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-2018-0065

January 29, 2021

Mr. Calvin J. Terada
Program Manager
Emergency Response Program
1200 Sixth Avenue
Mail Stop ECL-116
U.S. EPA, Region 10
Seattle, Washington 98101

Mr. R. E. McFarland
Incident Management and Preparedness Advisor
U.S. Coast Guard
13th Coast Guard District
Planning Division
915 Second Avenue
Seattle, Washington 98174

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Northwest Area Contingency Plan for the Response to Spills of Oil and Hazardous Substances (NWACP)

Dear Mr. Terada and Mr. McFarland:

Thank you for your letter of July 16, 2018, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the Northwest Area Contingency Plan for the Response to Spills of Oil and Hazardous Substances. This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016).

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

NMFS' biological opinion pursuant to ESA section 7(a)(2) on the effects of the NWACP is enclosed with this letter. In our opinion, we concluded that the proposed actions are not likely to jeopardize:

1. Puget Sound Chinook salmon,

2. Puget Sound steelhead,
3. Hood Canal chum salmon,
4. Lake Ozette sockeye salmon,
5. Bocaccio rockfish,
6. Yelloweye rockfish,
7. Pacific eulachon
8. Lower Columbia River Chinook salmon,
9. Lower Columbia River steelhead,
10. Lower Columbia River coho salmon,
11. Columbia River chum salmon,
12. Oregon Coast coho salmon,
13. Southern Oregon/Northern California Coastal coho salmon,
14. Upper Willamette River Chinook salmon,
15. Upper Willamette River steelhead,
16. Middle Columbia River steelhead trout,
17. Upper Columbia River spring-run Chinook salmon,
18. Upper Columbia River steelhead trout,
19. Snake River fall-run Chinook salmon,
20. Snake River spring/summer-run Chinook salmon,
21. Snake River steelhead,
22. Snake River sockeye salmon

or adversely modify their designated critical habitat.

We also determined that the proposed action is not likely to adversely affect:

1. Green sturgeon,
2. Leatherback sea turtles
3. Central American DPS humpback whales
4. Mexico DPS humpback whales
5. Green sea turtles,
6. Olive Ridley sea turtles,
7. Loggerhead turtles,
8. Blue whales,
9. Fin whales,
10. North Pacific right whales,
11. Sei whales,
12. Southern Resident DPS Killer whales,
13. Sperm whales,
14. Western North Pacific Gray whales,
15. Guadalupe fur seals.

Please contact Tom Hausmann, Portland, Oregon, 503-231-2315, or Tom.Hausmann@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: Elizabeth Petras, EPA
Andrea Latier, EPA

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

Northwest Area Contingency Plan for the Response to Spills of Oil and Hazardous Substances

NMFS Consultation Number: WCRO-2018-00065

Action Agencies: United States Environmental Protection Agency
United States Coast Guard

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?**
1.	Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*)	Threatened	Yes	No	Yes	No
2.	Puget Sound Steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
3.	Hood Canal chum salmon (*O. keta*)	Threatened	Yes	No	Yes	No
4.	Lake Ozette sockeye salmon (*O. nerka*)	Threatened	Yes	No	Yes	No
5.	Bocaccio rockfish (*Sebastes paucispinis*)	Endangered	Yes	No	Yes	No
6.	Yelloweye rockfish (*S. ruberrimus*)	Threatened	Yes	No	Yes	No
7.	Pacific eulachon (*Thaleichthys pacificus*)	Threatened	Yes	No	Yes	No
8.	Green sturgeon (*Acipenser medirostris*)	Threatened	Yes	No	Yes	No
9.	Lower Columbia River Chinook salmon (*O. tshawytscha*)	Threatened	Yes	No	Yes	No
10.	Lower Columbia River steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
11.	Lower Columbia River coho salmon (*O. kisutch*)	Threatened	Yes	No	Yes	No
12.	Columbia River chum salmon (*O. keta*)	Threatened	Yes	No	Yes	No
13.	Oregon Coast coho salmon (*O. kisutch*)	Threatened	Yes	No	Yes	No
14.	Southern Oregon/Northern California Coastal coho salmon (*O. kisutch*)	Threatened	Yes	No	Yes	No
15.	Upper Willamette River Chinook salmon (*O. tshawytscha*)	Threatened	Yes	No	Yes	No

	ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
16.	Upper Willamette River steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
17.	Middle Columbia River steelhead trout (*O. mykiss*)	Threatened	Yes	No	Yes	No
18.	Upper Columbia River spring-run Chinook salmon (*O. tshawytscha*)	Endangered	Yes	No	Yes	No
19.	Upper Columbia River steelhead trout (*O. mykiss*)	Threatened	Yes	No	Yes	No
20.	Snake River fall-run Chinook salmon (*O. tshawytscha*)	Threatened	Yes	No	Yes	No
21.	Snake River spring/summer-run Chinook salmon (*O. tshawytscha*)	Threatened	Yes	No	Yes	No
22.	Snake River steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
23.	Snake River sockeye salmon (*O. nerka*)	Endangered	Yes	No	Yes	No
24.	Leatherback sea turtle *(Dermochelys coriacea)*	Endangered	No	No	No	No
25.	Central America DPS humpback whales (*Megaptera novaeangliae*)	Endangered	No	No	No	No
26.	Mexico DPS humpback whale (*Megaptera novaeangliae*)	Endangered	No	No	No	No
27.	Green sea turtles *(Chelonia mydas)*	Endangered	No	No	NA	NA
28.	Olive ridley sea turtle (*Lepidochelys olivacea*)	Endangered	No	No	NA	NA
29.	Loggerhead sea turtle (*Caretta caretta*)	Threatened	No	No	No	No
30.	Blue whales (*Balaenoptera musculus*)	Endangered	No	No	NA	NA
31.	Fin whales (*Balaenoptera physalus*)	Endangered	No	No	NA	NA
32.	North Pacific right whales (*Eubalaena japonica*)	Endangered	No	No	No	No
33.	Sei whales (*Balaenoptera borealis*)	Endangered	No	No	NA	NA
34.	Southern Resident DPS Killer whales (*Orcinus orca*)	Endangered	No	No	No	No
35.	Sperm whales (*Physeter macrocephals*)	Endangered	No	No	NA	NA
36.	Western North Pacific Gray whales (*Eschrichtius robustus*)	Endangered	No	No	NA	NA
37.	Guadalupe fur seals (Arctocephalus townsendi)	Threatened	No	No	NA	NA

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	No
Pacific Coast Groundfish	Yes	No
Coastal Pelagic Species	Yes	No

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: January 29, 2021

TABLE OF CONTENTS

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 Lacey, Washington.

1.2. Consultation History

On November 6, 2003, NMFS issued a ten year Biological Opinion (NWR-2002-1959) on the Oil Spill Response Activities Conducted Under the Northwest Area Contingency Plan (NWACP). That Biological Opinion expired in 2013. The NWACP is prepared and maintained by the Environmental Protection Agency (EPA), United States Coast Guard (USGC), Washington State Department of Ecology (Ecology), Idaho Office of Emergency Management (IOEM), Oregon Department of Environmental Quality (ODEQ), and members of the Northwest Area Committee (NWAC). These entities serve as the Region 10 Regional Response Team (RRT).

On October 8, 2014, NMFS and United States Fish and Wildlife Service (USFWS) staff attended a Regional Response Team (RRT) Executive Committee meeting in Portland, Oregon. This meeting focused on the Center for Biological Diversity (CBD) and Friends of the Columbia River Gorge September 3, 2014 Notice of Intent (NOI) to sue the EPA and USCG for their failure to consult with the Services on the NWACP.

On October 31, 2014, NMFS received a request from the EPA and USCG for a list of threatened or endangered species and critical habitat that may be present in the project action area.

On November 19, 2014, NMFS provided a species list to the requesting agencies.

On January 7, 2015, NMFS attended a pre-consultation kick off meeting in Portland, Oregon, with the EPA, USCG, United States Fish and Wildlife Service (USFWS) and Department of Interior (DOI) representatives.

On January 24, 2015, NMFS attended a consultation task force meeting in Portland, Oregon, with the USCG, EPA, and USFWS.

On April 21, 2015, and on May 8, 2015, NMFS attended the action agency presentation, “Spill Response 101”, and discussed the use of the emergency action notification form prepared by a previous task force effort.

On June 9, 2015, NMFS attended the first full task force meeting in Lacey, Washington. The action agencies proposed to focus the consultation on a high risk of spills area map. The task force covered the following topics: action area, analytical framework, plan level consultation, conservation focus, matrix approach for deconstructing the action, lead office and incidental take.

On August 5, 2015, the EPA sent NMFS an email updating the action agencies’ progress on establishing the Statement of Work (SOW) and other contracting efforts to prepare the biological assessment.

On September 15, 2015, the action agencies and regulatory agencies met in Lacey, Washington, to discuss how to find species information online and to review the final SOW for contractor support for the biological assessment. The agencies also discussed efforts of the National Environmental Compliance Subcommittee of the National Response Team (NRT) to provide further guidance for implementation of the national Memorandum of Understanding (MOU) for spill response planning and the use of chemical dispersants.

On October 30, 2015, the EPA informed NMFS that they had obtained contractor support to complete the BA.

On December 15, 2015, action agencies and their contractors (BA working group) met with NMFS, USFWS and DOI in Portland, Oregon to discuss roles, responsibilities, and components of the BA. This discussion covered the description of the proposed action, the species list, the extent of the action area, the environmental baseline, the inclusion of spill scenarios, national spill planning, and emergency consultation procedures. NMFS agreed to help refine the list of potentially affected species presented by the action agencies at the meeting, and to provide information to assist in developing species assessments.

On January 12, 2016, the BA working group and the Services met to discuss work schedule and participation, components of the proposed action, best management practices (BMPs), the effects of other activities caused by the proposed action, action area extent, oil in the baseline, a refined species list, and refined emergency consultation procedures. The action agencies mentioned they were seeking internal clarification on what specific actions, such as hazing and preapproved activities, they may or may not include within the scope of the proposed action.

On January 25, 2016, the action agencies emailed NMFS a draft BA template including a first draft proposed action and action area description for comments.

On February 22, 2016, the action agencies emailed NMFS draft action area maps for comments.

On March 9, 2016, the action agencies emailed NMFS an updated species list for comments.

On April 26, 2016, the BA working group and the Services had a conference call to discuss progress and BA development next steps. The callers also discussed how the incident command structure affects the NWACP process, BMPs, conservation measures, and the proposed action. The USFWS requested the action agencies deconstruct the proposed action into specific response components along with the species exposure pathway, species response and species effects analysis for each response component in a tabular matrix.

On September 16, 2016, the BA working groups and the Services had a conference call to discuss further refining the proposed action description and the draft matrix tables. The callers also discussed the relationship of the NWACP to geographic response plans (GRPs), response components of in-situ-burning, and further refinement of the species list.

On October 11, 2016, the BA working group and Services met to discuss further refinement of the species list and the draft proposed action matrix. Meeting attendees also discussed 'no effect' determinations under consideration by the action agencies.

On January 10, 2017, the BA working group and Services met to receive and update on the status of the BA components. In addition, meeting attendees discussed the need to ensure the matrix approach properly aligns with the efforts out of USFWS Headquarters to provide guidance on matrix preparation.

On March 1, 2017, the Services received via email from the action agencies the environmental baseline section of the BA for comments.

On March 14, 2017, the Services attended a conference call with the BA team to discuss the Service's review and comments on the draft environmental baseline section and to discuss the action agencies' proposed approach for the effects analysis section of the BA.

On August 8, 2017, the Services received via email from the action agencies a request to review the first full draft BA. NMFS provided comments on September 28, 2017.

On January 19, 2018, the BA team and Services met via conference call to discuss comments, progress and schedule on the draft BA.

On January 29, 2018, the Services provided technical assistance via email to the action agencies, specifically to clarify comments made on December 4, 2017, that successful initiation of formal consultation could be accomplished with appropriate consideration of the comments and guidance the Services have already provided. This information was further supported with additional guidance and information provided by the Services regarding the next steps in the consultation process.

On July 16, 2018, the NMFS received from the action agencies via email (and later via regular mail) the final BA and cover letter requesting initiation of formal consultation.

On August 29, 2018, NMFS provided a letter to the action agencies confirming their request to initiate formal consultation.

On October 19, 2018 NMFS, EPA and USCG had a conference call to discuss NMFS non concurrence with the BA conclusion that response actions are not likely to adversely affect rockfish.

On February 22, 2019, NMFS, USFWS, EPA and USCG had a conference call to discuss the approach to incidental take in the USFWS and NMFS biological opinions, particularly in light of 2015 changes to the ESA regulations.

On October 22, 2019, the Service provided the action agencies a draft Biological Opinion for their consideration.

On February 24, 2020 the action agencies provided written comments on the draft Biological Opinion to NMFS.

On March 12, 2020, NMFS and the action agencies had a conference call to discuss the action agency comments.

On October 1, 2020, NMFS emailed letters to 37 Tribes with tribal land or usual and accustomed hunting and fishing areas in or adjacent to the proposed action area, offering them the opportunity to consult with NMFS on the Biological Opinion. On December 10, 2020, NMFS sent a fact sheet summarizing the Biological Opinion to five Tribes that requested further information. These tribes did not request further consultation with NMFS.

On November 25, 2020, NMFS the EPA and USCG a 2nd draft of the Biological Opinion to ensure that all of the comments on the October 22, 2019 draft were adequately addressed. On January 8, 2021, the EPA and USCG identified 12 comments that required further explanation. Those comments were discussed during telephone calls on January 8 and January 12, 2021.

1.3. Proposed Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02).

1.3.1 Response Actions

The EPA and the USCG propose to respond to discharges of oil and hazardous materials that threaten surface water per the Northwest Area Contingency Plan (NWACP) actions and best management practices (BMP) summarized below. We provide a copy of the Biological Assessment table describing these actions as a convenience to readers in Appendix 6.1.

