater decking, and 55 creosote-treated timber piles. They will install a new float, five finger piers, and 16 steel piles in an area where there was no overwater cover previously. The primary use of the marina is for moorage of recreational vessels.

In-water work will occur between November 1 and April 15, and will take about 3 weeks to complete. The applicant will only work during daylight hours. They will install a floating boom around the work area. They will stage materials upland and conduct work using a barge-mounted crane and hand tools. They will ensure the barge does not ground on the bottom. The applicant will remove a total of 1,967 square feet of existing overwater cover. This includes an existing 819 square foot fixed pier and associated 115 linear feet of skirting, a 117 square foot fixed pier, and 850 square feet of overwater decking. These fixed pier elements are located 10.75 inches above ordinary high water (OHW). It also includes the removal of a 110 square foot float, and a gangway that contributes 71 square feet of overwater cover. The applicant will remove 16,758 square feet of existing solid canopy, which currently shades the water. Additionally, they will remove approximately 37 linear feet of an existing concrete bulkhead.

The applicant will use a barge-mounted crane and vibratory hammer to remove a dolphin comprised of four 12-inch to 14-inch timber piles, and fifty-one 10-inch to 12-inch piles associated with the existing piers and float. Vibratory extraction will take up to 10 minutes per pile, and up to 110 minutes a day over two days. They will place the piles on a work barge, which will have filtration material to prevent sediment from entering the lake. They will dispose of the piles at an approved upland facility. They will cut piles that cannot be removed 2 feet below the mudline. They will fill holes left by pile removal with clean sand that matches the existing substrate.

The applicant will install six 12-inch steel piles and ten 18-inch steel piles using the barge-mounted crane and vibratory hammer. They will not impact proof piles. Vibratory installation will take 20 minutes per pile, and up to 140 minutes per day over four days. The applicant will then install anti-perching pile caps.

The applicant will install a total of 2,010 square feet of overwater cover. This will include a new 4-foot wide gangway that contributes 75 feet of overwater cover. The gangway will be 100% grated with 60% open space. The applicant will install a 6-foot wide, 935 square foot float over water 9 feet to 26 feet deep. Half of the float will be grated with 60% open space. The remainder of the float will consist of concrete panels with floatation tubs beneath them. They will install artificial lighting on the solid decking sections. The lighting will be low intensity directed toward the deck surfaces and away from the water to minimize light spillover. Additionally, the applicant will install five floating finger piers, each of which is 200 square feet in size (1,000 square feet total; Figure 4). The finger piers will be attached to an existing fixed pier and will be over water 28 feet to 34 feet depth. Half of each finger pier will be grated with 60% open space, and the other half will consist of concrete panels with floatation tubs beneath them. There will be no artificial lighting associated with the finger piers.

We considered whether or not the proposed action would cause any other activities and determined that it would cause the following activities: increased vessel activity. Currently, there are 126 vessels moored in the marina. The proposed action would increase vessel moorage to

131 vessels. Increased vessel activity is a consequence caused by the proposed action, because it would not occur but for the proposed action and is reasonably certain to occur.

Figure 1. Project site location in Lake Union, Washington.

Figure 2. Aerial view of project site and vicinity.

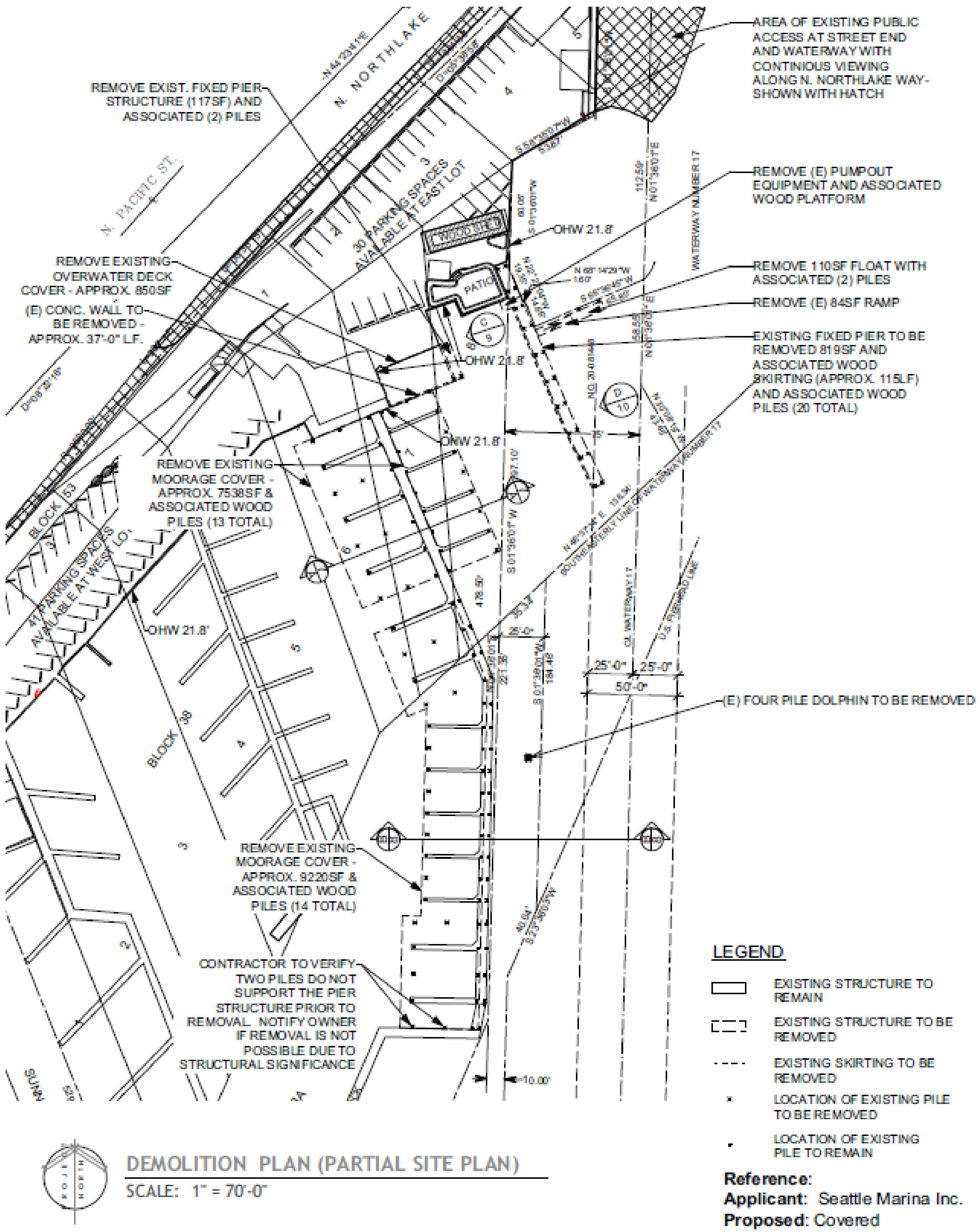

Figure 3. Existing marina structures to be removed.