1. Responders may use vessels in rivers, along shorelines, in the marine nearshore and in open marine water. The type of vessel used is determined based on its capabilities relative to spill specific needs. The vessel draft may limit use in shallow areas.

    a. The use of vessels would take into consideration sensitive habitats (e.g., nesting areas or spawning areas) based on presence and distribution of wildlife such as birds and mammals (to the extent that information is available in geographic response plans (GRPs), and avoid these areas when possible.
    b. Observe instructions in GRPs that outline boat and watercraft use restrictions within 183 m (200 yards) of National Wildlife Refuge sites or other sensitive areas.
    c. Obtain maps of sanctuary zones and vessel BMPs and standard operating procedures (SOP) for marine mammals.
    d. Do not stage boats such that shoreline vegetation is crushed. Boats should not rest on or press against vegetation at any time.
    e. Avoid anchor or prop-scarring of submerged vegetation.
    f. Maintain a buffer of at least 91 meters (100 yards) from marine mammals (e.g., whales) and 183 meters (200 yards) from Southern Resident Killer Whales.
    g. Do not move into the path of whales. If approached by a marine mammal, put the engine in neutral and allow it to pass.

2. Responders may use vehicles or heavy machinery to establish staging areas and support response actions heavy machinery in riparian areas and along shorelines. The type of vehicle used is determined based on its capabilities relative to spill-specific needs. Adverse weather (e.g., thunderstorms, low visibility) may limit use. Responses very rarely involves establishing staging areas in undeveloped environments. Most staging areas are in developed areas such as parking lots.

    a. Minimize traffic through oiled areas on non-solid substrates (e.g., sand, gravel, dirt) to reduce the likelihood that oil will be worked into the sediment.
    b. The use of heavy machinery is rare; when necessary, its use will take into consideration sensitive habitats (e.g., nesting areas or spawning areas) based on presence and distribution of fish and wildlife in the area and avoid these areas when possible.
    c. Consult GRPs, if established for the response area, to set staging area in location already identified for the purpose and having minimal additional impact on threatened and endangered species and designated critical habitat.
    d. Generally, vehicles are used on sand beaches and restricted to transiting outside of the oiled areas along the upper part of the beach. Use vehicles near listed plants or wildlife only if the benefits outweigh potential impacts.

3. Responders may establish and use staging areas in upland and riparian areas for solid and liquid waste management. Establishing a new staging area (beyond using an existing

parking lot or otherwise already developed area) is rare. Typically, response vessels launch from existing marinas. Equipment staging for routine spills is minimal and typically contained in small cargo trailers. Spills nearshore and in open water are typically accessed from existing vessel locations. Spills located in remote locations may require construction of new vessel, vehicle, and personnel access locations with associated land clearing and staging of necessities such as fuel tanks.

a. Use the same access point for repeat entries.
b. Construct new access points only when no other options are available to reach the location (emergency consultation may be necessary).
c. If new access points are needed, conduct a preliminary survey to determine the best route. Locate staging area and support facilities in the least sensitive area possible (use areas identified in GRPs, if available).
d. Special restrictions should be established for sensitive areas where foot traffic and equipment operation may be damaging, such as soft substrates.
e. Establish work zones and access in a manner that reduces contamination of clean areas. Observe species-specific buffer zones (e.g., 91 to 183 meters (100 to 200 yards) for marine mammals, see Section 4) when planning and implementing response action.
f. Remove all trash or anything that would attract wildlife to the site daily.
g. Do not cut, burn, or otherwise remove vegetation unless specifically approved by the EU.
h. Do not attempt to capture oiled wildlife. Report oiled wildlife sightings to the Wildlife Hotline.

4. Spill response may require foot traffic in upland, riparian, wetland and shoreline spill sites. Oiled shorelines may be accessed from existing roads, paths, etc. or from the water.

    a. Restrict access to specific areas for periods of time to minimize impacts on sensitive biological populations (e.g., nesting, breeding, or fish spawning).
    b. Walk on durable surfaces to the extent practicable; restrict foot traffic from sensitive areas (e.g., marshes, shellfish beds, salmon redds, algal mats, bird nesting areas, dunes, etc.) to reduce the potential for damage; use plywood or other material to reduce compaction.
    c. Minimize foot traffic through oiled areas on non-solid substrates (sand, gravel, dirt, etc.) to reduce the likelihood that oil will be worked into the sediment.

5. Responders may use aircraft over upland, riparian, shoreline and marine areas to monitor for wildlife and track the spill trajectory. Flying is typically restricted within a 457-meter (1,500-foot) radius, below 305 meters (1,000 feet) from areas identified as sensitive, with some areas (e.g., Olympic Coast National Marine Sanctuary) having more restrictive zones. Adverse weather (e.g., thunderstorms, low visibility, low cloud ceiling) may limit use. Aerial surveillance usually only happens during a large spill, so it's not a typical occurrence.

a. Observe flight restriction zones specified in the GRPs, including minimum ceiling height (altitude of 305 meter [1,000 feet] above ground is advised) and distance from known or suspected wildlife areas (e.g., nesting areas) in order to reduce wildlife exposure to noise or presence of airplanes or helicopters.

6. Responders may manage solid waste in upland, riparian, shoreline, marine nearshore and marine open water staging areas. Solid waste management is common to all response actions except natural attenuation.

   a. Oregon and Washington require that responders develop a waste management plan in accordance with the local ACP area contingency plan (ACP) (or regional contingency plan (RCP) in the absence of an ACP) that describes how waste will be stored and handled and how the possibility for disposed wastes to cause future environmental damage will be minimized. Solid waste management must be addressed in the disposal plan.
   b. Follow standard protocols for waste management actions. Waste accumulation and storage locations should meet the following criteria: spill prevention, control, and countermeasures are in place; storm water pollution prevention plans have severe weather contingency plans; ample storage for segregation of wastes; and an emergency response plan for waste accumulation/storage locations.
   c. Access to waste is restricted (temporary and semi permanent). Waste disposal plans describe the waste tracking system. Reporting system should be established (temporary and semi-permanent).
   d. Maintain adequate response equipment during waste management actions to respond quickly and appropriately to re-release of pollution.
   e. Establish temporary upland collection sites for oiled waste materials for large spill events; collection sites should be lined and surrounded by berms to prevent secondary contamination from run-off.
   f. Coordinate the locations of any temporary waste staging or storage sites with the Environmental Unit (EU).
   g. Separate and segregate any contaminated wastes generated to optimize waste disposal stream and minimize what has to be sent to hazardous waste sites.

7. Responders may manage liquid waste in upland, river, shoreline, marine nearshore and open marine water staging areas. Liquid waste management is common to many response actions. Decanting of oily water may be necessary during operations involving recovery of oil. Water may be mixed with the oil during recovery and need to be returned to the response area to preserves storage space for recovery of the maximum amount of oil possible.

   a. Liquid waste management must be addressed in the disposal plan.
   b. The response contractor or responsible party will seek approval from the Federal On Scene Coordinator (FOSC) and/or State On Scene Coordinator (SOSC) prior to decanting.
   c. Follow standard protocols for waste management actions.

d. Maintain adequate response equipment during waste management actions to respond quickly and appropriately to re-release of pollution.
e. Minimize the amount of water collected during skimming.
f. All decanting shall be done in a designated "Response Area" within a collection area, vessel collection well, recovery belt, weir area, or directly in front of a recovery system; a containment boom will be deployed around the collection area, where feasible, to prevent the loss of decanted oil or entrainment of species in recovery equipment.
g. Decanting shall be monitored at all times, so that discharge of oil in the decanted water is promptly detected.
h. Where feasible, decanting will be done just ahead of a skimmer recovery system so that discharges of oil in decanting water can be immediately recovered.
i. Coordinate the locations of any temporary waste staging or storage sites with the EU.

8. Responders will likely decontaminate vessels, vehicles and equipment in upland, river, shoreline, marine nearshore and open marine water staging areas. Decontamination is required anytime durable (not disposable) equipment is used on a spill response.

    a. Decontamination areas for personnel and equipment must be addressed in the disposal plan.
    b. A decontamination/exclusion zone will be set up at each staging area. The area will be plastic lined to prevent pollution from oiled personal protective equipment (PPE) and equipment. Oiled PPE and equipment will be collected in plastic barrels.
    c. Maintain adequate response equipment during decontamination to respond quickly and appropriately to rerelease of pollution.
    d. The placement and containment of materials from decontamination is an important consideration during spill response, so safety controls and proper disposal areas are used to significantly reduce the risk that oil would re-enter the environment.

9. Responders may use booming (containment, diversion, deflection, exclusion and recovery) in riparian, shoreline, marine nearshore and open marine waters). Booming is a typical response tool to control the spread of a spill. Boom effectiveness is maximized when water depth is greater than 5 times the draft of the boom and booms are not used in water less than 46 centimeters (18 inches) in depth. Booms are less effective in rough water, high winds, and fast currents. In currents greater than 1 nautical mile per hour (knot) booms are not set across the river, but rather at an angle to direct oil into an area where it can be collected. Booms are used to prevent oil from contacting shorelines, to prevent oil from spreading, and collect oil to enable oil recovery. Booms are also used to contain remobilized oil during decontamination (e.g., vessels, industrial equipment) and shoreline cleanup.

    a. Boom strategies in the GRPs are designed to consider species occurrence and habitat use, to the extent possible.

b. Monitor for the presence of marine mammals and seabirds.
c. Ensure that EU or NOAA SSC provides information on possible presence and impacts to ESA-listed (protected) species or critical habitats.
d. To the extent practicable, and when practicable, observe species-specific buffer zones (e.g., 91 to 183 meters [100 to 200 yards] for marine mammal) when planning and implementing response action.
e. Evaluate need to restrict access to sensitive habitats (e.g., nesting areas or spawning areas) based on presence and distribution of wildlife such as birds and mammals.
f. Arrange booms to minimize impacts to wildlife and wildlife movements.
g. Locate boom anchors using strategies identified in GRPs, if available.

10. Responders may construct berms, dams, pits, trenches or other barriers in upland, riparian, shoreline areas. These are tactics with the objective of containing spilled oil and limiting spreading of oil slicks. These tactics are used when oil threatens sensitive habitats (e.g., upper intertidal and back-shore areas) and other barrier options (e.g., boom, skimmers, less invasive barriers) are not effective. The water body must be small enough to dam (not more than about 3 meters (10 feet) across) and have low enough flow to not blow out an underflow dam. Equipment type – Motor graders are used if beach can sustain motor traffic well; front-end loaders or bulldozers are used if beach cannot sustain motor traffic well.

    a. Coordinate with the Services. Contact the EU to determine if any permits are required.
    b. Restrict use and closely monitor operations in sensitive habitats.
    c. Line the bottom of trenches that do not reach the water table (dry) with plastic to prevent the collected oil from penetrating deeper into the substrate.
    d. Minimize erosion and sediment runoff using engineered controls (e.g., silt fences and settling ponds).
    e. Minimize suspension of sediment to limit effects on water quality.
    f. Remove structures and fill trenches once response action is completed. Coordinate with the Services prior to constructing underflow dams.

11. Responders may block the top half of culverts in river, wetland and shoreline areas. Open culverts present a potential route for spilled oil to enter otherwise unaffected areas. This tactic is often used to protect sensitive habitats that are located downstream of the barrier. This tactic may be used to block tidal inflow to an up gradient waterbody. Generally only 61-centimeter- (<24-inch-) diameter culvert pipes are blocked. If complete blocking results in flooding, an underflow dam or booming would be used instead.

    a. Monitor water quality and sufficient flow downstream of barriers.
    b. Evaluate need to restrict access to sensitive habitats (e.g., nesting areas or spawning areas) based on presence and distribution of wildlife such as birds and mammals.

c. To the extent practicable, and when practicable, observe species specific buffer zones (e.g., 91 to 183 meters [100 to 200 yards] for marine mammals) when planning and implementing response action.
d. Minimize erosion and runoff using engineered controls (e.g., silt fences and settling ponds).
e. Remove structures once completed.

12. Responders may use skimming or vacuuming in rivers, wetlands, shorelines, marine nearshore and open marine water. Skimming/vacuuming is typically deployed in areas where floating oil naturally accumulates. Oil can be collected against a shoreline or contained by a boom. Skimming only works as long as there is sufficiently thick oil, approximately 6.3 millimeters (0.25 inches). Shallow water prevents use of some skimmers. Emulsified oil (affected by weathering/wave action/heat/type of oil) cannot be skimmed. Skimming is less effective in rough water and strong currents. Waves, debris, seaweed, and kelp reduce efficiency.

    a. Use methods that minimize the amount of water relative to oil taken in (e.g., flat-head nozzle [duckbill] and skim/vacuum at water surface only).
    b. Operations in sensitive areas (e.g., marshes, submerged aquatic vegetation, worm beds) must be very closely monitored, and a site-specific list of procedures and restrictions must be developed to minimize damage to vegetation.
    c. Adequate storage for recovered oil/water mixtures, as well as suitable transfer capability, must be available.
    d. Position intake to minimize plankton and larvae entrainment.
    e. To the extent practicable, and when practicable, observe species-specific buffer zones (e.g., 91 to 183 meters [100 to 200 yards] for marine mammals, see Section 4) when planning and implementing response action.

13. Responders may passively collect oil with sorbents (e.g., sorbent pads, sausage booms, pom poms and peat) in rivers, wetlands shorelines and the marine nearshore. The use of sorbents is labor intensive. Sorbents are typically hand placed from a light motor vehicle or shallow water craft; usually used for small quantities of oil and as an indicator of oil presence (will be marked by oil). Sorbents are often used on sheen, though they are ineffective because there must be sufficient product to be absorbed (sheen usually not sufficient quantity). Sorbents are more likely to be used in difficult-to-access areas where skimming is infeasible or in conjunction with most other response actions (not skimmers). Sorbents may be reused. Wave and tidal energy, as well as the oil type, affect efficacy.
    a. Retrieval of sorbent material, and at least daily monitoring to check that sorbents are not adversely affecting wildlife or breaking apart, are mandatory.
    b. Coordinate with the EU for corrective actions if entrapment of small crustaceans is observed.
    c. Continually monitor and collect passive sorbent material to prevent it from entering the environment as non-degradable, oily debris
    d. Follow appropriate cleaning and waste disposal protocols and regulations.