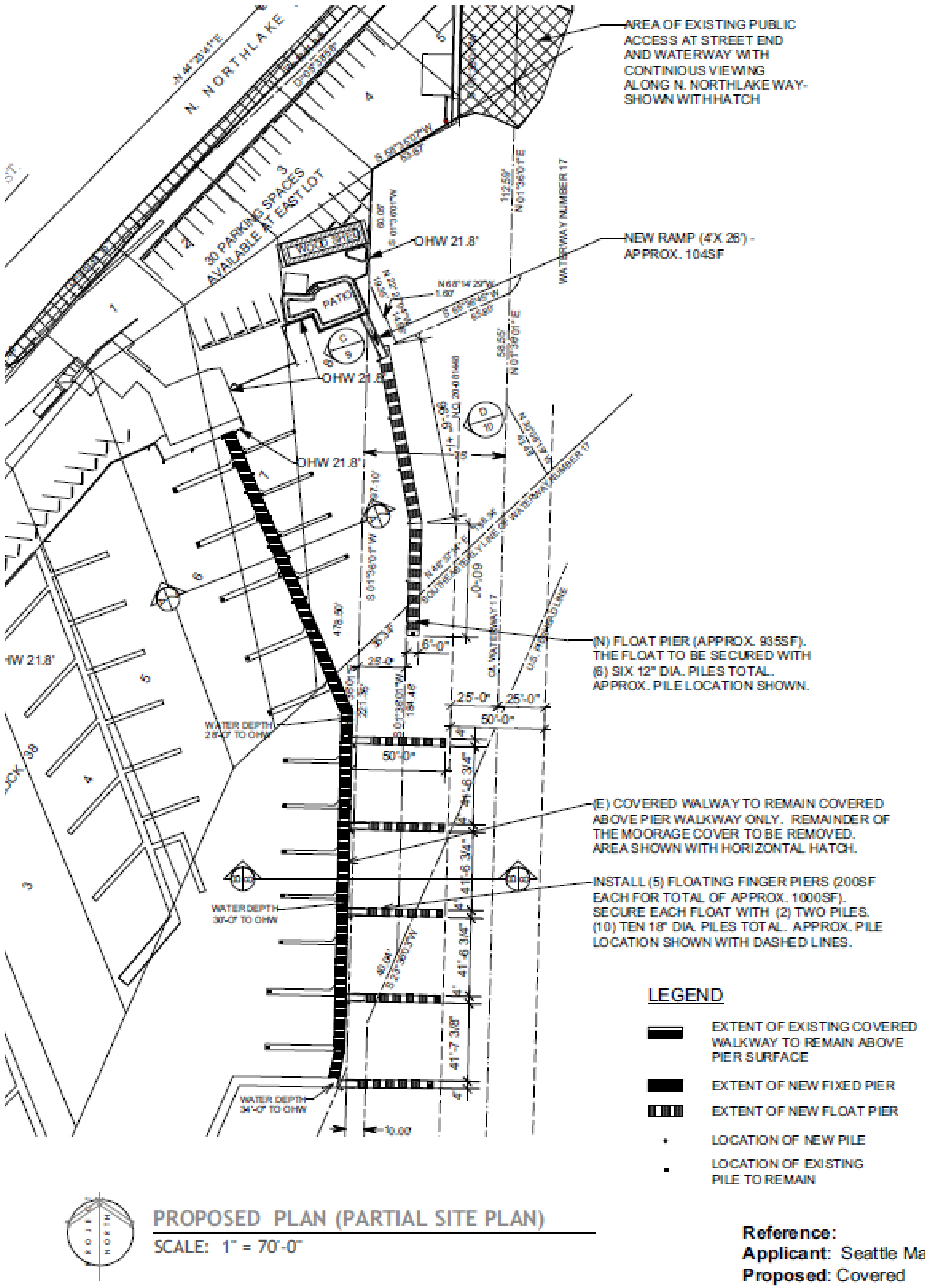

Figure 4. Marina structures to be installed.

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.

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 et al. 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). 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 (Mote et al. 2014). Decreases in summer precipitation of as much as 30 percent by the end of the century are consistently predicted across climate models (Mote et al. 2014). Precipitation is more likely to occur during October through March, less during summer months, and more winter precipitation will be rain than snow (ISAB 2007; Mote et al. 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 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).

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 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 et al. 2010). Temperature increases shift timing of key life cycle events for salmonids and species forming the base of their aquatic foodwebs (Crozier et al. 2011; 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 to 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. Acidification also impacts 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 to 32 inches by 2081 to 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 2015). 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 evolutionarily significant units (ESUs) (NWFSC 2015). 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

This section provides a summary of listing and recovery plan information, status, and limiting factors for the species addressed in this opinion. More information can be found in recovery plans and status reviews for these species. These documents are available on the NMFS West Coast Region website (http://www.fisheries.noaa.gov/).

PS Chinook salmon

We listed the PS Chinook salmon ESU as threatened on June 28, 2005 (70 FR 37160). Recovery plans for PS Chinook salmon include the Shared Strategy for Puget Sound 2007 Plan and the NMFS 2006 Plan (NMFS 2006; SSDC 2007). The most recent status review was in 2015 (NWFSC 2015). This ESU comprises 22 populations distributed over five geographic areas. Most populations within the ESU have declined in abundance over the past 7 to 10 years, with widespread negative trends in natural-origin spawner abundance and hatchery-origin spawners present in high fractions in most populations outside of the Skagit watershed. Escapement levels for all populations remain well below the Technical Recovery Team (TRT) planning ranges for recovery, and most populations are consistently below the spawner-recruit levels identified by the TRT as consistent with recovery.

Limiting factors for PS Chinook salmon include:

1. Degraded floodplain and in river channel structure.
2. Degraded estuarine conditions and loss of estuarine habitat
3. Degraded riparian areas and loss of in river large woody debris

4. Excessive fine-grained sediment in spawning gravel
5. Degraded water quality and temperature
6. Degraded nearshore conditions
7. Impaired passage for migrating fish
8. Severely altered flow regime

PS Steelhead

We listed the PS steelhead distinct population segment (DPS) as threatened on May 11, 2007 (72 FR 26722). There is a draft recovery plan for this DPS (NMFS 2018). The most recent status review was in 2015 (NWFSC 2015). This DPS comprises 32 populations. The DPS is currently at very low viability, with most of the 32 populations and all three population groups at low viability. Information considered during the most recent status review indicates that the biological risks faced by the PS Steelhead DPS have not substantively changed since the listing in 2007, or since the 2011 status review. Furthermore, the PS Steelhead TRT recently concluded that the DPS was at very low viability, as were all three of its constituent major population groups (MPGs), and many of its 32 populations. In the near term, the outlook for environmental conditions affecting PS steelhead is not optimistic. While harvest and hatchery production of steelhead in PS are currently at low levels and are not likely to increase substantially in the foreseeable future, some recent environmental trends not favorable to PS steelhead survival and production are expected to continue.