14. Responders may manually remove oil and oiled substrate using hand tools (e.g., rakes, shovels and scrapers) in upland, riparian, wetland and shoreline areas. This method is generally used on shorelines where the oil cannot be easily removed by mechanical means. Manual removal can be used on mud, sand, gravel, and cobble when oil is light, sporadic, and/or at or near the beach surface, or when there is no beach access for heavy equipment. Manual removal can be used to remove gross oil contamination (e.g., thick black oil, tar balls, congealed oils,) from shorelines or submerged oil that has formed semi-solid or solid masses. Manual removal is used in places that are difficult to access with heavy equipment. Adverse weather conditions (e.g., thunderstorms, snow and ice, extreme temperatures) may limit access and use. Responders may clean lightly contaminated coarse sediment and woody debris with ambient temperature, low pressure washing that will transport the oil into a pit or trench to be collected with sorbents. Flooding is applicable on all shoreline types where equipment can be effectively deployed; however, not recommended for steep intertidal or shorelines with fine grains or muddy substrates. Not generally useful on exposed rocky shorelines or submerged tidal flats because these areas are naturally well flooded.

    a. Restrict sediment removal to supra and upper intertidal zones (or above waterline on stream banks) to minimize disturbance of biological communities.
    b. Minimize the amount of sediment removed with the oil.
    c. Sediments should be removed only to the depth of oil penetration.
    d. Protect nearby sensitive areas from increased oil runoff/sheening or siltation by the proper deployment of booms, siltation curtains, sorbents, etc.; monitor for effectiveness of protection measures.
    e. Do not remove clean wrack; instead, move large accumulations of clean wrack to above the high-water line to prevent it from becoming contaminated.
    f. If in an archaeological and/or culturally sensitive area, activities may need to be monitored or may not be appropriate.

15. Responders may mechanically remove oil and oiled substrate (with or without excavation greater than 2.5 centimeters) and rework sediment in upland, riparian or shoreline areas. Mechanical removal with heavy equipment (e.g., bulldozers, backhoes) is usually implemented when the spill area/debris size exceeds the capacity of manual removal. It is typically used in sand, gravel, or cobble, where surface sediments are amenable to, and accessible by heavy equipment. The contaminated substrate is excavated to the depth of contamination. Dredging of sediments is only considered for sinking oils (rare). Sediment reworking may be used on sand or gravel beaches with high erosion rates or low sediment replenishment rates or where remoteness or other logistical limitations make sediment removal unfeasible.

    a. Implement after the majority of oil has come ashore, unless significant burial (sand beaches) or remobilization is expected; implement between tidal cycles to minimize burial and/or remobilization of oil.
    b. Protect nearby sensitive areas from increased oil runoff/sheening or siltation by the proper deployment of booms, siltation curtains, sorbents, etc.; monitor for effectiveness of protection measures.

c. Minimize the amount of oiled sediment removed by closely monitoring mechanical equipment operations.
d. In areas prone to erosion, replace removed sediment or soil with clean sediment.
e. Minimize erosion and runoff using engineered controls.
f. Monitor for the presence of special status animals and plants.
g. To the extent practicable, and when practicable, observe species-specific buffer zones (e.g., 91 to 183 meters [100 to 200 yards] for marine mammals, when planning and implementing response action.

16. Responders may remove woody debris and cut and remove terrestrial and aquatic vegetation (before or after oiling) in terrestrial, riparian, wetland and shoreline areas. This tactic is conducted before or after spill has been contained and cleanup activities begin. It is more likely to be used for plants that will grow back. Lightly oiled vegetation is typically left in place. Vegetation is removed if it poses a contact hazard to wildlife. Beach wrack is relocated before oil comes ashore when possible. Removal of large wood is generally avoided, unless it poses a persistent source of oil.

    a. Resource experts are routinely consulted regarding these concerns prior to vegetation removal.
    b. Strict monitoring of the operations must be conducted to minimize the degree of root destruction and mixing of oil deeper into the sediments.
    c. For plants attached to rock boulder or cobble beaches, sources of population recruitment must be considered. Access to bird nesting areas should be restricted during nesting seasons.
    d. Concentrate removal on vegetation and wood debris that is moderately to heavily oiled; leave lightly oiled and clean vegetation and wood debris in place.
    e. Do not remove clean, natural shoreline debris; instead, move large accumulations of clean debris to above the high-water line to prevent it from becoming contaminated.

17. Responders may use ambient temperature, low pressure flooding/flushing in terrestrial, riparian, lake, wetland and shoreline areas. Flooding is applicable on all shoreline types where equipment can be effectively deployed; however, not recommended for steep intertidal or shorelines with fine grains or muddy substrates. Not generally useful on exposed rocky shorelines or submerged tidal flats because these areas are naturally well flooded. The location must accommodate a collection boom (sufficiently large area and receiving water flow needs to be slow). Flooding/flushing works only on fresh oil (others require pressure washing).

18. Responders may construct underflow dams and berms to trap and contain oil in stream channels that are less than 10 feet wide. These are tactics with the objective of containing spilled oil and limiting spreading of oil slicks. These tactics are used when oil threatens sensitive habitats (e.g., upper intertidal and back-shore areas) and other barrier options (e.g., boom, skimmers, less invasive barriers) are not effective. The water body must be small enough to dam (not more than about 3 meters (10 feet) across) and have low enough flow to not blow out an underflow dam. Motor graders are used if beach can

sustain motor traffic well; front-end loaders or bulldozers are used if beach cannot sustain motor traffic well.

a. Implement after the majority of oil has come ashore, unless significant remobilization is expected; implement between tidal cycles to minimize remobilization of oil.
b. Protect nearby sensitive areas, identified in the GRPs or under advisement of the Services, from increased oil runoff/sheening or siltation by the proper deployment of booms, siltation curtains, sorbents, etc.; monitor for effectiveness of protection measures.
c. Use the lowest pressure that is effective and prevent suspension of bottom sediments (do not create a muddy plume).
d. Conduct all flushing adjacent to marshes from boats.
e. In marshes conduct at high tide either from boats or from the high-tide line to prevent foot traffic in vegetation.
f. Closely monitor flooding of shorelines with fine sediments (mixed sand and gravel, sheltered rubble, sheltered vegetative banks, marshes) to minimize excessive siltation or mobilization of contaminated sediments into the subtidal zone.
g. Prevent pushing or mixing oil deeper into the sediment by directing water above or behind the surface oil to create a sheet of water to remobilize oil to containment area for recovery.
h. Restrict flushing in marshes during high tide above the high tide line to minimize mixing oil into the sediments or mechanically damaging plants.

19. Responders may use pressure washing, steam cleaning or sand blasting in terrestrial, riparian and shoreline areas. Pressure washing/steam cleaning or sand blasting are infrequently used when heavy oil residue must be removed for aesthetic reasons (ship hulls, break-walls, man-made structures). Steam and sand blasting are very infrequently, if ever, used in the NW. Contaminated vessels are boomed with sorbents in industrial area, cleaned, and then released when clean.

a. Implement after the majority of oil has come ashore.
b. Restrict use to certain tidal elevations so that the oil/water effluent does not drain across sensitive low-tide habitats.
c. Closely monitor operations in sensitive habitats.
d. If small volumes of warm water are used to remobilize weathered oil from rocky surface, include larger volume of ambient water at low pressure to help carry re-mobilized oil into containment area for recovery.
e. Monitor booms and oil collection methods to prevent transport of oil and oiled sediments away from site to near shores and down coast.
f. Monitor for wildlife such as birds and mammals (evaluate need for hazing); establish buffer zone (i.e., nesting areas, haul out areas, spawning areas).
g. Avoid sensitive habitats (e.g., soft substrates, aquatic vegetation, spawning areas, etc.).

20. Responders may physically herd oil in rivers and lake, shoreline, wetland and marine nearshore areas. Physical herding is used to move oil into containment. It is rarely used to move oil more than a few hundred feet. Sufficiently thick product is required. When oil is contained in hard-to-access places (e.g., against seawalls or under docks), prop-wash from a vessel can help to push the product to a collection area (e.g., boom).

    a. Monitor for the presence of wildlife and plants.
    b. Minimize erosion and runoff using engineered controls (to the extent practicable).

21. Responders may use chemical dispersion in open marine water outside of the no dispersant use zone or in the case by case zone with emergency consultation. Chemical dispersion is only used in marine water bodies with sufficient depth (>18 meter [60 feet] deep). Dispersants are applied as soon as possible after a spill (when oil is not weathered and more concentrated). Chemical dispersion works best when there is wave energy to mix the dispersant into the oil and can be used in strong currents and higher sea states. Chemical dispersants are only applied to spilled oil and with completion of the dispersant use checklist, as described in the NWACP. In areas where dispersant use is not pre-authorized, RRT activation and approval is necessary before use.

    a. Requires Regional Response Team approval prior to use unless in a Pre-Authorization Zone.
    b. The EU would prepare a Net Environmental Benefit Analysis to evaluate the potential risk to animals and habitats in the area compared to not using dispersants.
    c. Monitor wildlife; establish species-specific buffer zone(s); use in water with adequate volume for dilution; apply only under conditions known to be successful; use only chemicals that are approved for use; implement wildlife deterrent techniques as needed.
    d. Special monitoring of applied response techniques (SMART) will be used to measure efficacy. SMART is a standardized monitoring program designed to monitor chemical dispersion and in situ burning activities.
    e. Follow dispersant policy checklist of environmental conditions which dictates favorable conditions for use.
    f. Aircraft should spray while flying into the wind and avoid spraying into strong crosswinds.

22. Responders may use in-situ burning in pre-authorization zones. Pre authorization zones are any area that is more than 3 miles from human population (>100 or more people per square mile). In situ burning in all other areas need incident-specific authorization.

    a. Requires Regional Response Team concurrance prior to use.
    b. Prior to an in situ burn, an on-site survey must be conducted to determine if any threatened or endangered species are present or at risk from burn operations, fire, or smoke.

c. Environmental Benefit Analysis would be conducted to evaluate the possible risk to species in the area of the in-situ burn and compare it to the risk of not using in-situ burning.
d. Protection measures may include moving the location of oil (in water) to an area where listed species are not present; temporary employment of hazing techniques, if effective; and physical removal of individuals of listed species only under the authority of the trustee agency.
e. Provisions must be made for mechanical collection of burn residue following any burn(s) (e.g., collection with nets, hand tools, or strainers).
f. SMART will be used to measure efficacy. SMART is a standardized monitoring program designed to monitor chemical dispersion and in situ burning activities.

23. Responders may use natural attenuation (with monitoring) in terrestrial, river and lake, shoreline, marine nearshore and marine offshore areas. Responders use natural attenuation when the adverse impacts resulting from response activities outweigh the benefits. Examples include: 1) when oiling has occurred on high-energy beaches where wave action will remove most of the oil in a short time; 2) remote or inaccessible shorelines; 3) wetlands, where treatment or cleaning may cause more damage than leaving it to recover naturally; 4) other response techniques are not practical. This method may be inappropriate for areas with high numbers of people, mobile animals, or ESA-listed species.

    a. May consider relocation or hazing activities if appropriate.
    b. Minimize presence of people and equipment.

24. Responders may use places of refuge for disabled vessels in rivers, shorelines, marine nearshore and open marine water. Places of refuge are determined by which resources at risk are in the area, including ESA-listed species, seasonal breeding locations, or designated critical habitat; Essential Fish Habitat; aquaculture facilities; other resources, lands and/or waters with special designations; offshore fisheries; near shore fisheries. The USCG Captain of the Port has the authority to designate a place of refuge for a specific disabled vessel.

    a. Follow the places of refuge decision matrix (NWACP Section 9410) when human life is not at risk.
    b. EPA must be consulted on any off shore scuttling of a vessel.
    c. States, tribes, local governments, and other stakeholders will be conferred with on a case-by case basis.

25. Responders may recovery non-floating oil from river and lake, marine nearshore and open marine water areas if they identify the presence of oils (e.g., diluted bitumen, Group V residual fuel oils, low API oil, asphalt and asphalt products) that may submerge or sink when spilled.

    a. Priority given to preventing, minimizing, and containing non-floating oils.

b. Respond rapidly and aggressively to recover oils when on the surface (if safe to do so) before the oils start to sink.

26. Responders may use hazing and deterrence in riparian, wetland, shoreline, marine nearshore and open marine water areas. Hazing and deterrence will only be used when wildlife are observed near a spill and when deemed necessary to prevent exposure to spilled material or direct injury.

    a. Hazing or deterrence measures will be conducted only as necessary under in coordination with the Services. Hazing and deterrence will prevent direct injuries and chemical toxicity (associated with the spilled material) to wildlife at the expense of behavioral effects and temporary exclusion from resources.
    b. NMFS has granted pre-authorization to the FOSC to implement specific deterrence activities to prevent killer whales from entering oil.

The proposed action is limited to NWACP responses conducted in the following four geographic areas where there are ESA listed species:

1. The Pacific Ocean off the coast of Washington and Oregon out the to the economic exclusion zone (EEZ) boundary, and
2. The Straits of Juan de Fuca, the Straits of Georgia, and Puget Sound, within the United States and
3. Columbia River, Clearwater River and Lochsa River
4. Tributaries to the Columbia River and Puget Sound that are crossed by oil or fuel oil pipelines or railroad bridges for trains that transport crude oil from production fields to refineries. In these tributaries, the proposed action covers response activities from a point one mile downstream from the most downstream pipeline or railroad bridge crossing to a point one mile upstream from the most upstream pipeline or railroad bridge crossing.