Limiting factors for PS steelhead include:

1. Continued destruction and modification of habitat
2. Widespread declines in adult abundance despite significant reductions in harvest
3. Threats to diversity posed by use of two hatchery steelhead stocks
4. Declining diversity in the DPS, including the uncertain but weak status of summer-run fish
5. A reduction in spatial structure
6. Reduced habitat quality
7. Urbanization
8. Dikes, hardening of banks with riprap, and channelization

2.2.2 Status of the Critical Habitat

We designated critical habitat for PS Chinook salmon on September 2, 2005 (70 FR 52630). Critical habitat for PS Chinook salmon includes 1,683 miles of streams, 41 square miles of lakes, and 2,182 miles of nearshore marine habitat in PS. The PS Chinook salmon ESU has 61 freshwater and 19 marine areas within its range. Of the freshwater watersheds, 41 are rated high conservation value, 12 low conservation value, and eight received a medium rating. Of the marine areas, all 19 are ranked with high conservation value. Habitat threats include but are not limited to urbanization, dredging, shoreline armoring, and marina and port development. These activities have diminished the availability and quality of nearshore marine habitats and reduced water quality across the region.

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 action area for this project includes the footprint of the project and adjacent aquatic areas within 300 feet due the spatial extent of increased turbidity (Section 2.5).

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).

As discussed in Section 1.3, the vessels most likely to moor at the piers are recreational vessels (i.e., pleasure craft). In-water noise in the action area is primarily characterized by vessel traffic from tugboats, fishing vessels, passenger vessels, and pleasure craft traveling through Lake Union (MarineTraffic 2019). The shoreline in the action area is highly developed with condominiums, office buildings, and water-dependent businesses. The shoreline consists solely of bulkheads and other types of shoreline armoring. There is extensive overwater cover from marinas, houseboat moorage, and vessel building and repair businesses. Substrate at the project site consists of mud overlying sand with no vegetation due to historic dredging.

Past and ongoing anthropogenic impacts, including climate change, described in Section 2.2, have impacted ESA-listed species and critical habitat present in the action area. Industrial activities at the nearby Gas Works Park in the early 1900s and 1950s contaminated sediments with polycyclic aromatic hydrocarbons (PAHs) (WDOE 2019). As part of cleanup efforts associated with Gas Works Park in 2000-2001, the lake bottom was overlaid with a clean sand sediment cap. The action area is currently listed on the Washington State 303(d) list of impaired waterways for water quality (WDOE 2018). It is currently listed as Category II for sediment quality.

In the Cedar River, the number of natural-origin spawning adult PS Chinook salmon has fluctuated between 306 and 1,893 individuals between 2004 and 2017 (WDFW 2019b). In the Sammamish, the number of natural spawners has fluctuated between 33 and 638 between 2004 and 2017 (WDFW 2019b). Adult Chinook salmon migrate through the Chittenden Locks from mid-June through September, with most adults moving through the Lake Washington Ship Canal and Lake Union in less than 1 day (City of Seattle 2008).

Juvenile Chinook migration into Lake Washington from Cedar Creek is bimodal with Chinook fry migration peaking in March (from January to mid-April), and smolt migration peaking in May and June (from mid-April and July) (WDFW 2019a). The density of Chinook fry utilizing shoreline habitat decreases logarithmically with increasing distance from the Cedar River, and juveniles are concentrated at the southern end of Lake Washington from February to May (Tabor et al. 2006). Juvenile Chinook migration into Lake Washington from Bear Creek is bimodal with Chinook fry peaking in March (from late January to mid-July), and smolt migration peaking in May (from mid-April to mid-July) (WDFW 2019a). Juvenile PS Chinook salmon generally migrate out of Lake Washington and Lake Sammamish from late May to early July (City of Seattle 2008). Juvenile Chinook spend 1 to 7 days moving through Lake Union (Celedonia et al. 2008b).

There are very few Lake Washington Basin steelhead. In the Cedar River, 10 or fewer adult natural-spawners have returned a year since 2007 (WDFW 2019c). In tributaries to North Lake Washington and Lake Sammamish, fewer than 10 adult natural-spawners returned between 1994 and 1999 (WDFW 2019c). North Lake Washington and Sammamish tributaries have not been monitored since 2000. Due to the small numbers of steelhead seen at the Chittenden Locks and estimated in the Cedar River, it is unlikely there are currently many steelhead in these tributaries.

Wild steelhead are closely related to resident *O. mykiss*. Resident *O. mykiss* are abundant below Landsburg dam and are a native wild population. Marshall et al. (2004) found that resident Cedar River *O. mykiss* produce out-migrating smolts and speculated that steelhead could produce adult resident *O. mykiss*. They concluded that the conservation of resident *O. mykiss* is likely an important aspect of reducing extinction risk for steelhead.

Returning steelhead pass through Chittenden Locks and the Lake Washington Ship Canal between January and May, and may remain within Lake Washington through June (City of Seattle 2008). Juvenile steelhead enter Lake Washington in April, and typically migrate through the ship canal to the locks between April and May.

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).

2.5.1 Effects to Listed Species

Underwater Noise

NMFS established the injury thresholds for impulsive sound at 206 dB peak, 187 dB cumulative sound exposure level (SEL_{cum}) for fish more than 2 grams, and 183 dB SEL_{cum} for fish less than 2 grams (Fisheries Hydroacoustic Working Group 2008). The behavioral disturbance threshold is

150 dB root mean square (RMS). Any received level below 150 dB sound exposure level (SEL) is considered "Effective Quiet" (Stadler and Woodbury 2009).

Pile extraction/installation

While impact pile driving produces an intense impulsive underwater noise, vibratory pile driving produces a lower level continuous noise (Duncan et al. 2010) that does not injure fish. Fish consistently avoid sounds like those of a vibratory hammer (Dolat 1997; Enger et al. 1993; Knudsen et al. 1997; Sand et al. 2000) and appear not to habituate to these sounds, even after repeated exposure (Dolat 1997; Knudsen et al. 1997). Illingworth & Rodkin (2017) report an underwater sound level 158 dB RMS at 10 meters for vibratory driving timber piles. The noise from the pile extraction/installation will attenuate to 150 dB RMS within 34 meters. We expect the noise from vibratory driving 24-inch steel piles to be less than or equal to this value. Caltrans (2015) reports an underwater sound level of 158 dB RMS for 18-inch steel pipe piles at 10 meters in three meters water depth. The noise from pile installation will attenuate to 150 dB RMS within 34 meters.

As described in Section 2.4, it is extremely unlikely that adult and juvenile PS Chinook salmon will be present during the in-water work window of November 1 to April 15. Therefore, the effects of in-water noise from vibratory pile driving on PS Chinook salmon are extremely unlikely to occur. Any of the few adult or juvenile PS steelhead that may occur could be displaced from the area within 34 meters of pile extraction/installation for the duration of vibratory pile driving. However, given the short duration, individuals are extremely unlikely to experience any adverse effects from vibratory pile installation.

Vessels

Tugboats may be used during demolition and installation of the piers. Vessel moorage at the marina will increase with implementation of the proposed action. The vast majority of that activity will likely occur during daylight hours, but some pre-dawn or post-dusk engine running and vessel movement may take place at the site. In the absence of specific use estimates, this assessment assumes that on any given day, 12 hours of continuous vessel noise is likely to occur, which likely overestimates exposure risk most of the time. Unlike construction noises, vessel noise could occur year-round. As discussed in Section 1.3, the vessels most likely to moor at the marina are private recreational vessels (i.e., sailing vessels, motor yacht, and yachts). Source levels for this type of vessel are 159 dB ± 9 dB (Veirs et al. 2016). However, the available information describes vessels running at or close to full-speed, which is likely to overestimate exposure risk. Because SEL is often identical to RMS for non-impulsive sources, we assume that are reported sound levels by Veirs et al. (2016) are in dB RMS which would, at worst, overestimate sound levels.