The four waterbody categories[1] that comprise the geographical limits of the responses governed by the proposed action reflect those areas where response actions are most likely to have effects to listed species and their critical habitats. More specifically:

Responses that occur within rivers and streams and that fall within the proposed action are those that occur in tributaries to Puget Sound or the Columbia River that are crossed by oil and fuel oil pipelines and railroad bridges. These waterbodies support salmon and steelhead spawning, rearing and fresh water migration. Some of these rivers also support eulachon spawning, rearing and fresh water migration. The vast majority of reported spills in the (EPA managed) inland zone are for small amounts of oil, or for oil that does not threaten surface water. In the last two years, the EPA has been notified of approximately 1,000 oil spills in Washington, Oregon, and Idaho. Of the 1,000 notifications since 2016, fewer than 10 resulted in the EPA deploying a FOSC, and only five required multi-day operations and the formation of Unified Command (USEPA and USCG, 2018).

[1] The EPA and USCG described the proposed action area as any area where they are authorized and responsible for response to an oil spill or hazardous material spill. NMFS reviewed these areas to determine which meet the legal definition of action area, that is, areas where a proposed action may effect ESA listed species and/or critical habitats.

Puget Sound is crossed by crude oil tankers and oil barges enroute to refineries and terminals. The BNSF railroad also travels along several long lengths Puget Sound shoreline. Puget Sound supports salmon and steelhead rearing and migration. Puget Sound also supports rockfish spawning and rearing. Puget Sound also supports marine mammals. In Sector Puget Sound, there was also about 1000 spills over the last two years, with spills ranging from 0.01 to 3,400 gallons. The types of oil were diesel, hydraulic, gasoline, unknown oil types, bilge slop, lubricating oil, and others(USEPA and USCG, 2018). For vessel or barge spills into Puget Sound, within the pre-authorization area[2] where burning is feasible and can be conducted at a safe distance from populated areas or sensitive resources, FOSCs have the authority to ignite the spilled oil either with or without using burning agents without RRT approval and all the above BMPs apply. In Puget Sound north of a line from a line from Point Wilson to Fort Casey, responders may use chemical dispersants in waters greater than 3 miles of the shoreline that are greater than 60 feet deep with approval from the RRT 10. Chemical dispersants will be applied as soon as possible after a spill (when oil is not weathered and more concentrated. Chemical dispersants work best when there is wave energy to mix the dispersant into the oil. Chemical dispersants can be used in strong currents and higher sea states. Chemical dispersants are only applied to spilled oil after completion of the dispersant use checklist, as described in the NWACP. In areas where dispersant use is not pre-authorized, RRT activation and approval is necessary before use.

The Columbia River is crossed by fuel oil pipelines and a railroad bridge. Oil tankers and barges travel from the Columbia River mouth to Portland and fuel oil barges travel up the Columbia River from Portland to Pasco, Washington. The Columbia River supports chum salmon spawning, rearing and migration, salmon and steelhead rearing and migration and eulachon spawning rearing and migration. In USCG Sector Columbia River between 2011 and 2016, there were 470 records of petroleum spills, which ranged from 0.1 to 6,762 gallons in volume. The types of oil were diesel, hydraulic, automobile, and unknown oil type, while the remaining percentage comprised small numbers of spills of bilge slop, vegetable, lubricating, motor, and other oils. The majority of spills or potentials spills in the marine area are due to equipment failure or boat groundings, or from sunken pleasure craft or fishing vessels. In most of these cases, the spills are small, and the responses are correspondingly small and do not involve establishing an Incident Command Post and Unified Command. Most often, spills are responded to with a single Incident Commander and small response team, following ICS constructs (USEPA and USCG, 2018).

Oil tanker vessels and oil barges travel through the Strait of Georgia, Strait of Juan de Fuca and in the Pacific Ocean off the coast of Washington and Oregon. The Strait of Juan de Fuca and the Pacific Ocean support adult salmon and steelhead and eulachon migration, marine mammals and turtles. The Oil Spill Task Force (OSTF) for the Pacific states and British Columbia compiles data for oil spills occurring along the West Coast of the US, British Columbia, and Alaska, and tracks regional trends in spills and related causal factors. The analyses provided in the OSTF annual report (OSTF, 2017) indicate that most reported spills are minor (less than 1,000 gallons in the coastal region). These finding are consistent with information collected by the USCG Sectors. For example, the majority of spills are diesel oil, and there are many small spills of less

[2] *In situ* burning is pre-authorized for any on-water area that is more than 5 km (3 miles) from human population, defined as 100 or more people per square mile

than 42 gallons in the region (OSTF, 2017). In Oregon, 70% of reported spills in 2016 were 42 gallons or less; in Washington, 90% of reported spills were 42 gallons or less. In a review of spills greater than 10,000 gallons from 2002 through 2016, there were no spills of that size in the marine environment off the coasts of Oregon or Washington (OSTF, 2017).

In the marine environment, it is often possible to remove oil from the water's surface before the spill reaches a shoreline, so the response is limited to on-water cleanup. The use of chemicals (e.g., dispersants) or in situ burning must occur quickly, before the oil begins to change texture or becomes too diluted for the techniques to be successful. There is generally a 96-hour window to respond to oil using dispersants or in situ burning. The use of mechanical methods (e.g., booming and then skimming) or sorbents generally lasts from one day to one week (typically no more than four-days), depending on the type of spill. As noted, most spills in the marine zone are the result of equipment failure or sinking vessels; for such spills, a boom is laid out to control the oil, which is then cleaned up.

Chemical dispersants are pre authorized in the Pacific Ocean from 3 nautical miles off the coast of Washington and Oregon to the 200 nautical mile limit of the Economic Exclusion Zone except in the Olympic Coast National Marine Sanctuary. Chemical dispersants can be used on the first day following a spill with RRT approval in: waters within 3 miles of the shoreline that are greater than 60 feet deep, the Olympic Coast National Marine Sanctuary, the Strait of Juan de Fuca.

Responders will use chemical dispersants to help minimize the impacts of oil when mechanical recovery is limited and the risk of environmental harm from chemically dispersing the oil is less than allowing the oil to remain undispersed and affect sea birds and marine mammals at the ocean surface or be transported to sensitive shoreline areas. Responders may not use chemical dispersants in marine waters that are both less than 3 nautical miles from the US coastline and less than 60 feet deep, marine waters south of a line drawn between the Point Wilson to Point Casey (the Admiralty Head border defining the primary entrance to Puget Sound from the Pacific Ocean), or in freshwater environments.

1.3.2 Authority

Most responses are relatively small and last less than four-days. The effects analysis in this biological opinion are based upon a response of up to four-days. For these responses, emergency consultation is not necessary. The conditions under which emergency consultation will still be needed are limited to the following:

- Spills occurring outside the Action Area
- When the RRT is activated to make a decision on using a chemical countermeasure in navigable water (NCP Subpart J)
    - Use of dispersants in areas outside the dispersant use pre-authorization zone (NWACP Sections 4000 and 4612)

- o Use of chemicals other than dispersants (i.e., shoreline cleaners, solidifiers, bioremediation).
- o Use of burning agents (a.k.a. accelerants) to initiate and/or sustain in situ burns in the case-by-case in situ burn area and in the inland zone

The NWACP was jointly prepared by the EPA, USCG, Washington State Department of Ecology (Ecology), Idaho Office of Emergency Management, Oregon Department of Environmental Quality (ODEQ), and members of the Northwest Area Committee (NWAC) who serve as the EPA Region 10 Regional Response Team (RRT 10). EPA and USCG regulatory authority to respond to oil spills is defined under the OPA of 1990, which was an amendment to the CWA. This response authority is triggered by a discharge or threat of discharge of oil to surface water. If such a discharge or threat of discharge exists, these action agencies are authorized to direct response actions in order to protect human health and the environment.

The regulatory authority that the EPA and USCG use to respond to hazardous materials incidents comes from the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, also known as "Superfund"). This authority is triggered by a release of hazardous materials that immediately impact human health or the environment. This law includes a petroleum exclusion clause. There does not need to be a tie to surface water for the EPA and USCG to respond to spills of hazardous material.

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) is the regulation that defines how the EPA and USCG will exercise the authorities granted within CERCLA and the OPA. The NCP requires the creation of Area Contingency Plans. The NCP is the regulation that defines how the EPA and USCG will exercise the authorities granted within CERCLA and the OPA. Regulations at 40 CFR 300.210 also require the creation of a Regional Contingency Plan to support responders and provide overarching guidance to ACPs. The NWACP is a consolidated plan containing the two Captain of the Port ACPs, the EPA inland ACP, the states' response plan and the regional contingency plan. As described in the NWACP, a decision was made to combine response plans required at the Federal and State levels into one plan to facilitate collaboration and compliance with Federal and State regulations. The scope of this consultation is limited to Federal actions carried out, authorized or funded by the Federal On-Scene Coordinator (FOSC) authority as described above.

As described in the EPA and USCG BA, all incidents use Incident Command System (ICS), which follows the National Incident Management System (NIMS) standard. ICS responses provide scalable, modular frameworks which increase efficiency and agility to meet the specific needs of each scenario. It is the FOSC's discretion as to how to tailor the response team to meet the needs of the incident. For example, as noted elsewhere in the BA, most spills in the action area are less than 100 gallons of oil and do not require the FOSC to stand up an EU or a Wildlife Branch. However, the responders will reach out to the trustee agencies, NOAA and DOI, to aid in understanding which resources at risk that may be in the area and affected by a response. This contact fulfills the need to identify resources at risk, and it is appropriate for most responses; thus throughout this Biological Opinion references to engaging the EU and/or setting up a Wildlife Branch will be met through these contacts.

In 2020, the USCG Sector Puget Sound and Sector Columbia River produced and signed their own ACPs, consistent with the National Contingency Plan and USCG requirements. The sector ACPs supersede the NWACP as the federal response plans in the COTP zones. The EPA and USCG authority and responsibility to respond comes from OPA and CERCLA, not the NWACP. Response actions taken under these authorities will not change with the new ACPs.

Under MSA, Federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (50 CFR 600.910).]

We considered, under the ESA, whether or not the proposed action would cause any other activities and determined that it would not.

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

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

The EPA and USCG determined the proposed action is not likely to adversely affect

1. Green sturgeon
2. Leatherback sea turtles
3. Central American DPS humpback whales
4. Mexico DPS humpback whales
5. Green sea turtles,
6. Olive Ridley sea turtles,
7. Loggerhead turtles,
8. Blue whales,
9. Fin whales,
10. North Pacific right whales,
11. Sei whales,
12. Southern Resident DPS Killer whales,
13. Sperm whales,
14. Western North Pacific Gray whales,
15. Guadalupe fur seals

or their critical habitat. Our concurrence is documented in the "Not Likely to Adversely Affect" Determinations section (Section 2.13).

2.1. Analytical Approach

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

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

The 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.

When writing or reviewing this section, please be sure that it (or another section of the opinion):

- Includes additional information on the analytical approach and the tools the consulting biologist has used for his or her effects analysis.
- Identifies limitations in the information available for the assessment.
- Identifies the assumptions the consulting biologist must make to proceed using the best available information, and the basis for these assumptions.
- Considers other provisions described in 402.17 to identify activities that are reasonably certain to occur and consequences caused by 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 PBFs that are essential for the conservation of the species.

One factor affecting the status of ESA-listed species considered in this opinion, and aquatic habitat at large, is climate change. Climate change is likely (Tague et al., 2013) 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. 2014, Mote et al 2016). Rain-dominated watersheds and those with significant contributions from groundwater may be less sensitive to predicted changes in climate (Mote et al., 2014; Tague et al., 2013).

During the last century, average regional air temperatures in the Pacific Northwest increased by 1-1.4°F as an annual average, and up to 2°F in some seasons (based on average linear increase per decade; (Abatzoglou et al., 2014; Kunkel et al., 2013)). Recent temperatures in all but two years since 1998 ranked above the 20th century average (Mote et al., 2014). 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 (editor), 2007; Mote et al., 2013). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB (editor), 2007; Mote et al., 2014). Models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events), in the western United States (Dominguez et al., 2012). The largest increases in winter flood frequency and magnitude are predicted in mixed rain-snow watersheds (Mote et al., 2014).

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

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

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

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

Moreover, as atmospheric carbon emissions increase, increasing levels of carbon are absorbed by the oceans, changing the pH of the water. A 38 percent to 109 percent increase in acidity is projected by the end of this century in all but the most stringent CO2 mitigation scenarios, and is essentially irreversible over a time scale of centuries (IPCC, 2014). Regional factors appear to be amplifying acidification in Northwest ocean waters, which is occurring earlier and more acutely than in other regions and is already impacting important local marine species (Barton et al., 2012; Feely et al., 2012). Acidification also affects sensitive estuary habitats, where organic matter and nutrient inputs further reduce pH and produce conditions more corrosive than those in offshore waters (Feely et al., 2012; Sunda and Cai, 2012).

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

2.2.1 Status of the Species

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

Table 1. Summary of listing and recovery plan information, status summaries and limiting factors for the species addressed in this opinion.