Based on the best available information, fish will be unaffected by non-impulsive noise levels under 150 dB SEL (Stadler and Woodbury 2009). To conservatively estimate source levels, we also assume that the mean plus the standard deviation represents the source level for each vessel class. We conservatively assume that the area of continuous acoustic affect during construction (above 150 dB SEL) will include all of the water within 46 meters around the piers. We conservatively assume that the area of continuous acoustic affect from on-going vessel traffic will include all of the water within 16 meters around the piers.

Adult and juvenile PS Chinook salmon are extremely unlikely to be present during the in-water work window and thus exposed to construction-related noise. Adult and juvenile PS steelhead are not nearshore dependent but may pass through the area of acoustic effect during migration. The most likely effect of exposure to non-injurious construction-related vessel noise levels would be temporary avoidance of the project site, which would cause no measurable effects on adult and juvenile PS steelhead that may occur.

Like adult and juvenile PS steelhead, adult PS Chinook salmon are not nearshore oriented. For the reasons described above, structure-related noise levels would cause no measurable effects on adult PS Chinook salmon, and adult and juvenile PS steelhead. However, juvenile PS Chinook salmon are nearshore oriented and are likely to occur near the piers. Juvenile Chinook salmon that are within 16 meters of structure-related vessels are likely to experience behavioral disturbance, such as acoustic masking (Codarin et al. 2009), startle response and altered swimming patterns (Neo et al. 2014), avoidance (Mueller 1980; Picciulin et al. 2010; Sebastianutto et al. 2011; Xie et al. 2008), and increased vulnerability to predators (Simpson et al. 2016). The intensity of these effects would increase with increased proximity to the source and/or duration. The affected area would be small in size, and only low numbers of PS Chinook salmon may be present at the project site at any given time. Therefore, the numbers of individuals that may be exposed to structure-related noise would likely comprise extremely small subsets of the cohorts from their populations. Thus, the numbers of exposed fish would be too low to cause any detectable population-level effects.

Turbidity

In-water pile removal and driving will cause short-term and localized increases in turbidity and total suspended solids (TSS). For reference, vibratory removal of hollow 30-inch steel piles in Lake Washington mobilized sediments that adhered to the piles as they were drawn through the water column, with much of the mobilized sediments being material that fell out of the hollow piles (Bloch 2010). Turbidity reached a peak of about 25 mg/L above background levels at 50 feet from the pile, and about 5 mg/L above background at 100 feet. Turbidity returned to background levels within 30 to 40 minutes. Pile installation created much lower turbidity. The proposed vibratory extraction of timber piles for this project is likely to mobilize far less sediment than the piles described above, because the timber piles are less than half the size (less surface area for sediments to adhere to) and they are solid (no tube to hold packed-in sediments). Therefore, the mobilization of bottom sediments, and resulting turbidity from the planned pile removal is likely to be less than that reported by Bloch.

The effects of turbidity on fish are species and size dependent. In general, severity typically increases with sediment concentration and duration of exposure, and decreases with the increasing size of the fish. Newcombe and Jensen (1996) reported minor physiological stress in juvenile salmon only after about three hours of continuous exposure to concentration levels of about 700 to 1,100 mg/L. Construction-related turbidity would be very short-lived and at concentrations too low to cause more than temporary, non-injurious behavioral effects (e.g., alarm reaction and avoidance of the plume), physiological effects (e.g., gill flaring and coughing), and temporary reduced feeding rates (Newcombe and Jensen 1996). None of these potential responses, individually, or in combination are likely to adversely affect any of the very few PS steelhead that may occur.

Vessels

Tugboats may be used during demolition and installation of the piers. After construction, vessel moorage will continue into the foreseeable future. As discussed in Section 1.3, the vessels most likely to moor at the new piers are recreational vessels. A recent study described the turbidly cause by tugboats operations in water about 40 feet (12 meters) deep (Wang et al. 2016). At about 13 minutes, the plume extended about 550 yards (500 meters) and had a TSS concentration of about 80 mg/L. The TSS concentration fell to 30 mg/L within 1 hour and to 15 mg/L within 3 hours. Turbidity caused by recreational vessels is expected to be less than or equal to these values. Therefore, vessel-related turbidity would be temporary and at concentrations too low to cause more than temporary, non-injurious effects that, as described above, are not expected to affect the fitness of exposed individuals.

Dissolved Oxygen

Mobilization of anaerobic sediments can decrease dissolved oxygen (DO) levels (Hicks et al. 1991; Morton 1976). However, as described above, only a small amount of sediment will be mobilized by construction and structure-related vessels. This suggests that any impacts on DO will be too small and short-lived to cause detectable effects in exposed fish.

Contaminants

Pile extraction/installation

Presently, creosote-treated piles contaminate the surrounding sediment up to two meters away with polycyclic aromatic hydrocarbon, or PAHs (Evans et al. 2009). Cutting or removing the creosote-treated piles mobilizes these PAHs into the surrounding water and sediments (Parametrix 2011; Smith 2008). The project will also release PAHs directly from creosote-treated timber if any of the piles break during removal (Parametrix 2011). The concentration of PAHs released into surface water rapidly dilutes. Smith (2008) reported concentrations of total PAHs of 101.8 µg/L 30 seconds after creosote-pile removal and 22.7 µg/L 60 seconds after. However, PAH levels in the sediment after pile removal can remain high for six months or more (Smith 2008). Romberg (2005) found a major reduction in sediment PAH levels three years after pile removal contaminated an adjacent sediment cap.

There are two pathways for PAH exposure to listed fish species in the action area, direct uptake through the gills and dietary exposure (Karrow et al. 1999; Lee and Dobbs 1972; McCain et al. 1990; Meador et al. 2006; Neff et al. 1976; Roubal et al. 1977; Varanasi et al. 1993). Fish rapidly uptake PAHs through their gills and food, but also efficiently remove them from their body tissues (Lee and Dobbs 1972; Neff et al. 1976). Juvenile Chinook salmon prey, including amphipods and copepods, uptake PAHs from contaminated sediments (Landrum et al. 1984; Landrum and Scavia 1983; Neff 1982).Varanasi et al. (1993) found high levels of PAHs in the stomach contents of juvenile Chinook salmon in the Duwamish estuary.

The primary effects of PAHs on salmonids from both uptake through their gills and dietary exposure are immunosuppression and reduced growth. Karrow et al. (1999) characterized the immunotoxicity of creosote to rainbow trout (*Oncorhynchus mykiss*) and reported a lowest observable effect concentration for total PAHs of 17 µg/L. Varanasi et al. (1993) found greater immune dysfunction, reduced growth, and increased mortality compared to control fish. In order to isolate the effects of dietary exposure of PAHs on juvenile Chinook salmon, Meador et al.

(2006)fed a mixture of PAHs intended to mimic those found by Varanasi et al. (1993) in the stomach contents of field-collected fish. These fish showed reduced growth compared to the control fish.

Vibratory pile removal will be limited to vibratory extraction and/or simple pull techniques, which will limit contamination. NMFS expects the water and substrate within 300 feet of pile removal activities will have increased levels of PAHs (NMFS 2017). Within this area, contaminants may be biologically available for years, at steadily decreasing levels. The removal of the creosote-treated timber will reduce listed-fish exposure to PAHs in the long-term. While present, contaminants such as PAHs are likely to bioaccumulate in benthic invertebrates (Landrum et al. 1984; Landrum and Scavia 1983; Neff 1982), some of which will be consumed by listed fish that forage in the action area. Fish have low PAH uptake retention (Niimi and Dookhran 1989; Niimi and Palazzo 1986) and metabolize PAHs rapidly (Hellou and Payne 1986; Roubal et al. 1977; Statham et al. 1978; Varanasi et al. 1989). Nevertheless, even brief exposure to PAH-contaminated habitats has been shown to reduce growth, suppress immune competence, and increased mortality in outmigrating juvenile Chinook salmon (Meador et al. 2006; Varanasi et al. 1993). In contrast, it is unlikely that adult listed salmonids that feed on forage fish would be impacted as biomagnification of PAHs does not occur in fish (Suedel et al. 1994). Further, juvenile PS steelhead move quickly through Lake Union and will be relatively large and free from shoreline obligation. Therefore, they are unlikely to be exposed to contaminated prey.

Juvenile Chinook salmon are known to forage between two and four meters depth (Tabor et al. 2011), which would overlap with the portions of the existing and proposed pier. The annual number of juvenile Chinook salmon that may be exposed to PAH-contaminated forage that will be attributable to this action is unquantifiable with any degree of certainty, as is the amount of contaminated prey that any individual fish may consume, or the intensity of any effects that an exposed individual may experience. However, the small affected area and the low volume of contaminated sediment that would be brought to the surface suggest that the probability of trophic connectivity to the contamination would be very low for any individual fish. Therefore, the numbers of fish that may be annually exposed to contaminated prey would be very low, and no detectable effects at the population level for Chinook salmon are expected.

<u>Vessels</u>
Propeller scour from construction-related and structure-related vessels may mobilized contaminated sediments. As described above, the annual number of juvenile Chinook salmon that may be exposed to PAH-contaminated forage that will be attributable to this action is unquantifiable with any degree of certainty. Given the small affected area, the numbers of fish that may be annually exposed to contaminated prey would be very low, and no detectable effects at the population level for Chinook salmon are expected.

Construction-related vessels may discharge small amounts of petroleum-based fuels and lubricants that contain PAHs. Infrequent and relatively small discharges of petroleum-based fuels and lubricants would occur from the vessels that will moor at the new piers. Any fuels and lubricants that may be used tend to evaporate quickly, with PAH dissipating within a few hours (Werme et al. 2010). Based on the available information, the concentrations and residence times of vessel-related petroleum-based substances will be too low to cause more than temporary low-level behavioral effects that, individually, or in combination will not affect the fitness or normal behaviors of exposed individuals.

Shade

Obstruction and Predation

Numerous studies demonstrate that juvenile salmon, in both marine and freshwater habitats, are more likely to avoid the shadow of an overwater structure than to pass through the shadow (Celedonia et al. 2008a; Celedonia et al. 2008b; Kemp et al. 2005; Moore et al. 2013; Munsch et al. 2014; Nightingale and Simenstad 2001; Ono et al. 2010; Southard et al. 2006). The applicant will remove the majority of the solid canopy that exists on site. However, they will be installing overwater structures that are closer to the water's surface and extend further from shore. Though grating will increase light penetration, shading will still occur. As discussed in Section 1.3, the applicant will be using grated decking on portions of their floating piers. DNR (2014) found that only about 15% of light could be transmitted through a grated deck with 60% open space raised 0 inches above the water's surface. Further, no light will penetrate through the concrete sections of the new floating piers.

An implication of juvenile salmon avoiding overwater structures is that some of them will swim around the structure (Nightingale and Simenstad 2001). This behavioral modification will cause them to temporarily utilize deeper habitat, thereby exposing them to increased piscivorous predation. This has been shown in the marine environment where juvenile salmonid consumption by piscivorous predators increased fivefold when juvenile pink salmon were forced to leave the shallow nearshore (Willette 2001). Further, swimming around overwater structures lengthens the salmonid migration route, which is correlated with increased mortality (Anderson et al. 2005). In summary, the increase in migratory path length from swimming around the new finger piers as well as the increased exposure to piscivorous predators in deeper water likely will result in proportionally increased juvenile PS Chinook mortality.

The annual number of juvenile PS Chinook salmon that may be exposed to increased predation and longer migration distances attributable to this action is unquantifiable with any degree of certainty. However, the small affected area suggests that the probability of mortality would be very low for any individual fish. Therefore, the numbers of fish that may be annually exposed to increased predation and longer migration distances will be very low, and no detectable effects at the population level are expected.

Adult PS Chinook salmon and PS steelhead will likely be too large to be affected by increased predation due to their size. Juvenile PS steelhead will move quickly through Lake Union and will be relatively large and free from shoreline obligation. Therefore, like adults, they are unlikely to face increased predation due to the presence of the structure.

Forage and Natural Cover

There is no SAV in the vicinity of the proposed project. However, intense shade can reduce the diversity of the aquatic communities under over-water structures (Nightingale and Simenstad 2001; Simenstad et al. 1999). Portions of the main float will be installed in water less than 15 feet deep over substrate that has not been previously shaded. Therefore, shade from the float and vessels moored at it will be detectable near the substrate. The new floating pier will be installed adjacent to dozens of similar structures that are installed within Lake Union. Within the lake, structure-related shade reduces the production and diversity of invertebrate organisms that are prey for juvenile salmonids. Therefore, within the lake, structure-related shade likely reduces productivity enough to reduce the fitness of juvenile PS Chinook salmon. The proposed floating pier would contribute measurably to that impact.

Artificial Lighting

No project work would occur outside of daylight hours. As discussed in Section 1.3, the applicant will install artificial lighting on the main float. Additionally, the construction barges and vessels that will moor at the new floating piers may be illuminated after dark. The type, intensity, and duration of vessel lighting would be variable, but most of the boat illumination would likely be limited to low-intensity navigation lights that would be on only for short periods (minutes) just before leaving the floating piers, or after arriving.

The available literature demonstrates that artificial lighting can attract fish (positive phototaxis) and may shift nocturnal behaviors toward more daylight-like behaviors. It may also affect light-mediated behaviors such as migration timing. In lacustrine environments, subyearling Chinook, coho, and sockeye salmon exhibit strong nocturnal phototaxic behavior toward light from 60-watt incandescent bulbs held about 6 feet above the water, with phototaxis positively correlated with light intensity (Tabor et al. 2017). Becker et al. (2013) found that the abundance of small shoaling fish and larger predatory fish increased in artificially illuminated estuarine waters. Ina et al. (2017) demonstrated that post-larvae and juvenile Pacific bluefin tuna show strong positive phototaxis. Celedonia and Tabor (2015) reported that attraction to artificial lights may delay the onset of early morning migration by up to 25 minutes for some juvenile Chinook salmon in the Lake Washington Ship Canal, but it was unlikely to alter migration timing in the evening. The available information to describe the effects of artificial lighting on predator/prey relationships suggests that light-based predatory success in piscivorous fish is probably offset by similar improvements in predator avoidance by juvenile salmonids (Mazur and Beauchamp 2003; Tabor et al. 1998).