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Puget Sound Chinook salmon	Threatened 6/28/05 (70 FR 37159)	Shared Strategy for Puget Sound 2007 NMFS 2006	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 TRT planning ranges for recovery, and most populations are consistently below the spawner-recruit levels identified by the TRT as consistent with recovery.	• Degraded floodplain and in-river channel structure • Degraded estuarine conditions and loss of estuarine habitat • Degraded riparian areas and loss of in-river large woody debris • Excessive fine-grained sediment in spawning gravel • Degraded water quality and temperature • Degraded nearshore conditions • Impaired passage for migrating fish • Severely altered flow regime
Puget Sound steelhead	Threatened 5/11/07	NMFS 2019	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 Puget Sound Steelhead DPS have not substantively changed since the listing in 2007, or since the 2011 status review. Furthermore, the Puget Sound Steelhead TRT recently concluded that the DPS was at very low viability, as were all three of its constituent MPGs, and many of its 32 populations. In the near term, the outlook for environmental conditions affecting Puget Sound steelhead is not optimistic. While harvest and hatchery production of steelhead in Puget Sound are currently at low levels and are not likely to increase substantially in the foreseeable future, some recent environmental trends not favorable to Puget Sound steelhead survival and production are expected to continue.	• Continued destruction and modification of habitat • Widespread declines in adult abundance despite significant reductions in harvest • Threats to diversity posed by use of two hatchery steelhead stocks • Declining diversity in the DPS, including the uncertain but weak status of summer-run fish • A reduction in spatial structure • Reduced habitat quality • Urbanization • Dikes, hardening of banks with riprap, and channelization

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Hood Canal summer-run chum	Threatened 6/28/05	Hood Canal Coordinating Council 2005 NMFS 2007	NWFSC 2015	This ESU is made up of two independent populations in one major population group. Natural-origin spawner abundance has increased since ESA-listing and spawning abundance targets in both populations have been met in some years. Productivity was quite low at the time of the last review, though rates have increased in the last five years, and have been greater than replacement rates in the past two years for both populations. However, productivity of individual spawning aggregates shows only two of eight aggregates have viable performance. Spatial structure and diversity viability parameters for each population have increased and nearly meet the viability criteria. Despite substantive gains towards meeting viability criteria in the Hood Canal and Strait of Juan de Fuca summer chum salmon populations, the ESU still does not meet all of the recovery criteria for population viability at this time.	• Reduced floodplain connectivity and function • Poor riparian condition • Loss of channel complexity Sediment accumulation • Altered flows and water quality

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lake Ozette sockeye salmon	Threatened 6/28/05	NMFS 2009a	NWFSC 2015	This single population ESU's size remain very small compared to historical sizes. Additionally, population estimates remain highly variable and uncertain, making it impossible to detect changes in abundance trends or in productivity in recent years. Spatial structure and diversity are also difficult to appraise; there is currently no successfully quantitative program to monitor beach spawning or spawning at other tributaries. Assessment methods must improve to evaluate the status of this species and its responses to recovery actions. Abundance of this ESU has not changed substantially from the last status review. The quality of data continues to hamper efforts to assess more recent trends and spatial structure and diversity although this situation is improving.	• Predation by harbor seals, river otters, and predaceous non-native and native species of fish • Reduced quality and quantity of beach spawning habitat in Lake Ozette • Increased competition for beach spawning sites due to reduced habitat availability • Stream channel simplification and increased sediment in tributary spawning areas
Puget Sound/ Georgia Basin DPS of Bocaccio	Endangered 04/28/10	NMFS 2017d	NMFS 2016d	Though bocaccio were never a predominant segment of the multi-species rockfish population within the Puget Sound/Georgia Basin, their present-day abundance is likely a fraction of their pre-contemporary fishery abundance. Most bocaccio within the DPS may have been historically spatially limited to several basins within the DPS. They were apparently historically most abundant in the Central and South Sound with no documented occurrences in the San Juan Basin until 2008. The apparent reduction of populations of bocaccio in the Main Basin and South Sound represents a further reduction in the historically spatially limited distribution of bocaccio, and adds significant risk to the viability of the DPS.	• Over harvest • Water pollution • Climate-induced changes to rockfish habitat • Small population dynamics

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Puget Sound/ Georgia Basin DPS of yelloweye Rockfish	Threatened 04/28/10	NMFS 2017d	NMFS 2016d	Yelloweye rockfish within the Puget Sound/Georgia Basin (in U.S. waters) are very likely the most abundant within the San Juan Basin of the DPS. Yelloweye rockfish spatial structure and connectivity is threatened by the apparent reduction of fish within each of the basins of the DPS. This reduction is probably most acute within the basins of Puget Sound proper. The severe reduction of fish in these basins may eventually result in a contraction of the DPS' range.	• Over harvest • Water pollution • Climate-induced changes to rockfish habitat • Small population dynamics
Southern DPS of eulachon	Threatened 3/18/10	NMFS 2017c	Gustafson et al. 2016	The Southern DPS of eulachon includes all naturally-spawned populations that occur in rivers south of the Nass River in British Columbia to the Mad River in California. Sub populations for this species include the Fraser River, Columbia River, British Columbia and the Klamath River. In the early 1990s, there was an abrupt decline in the abundance of eulachon returning to the Columbia River. Despite a brief period of improved returns in 2001-2003, the returns and associated commercial landings eventually declined to the low levels observed in the mid-1990s. Although eulachon abundance in monitored rivers has generally improved, especially in the 2013-2015 return years, recent poor ocean conditions and the likelihood that these conditions will persist into the near future suggest that population declines may be widespread in the upcoming return years	• Changes in ocean conditions due to climate change, particularly in the southern portion of the species' range where ocean warming trends may be the most pronounced and may alter prey, spawning, and rearing success. • Climate-induced change to freshwater habitats • Bycatch of eulachon in commercial fisheries • Adverse effects related to dams and water diversions • Water quality, • Shoreline construction • Over harvest • Predation

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Southern DPS of green sturgeon	Threatened 4/7/06	NMFS 2018	NMFS 2015c	The Sacramento River contains the only known green sturgeon spawning population in this DPS. The current estimate of spawning adult abundance is between 824-1,872 individuals. Telemetry data and genetic analyses suggest that Southern DPS green sturgeon generally occur from Graves Harbor, Alaska to Monterey Bay, California and, within this range, most frequently occur in coastal waters of Washington, Oregon, and Vancouver Island and near San Francisco and Monterey bays. Within the nearshore marine environment, tagging and fisheries data indicate that Northern and Southern DPS green sturgeon prefer marine waters of less than a depth of 110 meters.	• Reduction of its spawning area to a single known population • Lack of water quantity • Poor water quality • Poaching
Lower Columbia River Chinook salmon	Threatened 6/28/05	NMFS 2013	NWFSC 2015	This ESU comprises 32 independent populations. Twenty-seven populations are at very high risk, 2 populations are at high risk, one population is at moderate risk, and 2 populations are at very low risk Overall, there was little change since the last status review in the biological status of this ESU, although there are some positive trends. Increases in abundance were noted in about 70% of the fall-run populations and decreases in hatchery contribution were noted for several populations. Relative to baseline VSP levels identified in the recovery plan, there has been an overall improvement in the status of a number of fall-run populations, although most are still far from the recovery plan goals.	• Reduced access to spawning and rearing habitat • Hatchery-related effects • Harvest-related effects on fall Chinook salmon • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Contaminant

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River steelhead	Threatened 1/5/06	NMFS 2013	NWFSC 2015	This DPS comprises 23 historical populations, 17 winter-run populations and six summer-run populations. Nine populations are at very high risk, 7 populations are at high risk, 6 populations are at moderate risk, and 1 population is at low risk. The majority of winter-run steelhead populations in this DPS continue to persist at low abundances. Hatchery interactions remain a concern in select basins, but the overall situation is somewhat improved compared to prior reviews. Summer-run steelhead populations were similarly stable, but at low abundance levels. The decline in the Wind River summer-run population is a source of concern, given that this population has been considered one of the healthiest of the summer-runs; however, the most recent abundance estimates suggest that the decline was a single year aberration. Passage programs in the Cowlitz and Lewis basins have the potential to provide considerable improvements in abundance and spatial structure, but have not produced self-sustaining populations to date. Even with modest improvements in the status of several winter-run DIPs, none of the populations appear to be at fully viable status, and similarly none of the MPGs meet the criteria for viability.	• Degraded estuarine and nearshore marine habitat • Degraded freshwater habitat • Reduced access to spawning and rearing habitat • Avian and marine mammal predation • Hatchery-related effects • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River coho salmon	Threatened 6/28/05	NMFS 2013	NWFSC 2015	Of the 24 populations that make up this ESU, 21 populations are at very high risk, 1 population is at high risk, and 2 populations are at moderate risk. Recent recovery efforts may have contributed to the observed natural production, but in the absence of longer term data sets it is not possible to parse out these effects. Populations with longer term data sets exhibit stable or slightly positive abundance trends. Some trap and haul programs appear to be operating at or near replacement, although other programs still are far from that threshold and require supplementation with additional hatchery-origin spawners .Initiation of or improvement in the downstream juvenile facilities at Cowlitz Falls, Merwin, and North Fork Dam are likely to further improve the status of the associated upstream populations. While these and other recovery efforts have likely improved the status of a number of coho salmon populations, abundances are still at low levels and the majority of the populations remain at moderate or high risk. For the Lower Columbia River region land development and increasing human population pressures will likely continue to degrade habitat, especially in lowland areas. Although populations in this ESU have generally improved, especially in the 2013/14 and 2014/15 return years, recent poor ocean conditions suggest that population declines might occur in the upcoming return years	• Degraded estuarine and near-shore marine habitat • Fish passage barriers • Degraded freshwater habitat: Hatchery-related effects • Harvest-related effects • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Columbia River chum salmon	Threatened 6/28/05	NMFS 2013	NWFSC 2015	Overall, the status of most chum salmon populations is unchanged from the baseline VSP scores estimated in the recovery plan. A total of 3 of 17 populations are at or near their recovery viability goals, although under the recovery plan scenario these populations have very low recovery goals of 0. The remaining populations generally require a higher level of viability and most require substantial improvements to reach their viability goals. Even with the improvements observed during the last five years, the majority of populations in this ESU remain at a high or very high risk category and considerable progress remains to be made to achieve the recovery goals.	• Degraded estuarine and nearshore marine habitat • Degraded freshwater habitat • Degraded stream flow as a result of hydropower and water supply operations • Reduced water quality • Current or potential predation • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants
Oregon Coast coho salmon	Threatened 6/20/11; reaffirmed 4/14/14	NMFS 2016b	NWFSC 2015	This ESU comprises 56 populations including 21 independent and 35 dependent populations. The last status review indicated a moderate risk of extinction. Significant improvements in hatchery and harvest practices have been made for this ESU. Most recently, spatial structure conditions have improved in terms of spawner and juvenile distribution in watersheds; none of the geographic area or strata within the ESU appear to have considerably lower abundance or productivity. The ability of the ESU to survive another prolonged period of poor marine survival remains in question.	• Reduced amount and complexity of habitat including connected floodplain habitat • Degraded water quality • Blocked/impaired fish passage • Inadequate long-term habitat protection • Changes in ocean conditions

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Southern Oregon/ Northern California Coast coho salmon	Threatened 6/28/05	NMFS 2014	NMFS 2016c	This ESU comprises 31 independent, 9 independent, and 5 ephemeral populations all grouped into 7 diversity strata. Of the 31 independent populations, 24 are at high risk of extinction and 6 are at moderate risk of extinction. The extinction risk of an ESU depends upon the extinction risk of its constituent independent populations; because the population abundance of most independent populations are below their depensation threshold, the SONCC coho salmon ESU is at high risk of extinction and is not viable	• Lack of floodplain and channel structure • Impaired water quality • Altered hydrologic function • Impaired estuary/mainstem function • Degraded riparian forest conditions • Altered sediment supply • Increased disease/predation/competition • Barriers to migration • Fishery-related effects • Hatchery-related effects

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Upper Willamette River Chinook salmon	Threatened 6/28/05	NMFS 2011	NWFSC 2015	This ESU comprises seven populations. Five populations are at very high risk, one population is at moderate risk (Clackamas River) and one population is at low risk (McKenzie River). Consideration of data collected since the last status review in 2010 indicates the fraction of hatchery origin fish in all populations remains high (even in Clackamas and McKenzie populations). The proportion of natural origin spawners improved in the North and South Santiam basins, but is still well below identified recovery goals. Abundance levels for five of the seven populations remain well below their recovery goals. Of these, the Calapooia River may be functionally extinct and the Molalla River remains critically low. Abundances in the North and South Santiam rivers have risen since the 2010 review, but still range only in the high hundreds of fish. The Clackamas and McKenzie populations have previously been viewed as natural population strongholds, but have both experienced declines in abundance despite having access to much of their historical spawning habitat. Overall, populations appear to be at either moderate or high risk, there has been likely little net change in the VSP score for the ESU since the last review, so the ESU remains at moderate risk.	• Degraded freshwater habitat • Degraded water quality • Increased disease incidence • Altered stream flows • Reduced access to spawning and rearing habitats • Altered food web due to reduced inputs of microdetritus • Predation by native and non-native species, including hatchery fish • Competition related to introduced salmon and steelhead • Altered population traits due to fisheries and bycatch

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Middle Columbia River steelhead	Threatened 1/5/06	NMFS 2009b	NWFSC 2015	This DPS comprises 17 extant populations. The DPS does not currently include steelhead that are designated as part of an experimental population above the Pelton Round Butte Hydroelectric Project. Returns to the Yakima River basin and to the Umatilla and Walla Walla Rivers have been higher over the most recent brood cycle, while natural origin returns to the John Day River have decreased. There have been improvements in the viability ratings for some of the component populations, but the DPS is not currently meeting the viability criteria in the MCR steelhead recovery plan. In general, the majority of population level viability ratings remained unchanged from prior reviews for each major population group within the DPS.	• Degraded freshwater habitat • Mainstem Columbia River hydropower-related impacts • Degraded estuarine and nearshore marine habitat • Hatchery-related effects • Harvest-related effects • Effects of predation, competition, and disease
Upper Columbia River spring-run Chinook salmon	Endangered 6/28/05	Upper Columbia Salmon Recovery Board 2007	NWFSC 2015	This ESU comprises four independent populations. Three are at high risk and one is functionally extirpated. Current estimates of natural origin spawner abundance increased relative to the levels observed in the prior review for all three extant populations, and productivities were higher for the Wenatchee and Entiat populations and unchanged for the Methow population. However, abundance and productivity remained well below the viable thresholds called for in the Upper Columbia Recovery Plan for all three populations.	• Effects related to hydropower system in the mainstem Columbia River • Degraded freshwater habitat • Degraded estuarine and nearshore marine habitat • Hatchery-related effects • Persistence of non-native (exotic) fish species • Harvest in Columbia River fisheries

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Upper Columbia River steelhead	Threatened 1/5/06	Upper Columbia Salmon Recovery Board 2007	NWFSC 2015	This DPS comprises four independent populations. Three populations are at high risk of extinction while 1 population is at moderate risk. Upper Columbia River steelhead populations have increased relative to the low levels observed in the 1990s, but natural origin abundance and productivity remain well below viability thresholds for three out of the four populations. The status of the Wenatchee River steelhead population continued to improve based on the additional year's information available for the most recent review. The abundance and productivity viability rating for the Wenatchee River exceeds the minimum threshold for 5% extinction risk. However, the overall DPS status remains unchanged from the prior review, remaining at high risk driven by low abundance and productivity relative to viability objectives and diversity concerns.	• Adverse effects related to the mainstem Columbia River hydropower system • Impaired tributary fish passage • Degraded floodplain connectivity and function, channel structure and complexity, riparian areas, large woody debris recruitment, stream flow, and water quality • Hatchery-related effects • Predation and competition • Harvest-related effects
Snake River fall-run Chinook salmon	Threatened 6/28/05	NMFS 2017b	NWFSC 2015	This ESU has one extant population. Historically, large populations of fall Chinook salmon spawned in the Snake River upstream of the Hells Canyon Dam complex. The extant population is at moderate risk for both diversity and spatial structure and abundance and productivity. The overall viability rating for this population is 'viable.' Overall, the status of Snake River fall Chinook salmon has clearly improved compared to the time of listing and compared to prior status reviews. The single extant population in the ESU is currently meeting the criteria for a rating of 'viable' developed by the ICTRT, but the ESU as a whole is not meeting the recovery goals described in the recovery plan for the species, which require the single population to be "highly viable with high certainty" and/or will require reintroduction of a viable population above the Hells Canyon Dam complex.	• Degraded floodplain connectivity and function • Harvest-related effects • Loss of access to historical habitat above Hells Canyon and other Snake River dams • Impacts from mainstem Columbia River and Snake River hydropower systems • Hatchery-related effects • Degraded estuarine and nearshore habitat.