Based on the high level of shoreline development and the high density of boats and piers in the action area, nighttime artificial illumination is likely high. The lights from structure-related vessels and float will add to in-water illumination in the area. The lighting along the float will be low intensity directed toward the deck surfaces and away from the water to minimize light spillover. However, the lights will be located close to the water’s surface and some light spillover is likely to occur. Therefore, artificial light is likely to be detectable by fish. Adult PS Chinook and juvenile and adult PS steelhead are not nearshore dependent but may pass through the area during migration. However, juvenile PS Chinook salmon are nearshore oriented and are likely to be exposed to structure-related artificial lighting. Exposed juvenile Chinook would likely experience some level of nocturnal phototaxis, and may experience other altered behaviors, such as delayed resumption of migration in the morning. The effect this may have on the fitness and survival of exposed individuals is unknown. However, given the short duration of the work and the low numbers of juvenile PS Chinook salmon that may be present at the project site, any individuals that may be affected by artificial lighting would likely comprise extremely small subsets of the cohorts from their respective populations, and the numbers of exposed fish would be too low to cause any detectable population-level effects.

Propeller Wash

<u>Vessels</u>

Killgore et al. (2011) report that fish are killed by spinning boat propellers. Propeller-related turbulence has also been documented to kill small aquatic organisms like copepods (Bickel et al. 2011). Small fish that are exposed to propeller wash may also be displaced by the fast-moving turbulent water. Propeller wash is unlikely to affect adult PS Chinook salmon and PS steelhead, because they are unlikely to approach close enough to operating vessels to be exposed. In the unlikely event of adult exposure, their increased size and swimming ability suggest that they will swim away from the propeller wash with no detectable effects other than a very brief avoidance behavior.

Juvenile PS Chinook salmon and PS steelhead that migrate past the new piers are likely to be relatively close to the surface where they may be exposed to spinning propellers and propeller wash, and will be too small to effectively swim against the turbulent water. Juvenile PS steelhead may also be exposed to construction-related propellers and propeller wash. Therefore, juvenile PS Chinook salmon and juvenile PS steelhead may be injured, killed, or displaced by structure-related propellers or propeller wash. Although the likelihood of this interaction is very low for any individual fish or any individual boat trip, it is likely that over the life of the pier, at least some juvenile Chinook salmon and steelhead will experience reduced fitness or mortality from exposure to spinning propellers and/or propeller wash at the site. The annual number of individuals that may be impacted by this stressor is unquantifiable with any degree of certainty. However, based on the expectation that exposed individuals would be very small subsets of the cohorts from their respective populations, the numbers of exposed fish will be too low to cause detectable population-level effects.

<u>Forage and Natural Cover</u>

There is no SAV in the vicinity of the proposed project. However, propellers and propeller wash can mobilize sediments and dislodge aquatic organisms. In shallow water, propeller scour can reduce the density and diversity of the benthic community. Though construction-related and structure-related vessels would likely operate at low power levels, some would be situated over relatively shallow water (less than 15 feet deep). Therefore, propeller scour may reduce benthic resources adjacent to the new piers. As described above, within Lake Union, structure-related shade likely reduces the production and diversity of invertebrate organisms enough to reduce the fitness of juvenile PS Chinook salmon. The proposed floating piers would contribute measurably to that impact.

<u>2.5.2 Effects to Critical Habitat</u>

Designated critical habitat within the action area for PS Chinook salmon consists of freshwater migration corridors and their essential and biological features. The PBFs of designated PS Chinook salmon critical habitat in the action area include: freshwater 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.

Free of Obstruction and Excessive Predation
The proposed action will cause long-term minor effects on obstruction and episodic ephemeral effects on predation. Though grating will increase light penetration, shading will still occur. The proposed action will increase the area overwater cover close to the water's surface, and will extend overwater cover waterward of the shoreline. This may affect shoreline migration by juveniles. The proposed action will cause no change in the abundance of predators, but the increased overwater cover and may cause increased predation on juveniles. Artificial lighting along the float may also delay migration. The proposed action will act to maintain this PBF at a reduced functional level compared to undisturbed areas. Therefore, the action will cause a long-term minor change in the quality and function of this PBF.

Water Quantity
The proposed action will have no effect on water quantity, and will cause no change in the quality and function of this PBF.

Water Quality
The action will eliminate sources of ongoing PAH water contamination through the removal of the existing creosote-treated piles. Construction will briefly mobilize contaminated sediments, and may also very slightly reduce DO in very limited areas. Detectable construction-related effects on water quality are expected to be limited to the area well within 300 feet around the project site, and are not expected to persist past one or two hours after work stops. However, structure-related vessels may continue to mobilize contaminated sediments and discharge pollutants into the foreseeable future. Therefore, the action will cause a minor long-term negative change in the quality and function of this PBF.

Natural Cover
The proposed action will not affect natural cover from SAV as there is no SAV in the vicinity of the proposed or existing piers. Therefore, the action will cause no long-term negative change in the quality and function of this PBF.

2.6 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02 and 402.17(a)). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

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

The current condition of ESA-listed species and designated critical habitat within the action area are described in the Status of the Species and Critical Habitat and the Environmental Baseline sections above. The contribution of non-federal activities to those conditions include past and on-going shoreline development, vessel activities, and upland urbanization. Those actions were driven by a combination of economic conditions that characterized traditional natural resource-based industries, general resource demands associated with settlement of local and regional population centers, and the efforts of social groups dedicated to restoration and use of natural amenities, such as cultural inspiration and recreational experiences.

NMFS is unaware of any specific future non-federal activities that are reasonably certain to affect the action area. However, NMFS is reasonably certain that future non-federal actions such as the previously mentioned vessel activities are all likely to continue and increase in the future as the human population continues to grow across the region. Continued habitat loss and degradation of water quality from development and chronic low-level inputs of non-point source pollutants will likely continue into the future. Recreational and commercial use of waters within the action area is also likely to increase as the human population grows.

The intensity of these influences depends on many social and economic factors, and therefore is difficult to predict. Further, the adoption of more environmentally acceptable practices and standards may gradually reduce some negative environmental impacts over time. Interest in restoration activities has increased as environmental awareness rises among the public. State, tribal, and local governments have developed plans and initiatives to benefit ESA-listed species in the action area. However, the implementation of plans, initiatives, and specific restoration projects are often subject to political, legislative, and fiscal challenges that increase the uncertainty of their success.

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.

2.7.1 ESA-Listed Species

The species considered in this Opinion have been listed under the ESA, based on declines from historic levels of abundance and productivity, loss of spatial structure and diversity, and an array of limiting factors as a baseline habitat condition. Each species will be affected over time by cumulative effects, some positive – as recovery plan implementation and regulatory revisions increase habitat protections and restoration, and some negative – as climate change and unregulated or difficult to regulate sources of environmental degradation persist or increase. Overall, to the degree that habitat trends are negative, as described below, effects on viability parameters of each species are also likely to be negative. In this context we consider the effects of the proposed action's effect on individuals of the listed species at the population scale. The action area provides habitat for freshwater life histories of PS Chinook salmon and PS steelhead.

PS Chinook Salmon
The action area supports PS Chinook salmon adult and juvenile migration. The long-term trend in abundance of the PS Chinook salmon ESU is slightly negative. Reduced or eliminated accessibility to historically important habitat, combined with degraded conditions in available habitat appear to be the greatest threats to the recovery of PS Chinook salmon. Degraded water quality and temperature, degraded nearshore conditions, and impaired passage for migrating fish also continue to impact this species.

The environmental baseline within the action area has been degraded from shoreline development and vessels activities, and by nearby upland urbanization. The project site is currently listed on the Washington State 303(d) list of impaired waterways for water quality (WDOE 2018). However, the project site is located along the Lake Washington Ship Canal, which provides the only route to and from the marine waters for adults and juveniles of the Cedar River and North Lake Washington / Lake Sammamish PS Chinook salmon populations.

Project-related work will avoid the presence of out-migrating juvenile PS Chinook salmon and returning adults. The proposed action will also cause long-term beneficial effects on water and sediment quality by removing creosote-treated piles, the source of PAH contamination at the site. For the first few years following construction, out-migrating juveniles may be exposed to ever-decreasing levels of contaminated forage, due to mobilization of small amounts of contaminated sediments. Consumption of contaminated forage may reduce growth, increase susceptibility to infection, and increase mortality in some individuals.

The shade cast by the pier may increase mortality in juvenile PS Chinook salmon through increased predation and migratory path length. Artificial lighting along the main float may also delay migration. Propellers and propeller wash associated with use of the new floating piers may also injure, kill, or displace juvenile PS Chinook salmon. Across the lake, structure-related shade, propellers, and propeller wash may reduce forage organisms enough to reduce the fitness of juvenile PS Chinook salmon. The proposed floating piers would contribute measurably to that impact.

The number of PS Chinook salmon that are likely to be injured or killed by action-related stressors is unknown, but is expected to be very low, and such a small fraction of a returning cohort that it will have no detectable effect on any of the characteristics of a viable salmon population (VSP), abundance, productivity, distribution, or genetic diversity) for the affected population(s). Similarly, the annual number of juveniles that are likely to be injured or killed by exposure to action-related stressors is also unknown, but is expected to be too low to cause detectable effects on any VSP characteristics for the affected population(s).

The proposed action will increase the area of overwater cover and vessel traffic, which will keep certain habitat conditions at slightly reduced functional levels as compared to undisturbed areas. However, the structure will not cause or worsen any habitat conditions in a manner that would act to limit the recovery of this species. Based on the best available information, the scale of the direct and indirect effects of the proposed action, when considered in combination with the degraded baseline, cumulative effects, and the impacts of climate change, will be too small to cause any population level impacts on PS Chinook salmon. Therefore, the proposed action will not appreciably reduce the likelihood of survival and recovery of this listed species.

PS Steelhead

The environmental baseline within the action area has been degraded from shoreline development and maritime activities, and by nearby upland urbanization. The project site is currently listed on the Washington State 303(d) list of impaired waterways for water quality (WDOE 2018). However, the project site is located along the Lake Washington Ship Canal, which provides the only route to and from the marine waters for adults and juveniles of the Cedar River and North Lake Washington / Lake Sammamish DIPs. Ten or fewer adult natural-spawner Cedar River and North Lake Washington / Lake Sammamish PS steelhead are estimated to remain.

Propellers and propeller wash associated with construction-related and structure-related vessels may injure, kill, or displace juvenile PS steelhead. The number of PS steelhead that are likely to be injured or killed by action-related stressors is unknown, but is expected to be very low, and such a small fraction of a returning cohort that it will have no detectable effect on any of the characteristics of a VSP, abundance, productivity, distribution, or genetic diversity) for the affected population(s). Similarly, the annual number of juveniles that are likely to be injured or killed by exposure to action-related stressors is also unknown, but is expected to be too low to cause detectable effects on any VSP characteristics for the affected population(s).

Based on the best available information, the scale of the direct and indirect effects of the proposed action, when considered in combination with the degraded baseline, cumulative effects, and the impacts of climate change, will be too small to cause any population level impacts on PS steelhead. Therefore, the proposed action will not appreciably reduce the likelihood of survival and recovery of this listed species.

2.7.2 Critical Habitat

As described above at Section 2.5.2, the proposed action is likely to adversely affect designated critical habitat for PS Chinook salmon. Past and ongoing anthropogenic activities have degraded salmonid critical habitat throughout the Puget Sound basin. Hydropower and water management activities have reduced or eliminated access to significant portions of historic spawning habitat. Timber harvests, agriculture, industry, urbanization, and shoreline development have adversely altered floodplain and stream morphology in many watersheds, diminished the availability and quality of estuarine and nearshore marine habitats, and reduced water quality across the region. Future non-federal actions and climate change are likely to increase and continue acting against the quality of salmonid critical habitat. The intensity of those influences on salmonid habitats is uncertain, as is the degree to which those impacts may be tempered by adoption of more environmentally acceptable land use practices, implementation of non-federal plans that are intended to benefit salmonids, and efforts to address the effects of climate change.

PS Chinook salmon critical habitat in the action area is limited to freshwater migration corridors. PBFs that will be affected by the action are limited to freedom of obstruction and excessive predation and water quality. As described above, the project site is located along a heavily impacted waterway, and currently functions at greatly reduced levels as compared to undisturbed freshwater migratory corridors.

The proposed action will cause minor long-term effects on water quality. Construction will cause brief minor impacts on water quality within about 300 feet of the site. Structure-related vessels may mobilize contaminated sediments and discharge pollutants. Therefore, the action will cause a long-term minor change in the quality and function of this PBF.

The proposed action will cause long-term minor effects on obstruction and predation. The proposed action will increase the area overwater cover close to the water's surface, and will extend overwater cover waterward of the shoreline. This may affect shoreline migration by juveniles. The proposed action will cause no change in the abundance of predators, but the presence of the overwater structure may cause increased predation. Artificial lighting along the main float may also delay migration. Therefore, the action will cause a long-term minor change in the quality and function of this PBF.

The proposed action will increase the area of overwater cover and increased vessel traffic, which will keep certain habitat conditions at slightly reduced functional levels as compared to undisturbed areas. However, based on the best available information, the scale of the proposed action's effects, when considered in combination with the degraded baseline, cumulative effects, and the impacts of climate change, will be too small to cause any detectable long-term negative changes in the quality or functionality of freshwater migration corridor PBFs in the action area. Therefore, this critical habitat will maintain its current level of functionality, and retain its current ability for PBF to become functionally established, to serve the intended conservation role for PS Chinook salmon.

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 PS steelhead and PS Chinook salmon, or destroy or adversely modify PS Chinook salmon 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:

Harm of PS Chinook salmon from exposure to

- contaminated forage,
- structure-related noise,
- structure-related propeller wash,
- structure-related reduced forage,
- structure-related altered migratory behaviors, and
- structure-related predation.

Harm of PS steelhead from

- construction-related propeller wash, and
- structure-related propeller wash.

The distribution and abundance of fish that occur within an action area are affected by habitat quality, competition, predation, and the interaction of processes that influence genetic, population, and environmental characteristics. These biotic and environmental processes interact in ways that may be random or directional, and may operate across far broader temporal and spatial scales than are affected by the proposed action. Thus, the distribution and abundance of fish within the action area cannot be attributed entirely to habitat conditions, nor can NMFS precisely predict the number of fish that are reasonably certain to be injured or killed if their habitat is modified or degraded by the proposed action.