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Snake River spring/summer-run Chinook salmon	Threatened 6/28/05	NMFS 2017a	NWFSC 2015	This ESU comprises 28 extant and four extirpated populations. All expect one extant population (Chamberlin Creek) are at high risk. Natural origin abundance has increased over the levels reported in the prior review for most populations in this ESU, although the increases were not substantial enough to change viability ratings. Relatively high ocean survivals in recent years were a major factor in recent abundance patterns. While there have been improvements in abundance and productivity in several populations relative to prior reviews, those changes have not been sufficient to warrant a change in ESU status.	• Degraded freshwater habitat • Effects related to the hydropower system in the mainstem Columbia River, • Altered flows and degraded water quality • Harvest-related effects • Predation
Snake River basin steelhead	Threatened 1/5/06	NMFS 2017a	NWFSC 2015	This DPS comprises 24 populations. Two populations are at high risk, 15 populations are rated as maintained, 3 populations are rated between high risk and maintained, 2 populations are at moderate risk, 1 population is viable, and 1 population is highly viable. Four out of the five MPGs are not meeting the specific objectives in the draft recovery plan based on the updated status information available for this review, and the status of many individual populations remains uncertain A great deal of uncertainty still remains regarding the relative proportion of hatchery fish in natural spawning areas near major hatchery release sites within individual populations.	• Adverse effects related to the mainstem Columbia River hydropower system • Impaired tributary fish passage • Degraded freshwater habitat • Increased water temperature • Harvest-related effects, particularly for B-run steelhead • Predation • Genetic diversity effects from out-of-population hatchery releases

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Snake River sockeye salmon	Endangered 6/28/05	NMFS 2015	NWFSC 2015	This single population ESU is at very high risk dues to small population size. There is high risk across all four basic risk measures. Although the captive brood program has been successful in providing substantial numbers of hatchery produced fish for use in supplementation efforts, substantial increases in survival rates across all life history stages must occur to re-establish sustainable natural production In terms of natural production, the Snake River Sockeye ESU remains at extremely high risk although there has been substantial progress on the first phase of the proposed recovery approach – developing a hatchery based program to amplify and conserve the stock to facilitate reintroductions.	• Effects related to the hydropower system in the mainstem Columbia River • Reduced water quality and elevated temperatures in the Salmon River • Water quantity • Predation

2.2.2 Status of the Critical Habitats

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

Table 2. Status of critical habitat adversely affected by proposed action

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Puget Sound Chinook salmon	9/02/05 70 FR 52630	Critical habitat for Puget Sound Chinook salmon includes 1,683 miles of streams, 41 square mile of lakes, and 2,182 miles of nearshore marine habitat in Puget Sounds. The Puget Sound 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.
Puget Sound steelhead	2/24/16 81 FR 9252	Critical habitat for Puget Sound steelhead includes 2,031 stream miles. Nearshore and offshore marine waters were not designated for this species. There are 66 watersheds within the range of this DPS. Nine watersheds received a low conservation value rating, 16 received a medium rating, and 41 received a high rating to the DPS.
Hood Canal summer-run chum	9/02/05 70 FR 52630	Critical habitat for Hood Canal summer-run chum includes 79 miles and 377 miles of nearshore marine habitat in HC. Primary constituent elements relevant for this consultation include: 1) Estuarine areas free of obstruction with water quality and aquatic vegetation to support juvenile transition and rearing; 2) Nearshore marine areas free of obstruction with water quality conditions, forage, submerged and overhanging large wood, and aquatic vegetation to support growth and maturation; 3) Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.
Lake Ozette sockeye salmon	9/02/05 70 FR 52630	Critical habitat is comprised of a single subbasin containing a single watershed, Ozette Lake Subbasin located in Clallam County, Washington. It encompasses approximately 101 mi2 and approximately 317 miles of streams; Ozette Lake, the dominant feature of the watershed, is entirely located within the Olympic National Park. The known beach spawning areas, and three tributaries used by sockeye salmon for spawning, incubation, and migration, are encompassed as part of critical habitat for the listed species. Beach spawning is degraded by historical sediment loading, disrupted hydrology, and encroachment of riparian vegetation. Streams supporting spawning, rearing, and migration are impaired by lack of large wood, excessive fine sediment levels (Big River), and mammalian predation.
Puget Sound/Georgia Basin DPS of bocaccio	11/13/2014 79 FR68042	Critical habitat for bocaccio includes 590.4 square miles of nearshore habitat and 414.1 square miles of deepwater habitat. Critical habitat is not designated in areas outside of United States jurisdiction; therefore, although waters in Canada are part of the DPSs' ranges for all three species, critical habitat was not designated in that area. Based on the natural history of bocaccio and their habitat needs, NMFS identified two physical or biological features, essential for their conservation: 1) Deepwater sites (>30 meters) that support growth, survival, reproduction, and feeding opportunities; 2) Nearshore juvenile rearing sites with sand, rock and/or cobbles to support forage and refuge. Habitat threats include degradation of rocky habitat, loss of eelgrass and kelp, introduction of non-native species that modify habitat, and degradation of water quality as specific threats to rockfish habitat in the Georgia Basin.
Puget Sound/Georgia Basin DPS of yelloweye rockfish	11/13/2014 79 FR68042	Critical habitat for yelloweye rockfish includes 414.1 square miles of deepwater marine habitat in Puget Sound, all of which overlaps with areas designated for canary rockfish and bocaccio. No nearshore component was included in the CH listing for juvenile yelloweye rockfish as they, different from bocaccio and canary rockfish, typically are not found in intertidal waters (Love et al., 1991). Yelloweye rockfish are most frequently observed

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
		in waters deeper than 30 meters (98 feet) near the upper depth range of adults (Yamanaka et al., 2006). Habitat threats include degradation of rocky habitat, loss of eelgrass and kelp, introduction of non-native species that modify habitat, and degradation of water quality as specific threats to rockfish habitat in the Georgia Basin.
Southern DPS of eulachon	10/20/11 76 FR 65324	Critical habitat for eulachon includes portions of 16 rivers and streams in California, Oregon, and Washington. All of these areas are designated as migration and spawning habitat for this species. In Oregon, we designated 24.2 miles of the lower Umpqua River, 12.4 miles of the lower Sandy River, and 0.2 miles of Tenmile Creek. We also designated the mainstem Columbia River from the mouth to the base of Bonneville Dam, a distance of 143.2 miles. Dams and water diversions are moderate threats to eulachon in the Columbia and Klamath rivers where hydropower generation and flood control are major activities. Degraded water quality is common in some areas occupied by southern DPS eulachon. In the Columbia and Klamath river basins, large-scale impoundment of water has increased winter water temperatures, potentially altering the water temperature during eulachon spawning periods. Numerous chemical contaminants are also present in spawning rivers, but the exact effect these compounds have on spawning and egg development is unknown. Dredging is a low to moderate threat to eulachon in the Columbia River. Dredging during eulachon spawning would be particularly detrimental.
Southern DPS of green sturgeon	10/09/09 74 FR 52300	Critical habitat has been designated in coastal U.S. marine waters within 60 fathoms depth from Monterey Bay, California (including Monterey Bay), north to Cape Flattery, Washington, including the Strait of Juan de Fuca, Washington, to its United States boundary; the Sacramento River, lower Feather River, and lower Yuba River in California; the Sacramento-San Joaquin Delta and Suisun, San Pablo, and San Francisco bays in California; tidally influenced areas of the Columbia River estuary from the mouth upstream to river mile 46; and certain coastal bays and estuaries in California (Humboldt Bay), Oregon (Coos Bay, Winchester Bay, Yaquina Bay, and Nehalem Bay), and Washington (Willapa Bay and Grays Harbor), including, but not limited to, areas upstream to the head of tide in various streams that drain into the bays, as listed in Table 1 in USDC (2009). The CHRT identified several activities that threaten the PBFs in coastal bays and estuaries and necessitate the need for special management considerations or protection. The application of pesticides is likely to adversely affect prey resources and water quality within the bays and estuaries, as well as the growth and reproductive health of Southern DPS green sturgeon through bioaccumulation. Other activities of concern include those that disturb bottom substrates, adversely affect prey resources, or degrade water quality through re-suspension of contaminated sediments. Of particular concern are activities that affect prey resources. Prey resources are affected by: commercial shipping and activities generating point source pollution and non-point source pollution that discharge contaminants and result in bioaccumulation of contaminants in green sturgeon; disposal of dredged materials that bury prey resources; and bottom trawl fisheries that disturb the bottom (but result in beneficial or adverse effects on prey resources for green sturgeon).
Lower Columbia River Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 47 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some, or high potential for improvement. We rated conservation value of HUC5 watersheds as high for 30 watersheds, medium for 13 watersheds, and low for four watersheds.
Lower Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses nine subbasins in Oregon and Washington containing 41 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
		in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 28 watersheds, medium for 11 watersheds, and low for two watersheds.
Lower Columbia River coho salmon	2/24/16 81 FR 9252	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 55 occupied watersheds, as well as the lower Columbia River and estuary rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 34 watersheds, medium for 18 watersheds, and low for three watersheds.
Columbia River chum salmon	9/02/05 70 FR 52630	Critical habitat encompasses six subbasins in Oregon and Washington containing 19 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 16 watersheds, and medium for three watersheds.
Oregon Coast coho salmon	2/11/08 73 FR 7816	Critical habitat encompasses 13 subbasins in Oregon. The long-term decline in Oregon Coast coho salmon productivity reflects deteriorating conditions in freshwater habitat as well as extensive loss of access to habitats in estuaries and tidal freshwater. Many of the habitat changes resulting from land use practices over the last 150 years that contributed to the ESA-listing of Oregon Coast coho salmon continue to hinder recovery of the populations; changes in the watersheds due to land use practices have weakened natural watershed processes and functions, including loss of connectivity to historical floodplains, wetlands and side channels; reduced riparian area functions (stream temperature regulation, wood recruitment, sediment and nutrient retention); and altered flow and sediment regimes (NMFS 2016b). Several historical and ongoing land uses have reduced stream capacity and complexity in Oregon coastal streams and lakes through disturbance, road building, splash damming, stream cleaning, and other activities. Beaver removal, combined with loss of large wood in streams, has also led to degraded stream habitat conditions for coho salmon (Stout et al. 2012)
Southern Oregon/Northern California Coast coho salmon	5/5/99 64 FR 24049	Critical habitat includes all areas accessible to any life-stage up to long-standing, natural barriers and adjacent riparian zones. SONCC coho salmon critical habitat within this geographic area has been degraded from historical conditions by ongoing land management activities. Habitat impairments recognized as factors leading to decline of the species that were included in the original listing notice for SONCC coho salmon include: 1) Channel morphology changes; 2) substrate changes; 3) loss of in-stream roughness; 4) loss of estuarine habitat; 5) loss of wetlands; 6) loss/degradation of riparian areas; 7) declines in water quality; 8) altered stream flows; 9) fish passage impediments; and 10) elimination of habitat
Upper Willamette River Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Oregon containing 56 occupied watersheds, as well as the lower Willamette/Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some, or high, potential for improvement. Watersheds are in good to excellent condition with no potential for improvement only in the upper McKenzie River and its tributaries (NMFS 2005). We rated conservation value of HUC5 watersheds as high for 22 watersheds, medium for 16 watersheds, and low for 18 watersheds.
Upper Willamette River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses seven subbasins in Oregon containing 34 occupied watersheds, as well as the lower Willamette/Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
		to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. Watersheds are in good to excellent condition with no potential for improvement only in the upper McKenzie River and its tributaries (NMFS 2005). We rated conservation value of HUC5 watersheds as high for 25 watersheds, medium for 6 watersheds, and low for 3 watersheds.
Middle Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 15 subbasins in Oregon and Washington containing 111 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of occupied HUC5 watersheds as high for 80 watersheds, medium for 24 watersheds, and low for 9 watersheds.
Upper Columbia River spring-run Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses four subbasins in Washington containing 15 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some, or high, potential for improvement. We rated conservation value of HUC5 watersheds as high for 10 watersheds, and medium for five watersheds. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Upper Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Washington containing 31 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 20 watersheds, medium for eight watersheds, and low for three watersheds.
Snake River fall-run Chinook salmon	10/25/99 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers, and all tributaries of the Snake and Salmon rivers presently or historically accessible to this ESU (except reaches above impassable natural falls, and Dworshak and Hells Canyon dams). Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar et al. 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Snake River spring/summer-run Chinook salmon	10/25/99 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers, and all tributaries of the Snake and Salmon rivers (except the Clearwater River) presently or historically accessible to this ESU (except reaches above impassable natural falls and Hells Canyon Dam). Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar et al. 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Snake River basin steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 25 subbasins in Oregon, Washington, and Idaho. Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar et al. 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Snake River sockeye salmon	10/25/99 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers; Alturas Lake Creek; Valley Creek; and Stanley, Redfish, Yellow Belly, Pettit and Alturas lakes (including their inlet and outlet creeks). Water quality in all five lakes generally is adequate for juvenile sockeye salmon, although zooplankton numbers vary considerably. Some reaches of the Salmon River and tributaries exhibit temporary elevated water temperatures and sediment loads that could restrict sockeye salmon production and survival (NMFS 2015b). Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.

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 NWACP covers the entire Northwest. The action agencies respond to oil and hazardous material spills throughout the states of Washington, Oregon, Idaho and Montana. The action area is all areas within the Northwest that have a potential for oil and hazardous material spills greater than 11,000 gallons from hazardous liquid pipelines, high capacity rail corridors (carrying unit trains of crude oil), and commercial shipping waterways. The action area includes the entire coastal zone out to the extent of the EEZ and along the Columbia River downstream of its confluence with the Snake River.

The action area includes a 1-mile buffer on both sides of the high-volume transportation corridors and a one mile buffer inland along the coast for staging and ingress/egress areas during a response action. At locations where pipelines or railways carrying unit trains cross major waterways, the buffer extends 32 kilometers (20 miles). Appendix 6.2 shows maps from the BA of the entire Washington, Oregon, and Idaho action area, respectively.

The proposed action includes spill responses in four identified geographic areas and we do not expect the effects of those responses to go outside those areas. Thus, the action area is the four waterbody categories described in the proposed action. As explained, those waterbodies were derived from an assessment as to where response actions are most likely to have effects to listed species and their critical habitats due to overlaps with spill risk activities.

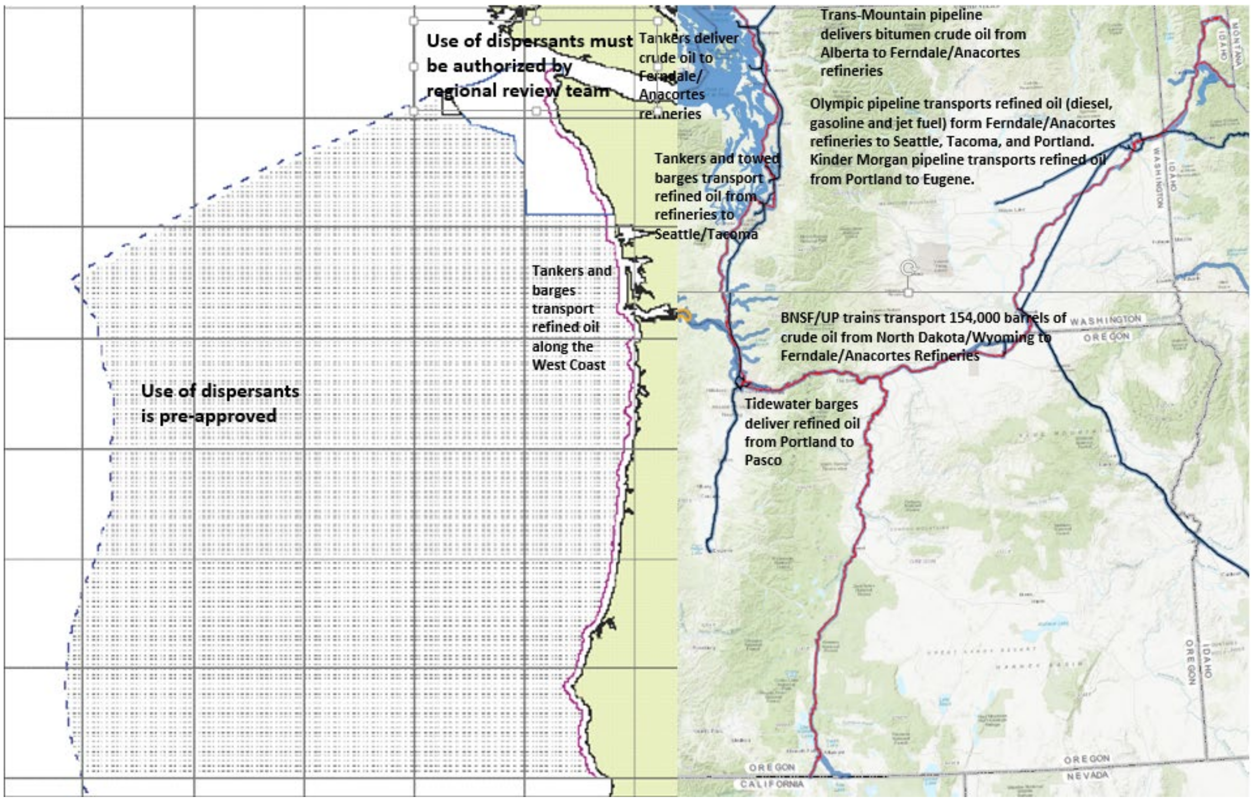

Figure 1. Image Depicting Major Oil Transit Routes

2.3.1 Rivers and Streams

Rivers and streams are waters crossed by railroad bridges or oil and fuel oil pipelines in Washington and Oregon that are populated by ESA listed species. The action area includes these rivers and streams listed in Tables 4 and 5 below, as well as a 1-mile buffer that has been extended on both sides of all high-volume transportation corridors. The buffers are intended to capture potential effects to species from staging areas that would be utilized during a response action and associated ingress/egress. The buffers will provide a range of staging area and access options to reduce potential impacts on critical habitat during a response. The buffers also extend 32 km (20 miles) downstream of locations where pipelines or railways carrying unit trains cross major waterways, to provide a conservative estimate of the downstream area that might be affected by a spill response.

The BNSF carries an average of 64,000 barrels of North Dakota light crude oil per day to the Tesoro refinery in Anacortes and 66,000 barrels of North Dakota light crude oil to the BP and Phillips 66 refineries in Ferndale. The BNSF also delivers Alberta medium/heavy crude oil to the Tesoro refinery. Between Vancouver Washington and Ferndale, the BNSF railroad cross 19 rivers and 7 streams. The action area extends 20 miles downstream from the railroad crossing where response actions will chase oil transported by currents. The Union Pacific railroad carries an average of 24,000 barrels of North Dakota light crude oil per day from Portland, Oregon to the US Oil refinery in Tacoma, Washington using BNSF tracks once it crosses the Columbia River. Table 3 summarizes the crossing locations and the salmon and steelhead habitat functions at the crossings.

Table 3. Points where railroads intercepts or crosses inland rivers and streams with ESA listed species.

River	*Streams*	*Railroad Crossing Location*	*Steelhead spawning/ rearing and migration*	*Chinook spawning/ rearing and migration*	*Coho spawning/ rearing and migration*	*Chum spawning/ rearing and migration*
Nooksack		*48.845783°/-122.587910° RM 6.2*	*N/Y*	*Y/Y*	*NA*	*NA*
Samish		*48.520484°/-122.355386° RM 7*	*N/Y*	*N/Y*	*NA*	*NA*
Skagit		*48.445410/-122.324728 RM 13*	*N/Y*	*N/Y*	*NA*	*NA*
Skagit		*48.424720/-122.338406 RM 10*	*N/Y*	*N/Y*	*NA*	*NA*
Skagit		*48.328954°/-122.344207° RM 3.7*	*N/Y*	*N/Y*	*NA*	*NA*
	Fisher Creek	*48.317619°/-122.303597°*	*N/N*	*N/N*	*NA*	*NA*
Stillaguamish		*48.205171°/ -122.261573° RM 6*	*N/Y*	*Y/Y*	*NA*	*NA*
Stillaguamish		*48.196193°/-122.244407° RM 8*	*N/Y*	*Y/Y*	*NA*	*NA*
	Portage Creek	*48.193475°/-122.240563°*	*N/Y*	*N/N*	*NA*	*NA*
	Quilceda Creek	*48.085274°/-122.174835°*	*N/Y*	*Y/Y*	*NA*	*NA*
Snohomish		*48.035982°/ -122.183939°*	*N/Y*	*N/Y*	*NA*	*NA*
Snohomish		*48.017042°/-122.189138°*	*N/N*	*Y/Y*	*NA*	*NA*
Salmon Bay		*47.666962°/-122.402157°*	*N/Y*	*N/Y*	*NA*	*NA*
Duwamish Waterway		*47.487894°/- 122.232852° RM 8*	*Y/Y*	*Y/Y*	*NA*	*NA*
Green River		*47.361206°/-122.240938 RM 25*	*N/Y*	*N/Y*	*NA*	*NA*
White River		*47.265673°/-122.230103° RM 6*	*N/Y*	*N/N*	*NA*	*NA*

River	Streams	Railroad Crossing Location	Steelhead spawning/ rearing and migration	Chinook spawning/ rearing and migration	Coho spawning/ rearing and migration	Chum spawning/ rearing and migration
Puyallup River		*47.196455°/-122.250328° RM 10*	*N/Y*	*N/Y*	*NA*	*NA*
Puyallup River		*47.241651°/-122.402715° RM 2*	*N/Y*	*N/Y*	*NA*	*NA*
Nisqually River		*47.058097°/-122.691368° RM 4*	*Y/Y*	*Y/Y*	*NA*	*NA*
Deschutes River		*46.950812°/-122.849523°*	*Y/Y*	*Y/Y*	*NA*	*NA*
Lower Cowlitz		*46.356298°/-122.932929°, RM 23*	*N/Y*	*Y/Y*	*N/Y*	*N/Y*
Toutle		*46.310595°/-122.915082°RM4*	*N/Y*	*N/Y*	*N/Y*	*N/Y*
Kalama		*46.034410°/--\122.858793° RM 2.25*	*Y/Y*	*Y/Y*	*Y/Y*	*N/Y*
	Burke Creek	*45.943149°/ -122.776267°*	*N/Y*	*N/N*	*N/Y*	*N/N*
	Burris Creek	*45.930670°/-122.758249°*	*N/N*	*N/Y*	*N/Y*	*N/N*
	Wallace Slough	*45.878573°/-122.753418°*	*N/Y*	*N/N*	*N/Y*	*N/N*
Lewis		*45.868590/-122.746398 RM 1.9*	*N/Y*	*N/Y*	*N/Y*	*N/Y*
	Gee Creek	*45.829564°/-122.749259°*	*N/Y*	*N/N*	*N/Y*	*N/Y*
Salmon Creek		*45.732144°/-122.734460°*	*N/Y*	*N/N*	*N/Y*	*N/N*
Lake		*45.726721/-122.740651RM 9*	*N/Y*	*N/Y*	*N/Y*	*N/Y*
Columbia		*45.624326°/ -122.691364°*	*N/Y*	*N/Y*	*N/Y*	*N/Y*
	Washougal	*45.584472/-122.396985*	*N/Y*	*N/Y*	*N/Y*	*N/Y*
	Lawton Creek	*45.561233°/ -122.266843°*	*N/Y*	*N/N*	*N/Y*	*N/Y*

River	*Streams*	*Railroad Crossing Location*	*Steelhead spawning/ rearing and migration*	*Chinook spawning/ rearing and migration*	*Coho spawning/ rearing and migration*	*Chum spawning/ rearing and migration*
	Indian Mary Creek	*45.607385°/ -122.071070°*	*N/Y*	*N/N*	*N/Y*	*N/Y*
	Duncan Creek	*45.612823°/ -122.054744°*	*N/N*	*N/N*	*N/N*	*N/Y*
	Unnamed	*45.616672°/ -122.043159°*	*N/N*	*N/N*	*N/Y*	*N/N*
	Woodard Creek, Little Creek	*45.621388°/ -122.023470°*	*Y/Y*	*N/N*	*N/Y*	*N/N*
	Hardy Creek	*45.634628°/ -122.001239°*	*N/N*	*N/N*	*N/Y*	*Y/Y*
	Hamilton Creek	*45.641271°/ -121.977642°*	*N/N*	*N/N*	*N/N*	*Y/Y*
	Unnamed	*45.670545°/ -121.908524°*	*N/Y*	*N/N*	*N/N*	*N/N*
	Rock Creek	*45.689387°/ -121.888200°*	*N/Y*	*N/Y*	*N/N*	*N/N*
	Kanaka Creek	*45.695345°/ -121.878058°*	*N/N*	*N/N*	*N/Y*	*N/N*
	Nelson Creek	*45.700767°/ -121.861472°*	*N/N*	*N/N*	*N/Y*	*N/N*
	Unnamed	*45.707353°/ -121.841505°*	*N/N*	*N/N*	*N/Y*	*N/N*
	Wind River	*45.715664°/ -121.791859°*	*N/Y*	*N/Y*	*N/Y*	*N/N*
	Unnamed	*45.711405°/ -121.778723°*	*N/N*	*N/N*	*N/Y*	*N/N*
	Unnamed	*45.706170°/ -121.763820°*	*N/N*	*N/N*	*N/Y*	*N/N*
	Collins Creek	*45.699177°/ -121.727874°*	*N/Y*	*N/N*	*N/Y*	*N/N*
	Unnamed	*45.698983°/ -121.720369°*	*N/Y*	*N/N*	*N/N*	*N/N*
	Dog Creek	*45.709923°/ -121.671452°*	*N/Y*	*N/N*	*N/N*	*N/N*