Therefore, we cannot predict with meaningful accuracy the number of juvenile PS Chinook salmon and PS steelhead that are reasonably certain to be injured or killed by exposure to these stressors. Additionally, NMFS knows of no device or practicable technique that would yield reliable counts of individuals that experience these impacts. In such circumstances, NMFS uses the causal link established between the activity and the likely extent and duration of changes in habitat conditions to describe the extent of take as a numerical level of habitat disturbance. The most appropriate surrogates for take are action-related parameters that are directly related to the magnitude of the expected take.

Construction-Related Propeller Wash
For this action, the timing and duration of work are the best available surrogates for the extent of take of listed species from exposure to construction-related propeller wash. Timing and duration of work are applicable because the planned work windows were selected to reduce the potential for fish presence at the project site. Therefore, working outside of the planned work window and/or working for longer than planned would increase the number of fish likely to be exposed to construction-related impacts that are likely to cause injury or reduce fitness.

Contaminated Forage
For increased PAH exposure, the best available indicator for the extent of take is the extent of visible increased turbidity. Based on past projects (Bloch 2010), the observed extent of turbidity is a reliable indicator of the extent of elevated suspended sediment, and therefore, the extent of exposure of listed species. Because PAHs will be released during activities that increase suspended sediment, the observed extent of turbidity is a reliable indicator of the extent of PAH exposure.

Structure-Related Reduced Forage, Altered Migratory Behaviors, and Increased Predation
The area of solid and grated overwater cover is the best available surrogate for the extent of take of juvenile PS Chinook salmon from exposure to structure-related altered lighting. This is because the size of the shaded area is positively correlated with area of overwater cover, and the intensity of the shadow is correlated with how much light penetrates through the overwater structure. As the size and intensity of the shadow increases, the amount of productive habitat and available forage decreases. This reduces available shelter and forage, which increases risk of predation, increases energetic costs, and reduces fitness in exposed individuals.

The size of the artificially illuminated area is positively correlated with the size of the main float. As the size of the float increases, the number of lights needed to illuminate the float increases. As the number of lights increases, the size of the artificially illuminated area increases. With an increase in artificially illuminated area, the likelihood that fish are exposed to artificial light, and therefore experience phototaxis and other light altered behaviors, increases.

Structure-Related Vessel Noise and Propeller Wash
The area of overwater cover from the new piers is the best available surrogate for the extent of 1) take of juvenile PS Chinook salmon from structure-related vessel noise, and 2) take of juvenile PS steelhead and juvenile PS Chinook from propeller wash. This is because both stressors are positively correlated with the number of vessels that moor at the new piers, which is largely a function of each pier's length. As the length of each pier increases, the number of vessels that can moor there would increase. As the number of vessels increases, vessel activity would likely increase, and the potential for listed species to be exposed to the related noise and propeller wash would increase.

In summary, the extent of take for this action is defined as:

PS Chinook salmon:
1. Geographic extent of visible turbidity; and
2. Area of overwater cover.

PS steelhead:
3. In-water work between November 1 and April 15; and
4. Area of overwater cover.

Exceedance of any of the exposure limits described above would constitute an exceedance of authorized take that would trigger the need to reinitiate consultation.

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).

The Corps shall:

1. Implement monitoring and reporting to confirm that the take exemption for the proposed action is not exceeded.

2.9.4 Terms and Conditions

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

1) The following terms and conditions implement reasonable and prudent measure 1:
    i) Require the applicant to maintain and submit construction logs to verify that all take indicators are monitored and reported. The logs should indicate:
        (1) An in-water work window of November 1 to April 15;
        (2) A visible turbidity plume not to exceed 300 feet from the project site during any portion of the project; and
        (3) A maximum of 2,010 square feet of new/replaced overwater cover, which includes:
            (i) One fully grated gangway that is 75 square feet in size;
            (ii) One 50% grated float that is 935 square feet in size; and
            (iii) Five 50% grated floating finger piers, each of which is 200 square feet in size (1,000 square feet total)
    ii) Submit an electronic post-construction report to NMFS within six months of project completion. Send the report to: projectreports.wcr@noaa.gov. Be sure to include the

NMFS Tracking number for this project in the subject line: Attn: WCRO-2019-02762.

2.10 Conservation Recommendations

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

The Corps should encourage the applicant to:

1) Ensure their contractors use the lowest safe maneuvering speeds and power settings when maneuvering in shallow water close to the shoreline, with the intent to minimize propeller wash.
2) Require their contractors to install full-depth silt curtains around in-water pile removal and installation to minimize the spread of contaminated sediments.
3) Develop a plan to reduce the environmental impacts of the marina. Suggested measures include:
    i) Instruct users about the importance of nearshore habitats at the site to migrating juvenile salmon;
    ii) Require users to operate vessels at low speeds near the marina and other shoreline areas to reduce propeller scour;
    iii) Require users to maintain and operate their vessels with the intent to reduce the potential for toxic chemicals to enter or remain in the water at the site; and
    iv) Establish a system to prevent and/or remove litter and wastes from the area around the marina.

Additionally, the Corps should:

4) Coordinate with NMFS, other resource agencies, and technical experts to address contaminated sediments and water quality issues in Lake Union and the ship canal.
5) Conduct or support continuing research to better understand the distribution, abundance, and habitat use of PS Chinook salmon and PS steelhead in Lake Union and the ship canal.

2.11 Reinitiation of Consultation

This concludes formal consultation for the Seattle Marina Project in Seattle, Washington. 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.

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 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 Sections 1 and 2 of this document. The action area includes areas designated as EFH for various life-history stages of Pacific Coast salmon (PFMC 2014). The action area is not designated as a habitat area of particular concern (HAPC).

3.2 Adverse Effects on Essential Fish Habitat

The ESA portion of this document describes the adverse effects of this proposed action on ESA-listed species and critical habitat, and is relevant to the effects on EFH for Pacific coast salmon. Based on the analysis of effects presented in Section 2.5, the proposed action will cause small-scale adverse effects on this EFH through direct or indirect physical, chemical, or biological alteration of the water or substrate, and through alteration of benthic communities, and the reduction in prey availability. Therefore, we have determined that the proposed action would adversely affect the EFH identified above.

3.3 Essential Fish Habitat Conservation Recommendations

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in section 3.2, above, approximately 0.05 acres of designated EFH for Pacific Coast salmon.

To reduce adverse alteration of the physical, chemical, or biological characteristics of the water and substrates and available prey, the Corps should encourage the applicant to:

1) Require their contractors to install full-depth silt curtains around in-water pile installation to minimize the spread of contaminants.

2) Require that contractors and tugboat operators adjust work practices to ensure that turbidity does not exceed 300 feet from the project site, and to halt work should the visible turbidity plum approach that range.

To reduce adverse alteration of benthic communities and the reduction in prey availability, the Corps should require the applicant to:

3) Ensure barges and other structures do not ground out on the bottom or anchor in submerged aquatic vegetation.
4) Ensure their contractors use the lowest safe maneuvering speeds and power settings when maneuvering in shallow water close to the shoreline, with the intent to minimize propeller wash.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the Corps 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 user of this opinion is the Corps. Other interested users could include marina and residential pier project applicants, the citizens of Seattle, and tribes. 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 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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