River	*Streams*	*Railroad Crossing Location*	*Steelhead spawning/ rearing and migration*	*Chinook spawning/ rearing and migration*	*Coho spawning/ rearing and migration*	*Chum spawning/ rearing and migration*
	Little White Salmon	*45.711245°/ -121.648335°*	*N/Y*	*N/Y*	*N/Y*	*N/N*
	White Salmon	*45.728538°/ -121.521704°*	*N/Y*	*NA*	*NA*	*NA*
	Jewett Creek	*45.716986°/ -121.474103°*	*Y/Y*	*NA*	*NA*	*NA*
	Catherine Creek	*45.706993°/ -121.358082°*	*N/Y*	*NA*	*NA*	*NA*
	Major Creek	*45.708761° / -121.351633°*	*N/Y*	*NA*	*NA*	*NA*
	Unnamed	*45.710675°/ -121.344808°*	*N/Y*	*NA*	*NA*	*NA*
	Klickitat	*45.696396°/ -121.291764°*	*N/Y*	*NA*	*NA*	*NA*
	Rock Creek	*45.703142°/ -120.461136°*	*N/Y*	*NA*	*NA*	*NA*
	Chapman Creek	*45.718830°/ -120.310543°*	*N/Y*	*NA*	*NA*	*NA*
	Wood Creek	*45.748551°/ -120.200535°*	*N/Y*	*NA*	*NA*	*NA*
	Pine Creek	*45.789598°/ -120.085414°*	*N/Y*	*NA*	*NA*	*NA*
	Alder Creek	*45.835514°/ -119.929056°*	*N/Y*	*NA*	*NA*	*NA*
	Dead Canyon	*45.869309°/ -119.824290°*	*N/Y*	*NA*	*NA*	*NA*
Columbia River		*46.217303°/-119.104405°*	*N/Y*	*N/Y*	*NA*	*NA*
	Sandy River	*45.541790°/-122.382277°*	*Y/Y*	*Y/Y*	*Y/Y*	*NA*
	Latourell Creek	*45.541380°/-122.218104°*	*Y/Y*	*Y/Y*	*Y/Y*	*NA*
	Bridal Veil Creek	*-122.218104°/-122.182257°*	*Y/Y*	*Y/Y*	*Y/Y*	*NA*
	Oneonta Creek	*45.589856°/-122.075530°*	*Y/Y*	*NA*	*NA*	*NA*

River	*Streams*	*Railroad Crossing Location*	*Steelhead spawning/ rearing and migration*	*Chinook spawning/ rearing and migration*	*Coho spawning/ rearing and migration*	*Chum spawning/ rearing and migration*
	Horsetail Creek	*45.590467°/-122.069432°*	*Y/Y*	*NA*	*NA*	*NA*
	Unnamed	*45.602069°/-122.045382°*	*Y/Y*	*NA*	*NA*	*NA*
	Tumalt Creek	*45.610040°/-122.029680°*	*Y/Y*	*NA*	*NA*	*NA*
	McCord Creek	*45.614966°/-121.997416°*	*Y/Y*	*Y/Y*	*Y/Y*	*NA*
	Moffett Creek	*45.623999°/-121.978187°*	*Y/Y*	*Y/Y*	*Y/Y*	*NA*
	Tanner Creek	*45.631958°/-121.957096°*	*Y/Y*	*Y/Y*	*Y/Y*	*NA*
	Eagle Creek	*45.640331°/-121.931407°*	*Y/Y*	*Y/Y*	*Y/Y*	*Y/Y*
	Ruckel Creek	*45.647075°/-121.920587°*	*Y/Y*	*NA*	*Y/Y*	*NA*
	Herman Creek	*45.679150°/-121.860550°*	*Y/Y*	*Y/Y*	*Y/Y*	*NA*
	Gordon Creek	*45.693065°/-121.779711°*	*Y/Y*	*NA*	*Y/Y*	*NA*
	Lindsey Creek	*45.690396°/-121.713051°*	*Y/Y*	*Y/Y*	*Y/Y*	*NA*
	Warren Creek	*45.689022°/-121.704845°*	*Y/Y*	*NA*	*NA*	*NA*
	Starvation Creek	*45.689370°/-121.690695°*	*Y/Y*	*NA*	*Y/Y*	*NA*
	Viento Creek	*45.696846°/-121.673934°*	*Y/Y*	*Y/Y*	*Y/Y*	*NA*
	Pertham Creek	*45.700065°/-121.637743°*	*Y/Y*	*NA*	*Y/Y*	*NA*
	Hood River	*45.710390°/-121.507627°*	*Y/Y*	*Y/Y*	*Y/Y*	*NA*
	Rock Creek	*45.685372°/-121.404742°*	*Y/Y*	*NA*	*NA*	*NA*
	Moser Creek	*45.685286°/-121.394489°*	*Y/Y*	*NA*	*NA*	*NA*

River	*Streams*	*Railroad Crossing Location*	*Steelhead spawning/ rearing and migration*	*Chinook spawning/ rearing and migration*	*Coho spawning/ rearing and migration*	*Chum spawning/ rearing and migration*
	Rowena Creek	***45.695156°/-121.310482°***	***Y/Y***	***NA***	***NA***	***NA***
	Chenowith Creek	***45.633460°/-121.211252°***	***Y/Y***	***NA***	***NA***	***NA***
	Mill Creek	***45.604553°/-121.188223°***	***Y/Y***	***NA***	***NA***	***NA***
	Threemile Creek	***45.600346°/-121.141416°***	***Y/Y***	***NA***	***NA***	***NA***
	Fifteenmile Creek	***45.612096°/-121.122721°***	***Y/Y***	***NA***	***NA***	***NA***
	Unnamed	***45.646835°/-120.881892°***	***Y/Y***	***NA***	***NA***	***NA***
	Spanish Hollow Creek	***45.672175°/-120.830385°***	***N/Y***	***NA***	***NA***	***NA***
	John Day River	***45.732456°/-120.649366°***	***N/Y***	***NA***	***NA***	***NA***
	Willow Creek	***45.796779°/-120.018847°***	***N/Y***	***NA***	***NA***	***NA***
	Umatilla River	***45.804397°/-119.360328°***	***N/Y***	***NA***	***NA***	***NA***
	Stanfield Drain	***45.781434°/-119.224533°***	***N/Y***	***NA***	***NA***	***NA***
	Umatilla River	***45.687366°/-119.103702°***	***N/Y***	***NA***	***NA***	***NA***
	Umatilla River	***45.663854°/-118.989565°***	***N/Y***	***NA***	***NA***	***NA***
	Umatilla River	***45.660073°/-118.971492°***	***N/Y***	***NA***	***NA***	***NA***
	Umatilla River	***45.658093°/-118.964391°***	***N/Y***	***NA***	***NA***	***NA***
	Umatilla River	***45.671007°/-118.811516°***	***N/Y***	***NA***	***NA***	***NA***
	Umatilla River	***45.676379°/-118.565917°***	***N/Y***	***NA***	***NA***	***NA***

River	Streams	Railroad Crossing Location	Steelhead spawning/ rearing and migration	Chinook spawning/ rearing and migration	Coho spawning/ rearing and migration	Chum spawning/ rearing and migration
	Mission Creek	45.667947°/-118.643817°	Y/Y	NA	NA	NA
	Cottonwood Creek	45.671565°/-118.600060°	Y/Y	NA	NA	NA
	Umatilla River	45.676379°/-118.565917°	Y/Y	NA	NA	NA
	Umatilla River	45.685330°/-118.494300°	Y/Y	NA	NA	NA
	Buckaroo Creek	45.682975°/-118.459101°	Y/Y	NA	NA	NA
	Iskuulpa Creek	45.697912°/-118.393953°	Y/Y	NA	NA	NA
	Meacham Creek	45.688747°/-118.358133°	Y/Y	NA	NA	NA
	Meacham Creek	45.574048°/-118.324593°	Y/Y	NA	NA	NA
	Meacham Creek	45.508401°/-118.280776°	Y/Y	NA	NA	NA
	Meacham Creek	45.489220°/-118.324672°	Y/Y	NA	NA	NA
	Meacham Creek	45.526727°/-118.345024°	Y/Y	NA	NA	NA

A 64-mile extension into Washington state of the Canadian Trans Mountain Pipeline delivers diluted bitumen crude oil from Canadian oil sands to the Anacortes refinery. Three Olympic Pipelines (8-inch diameter, 14 inch diameter, and 20 inch diameter) carry diesel, gasoline, and jet fuel from four refineries in Ferndale, Washington to Seattle, Washington and to Portland, Oregon. The pipelines cross 10 major rivers that discharge to Puget Sound and 35 perennial streams that are either tributaries to these major rivers or are small tributaries to Puget Sound. The pipeline crosses seven major Lower Columbia River rivers and 17 smaller, perennial streams before it crosses the Lower Columbia River and terminates at the Portland Fuel Hub in Portland Harbor. The action area extends 20 miles downstream from the pipeline crossing where response actions will chase oil transported by currents. Refined fuels are transported from the Portland Fuel Hub to the Portland Airport and to Eugene Oregon in the Kinder Morgan 14-inch diameter pipeline. The Kinder Morgan pipeline crosses the Willamette River three times (Table 4).

Table 4. Points where the Transmountain, Olympic and Kinder Morgan pipelines cross inland rivers and streams with ESA listed species. (N= no, Y=yes; NA= Not Applicable). * denotes the Transmountain pipeline crossings.

River	Streams	Pipeline Crossing Location	Steelhead spawning/ rearing and migration	Chinook spawning/ rearing and migration	Coho spawning/ rearing and migration	Chum spawning/ rearing and migration
Nooksack*		48.900179°/ -122.335483°	N/Y	Y/Y	NA	NA
Nooksack*		48.833059°/ -122.597843°	N/Y	Y/Y	NA	NA
Nooksack		48.819318°/-122.580221° RM 4	N/Y	Y/Y	NA	NA
	Schell Ditch	48.822103°/-122.626146°	N/N	N/Y	NA	NA
	Lummi River	48.820899°/-122.604845°	N/N	N/Y	NA	NA
	Silver Creek	48.818238°/-122.534141°	N/N	N/N	NA	NA
	Baker Creek	48.793921°/-122.445182°	N/N	N/N	NA	NA
	Spring Creek	48.811602°/-122.472359°	Y/Y	N/N	NA	NA
	Squalicum Creek	48.781413°/-122.437414°	Y/Y	N/Y	NA	NA
	Whatcum Creek	48.754436°/-122.436803°	Y/Y	Y/Y	NA	NA
	Chuckanut Creek	48.685210°/-122.428541°	Y/Y	N/N	NA	NA
Samish		48.522019/-122.390645° RM 6.5	N/Y	N/Y	NA	NA
	Bear Creek	48.647683°/-122.387199°	Y/Y	Y/Y	NA	NA
Skagit		48.395272/ -122.363533 RM 7	N/Y	N/Y	NA	NA
	Britt Slough	48.391532°/-122.360160°	N/Y	N/Y	NA	NA
	Hill Ditch	48.343680°/-122.320140°	N/Y	N/Y	NA	NA
	Fisher Creek	48.317619°/-122.303597°	N/N	N/N	NA	NA
Stillaguamish		48.198764/ -122.204595 RM 11	N/N	Y/Y	NA	NA
	Pilchuck Creek	48.218025 / -122.216479 RM 1	N/Y	Y/Y	NA	NA
	Freedom Creek	48.287587°/-122.278283°	N/Y	N/Y	NA	NA
	Portage Creek	48.171367°/-122.185627°	N/Y	N/N	NA	NA

River	Streams	Pipeline Crossing Location	Steelhead spawning/ rearing and migration	Chinook spawning/ rearing and migration	Coho spawning/ rearing and migration	Chum spawning/ rearing and migration
	Middle Fork Quilceda Creek	48.126715°/-122.153270°	N/Y	Y/Y	NA	NA
	Quilceda Creek	48.122044°/-122.149932°	N/Y	Y/Y	NA	NA
Snohomish		47.928325 / -122.168711 RM 11	N/Y	N/Y	NA	NA
	Allen Creek	48.078949°/-122.128622°	N/N	Y/Y	NA	NA
	Ebey Slough (2 crossings)	47.976750°/-122.143966° 47.950734°/-122.156986°	N/Y	N/Y	NA	NA
	Swan Trail Slough	47.946594°/-122.159033°	N/Y	N/Y	NA	NA
Sammamish		47.756093°/-122.172006°	N/Y	Y/Y	NA	NA
	Valley Creek	47.657543°/-122.158834°	N/N	N/Y	NA	NA
	Kelsey Creek	47.622348°/-122.157377°	N/N	N/Y	NA	NA
	Richards Creek	47.591787°/-122.161477°	N/N	N/Y	NA	NA
	Sunset Creek	47.572407°/-122.153485°	N/N	N/Y	NA	NA
	Coal Creek	47.553068°/-122.167306°	N/Y	N/Y	NA	NA
	May Creek	47.506198°/-122.171522°	N/Y	Y/Y	NA	NA
Cedar River		47.474405/-122.175512 RM 3	Y/Y	Y/Y	NA	NA
Green River		47.36869/-122.240938 RM 24	N/Y	N/Y	NA	NA
	Springbrook Creek	47.462938°/-122.228573°	N/Y	N/Y	NA	NA
	Mill Creek	47.399197°/-122.233969°	N/N	N/N	NA	NA
Green River		47.36869/-122.240938 RM 24	N/Y	N/Y	NA	NA
	Mill Creek	47.337422°/-122.243982°	N/Y	N/Y	NA	NA

River	*Streams*	*Pipeline Crossing Location*	*Steelhead spawning/ rearing and migration*	*Chinook spawning/ rearing and migration*	*Coho spawning/ rearing and migration*	*Chum spawning/ rearing and migration*
Hylebos Creek		*47.255258°/-122.322875°*	*N/Y*	*N/N*	*NA*	*NA*
Wapato Creek		*47.235307°/-122.361768°*	*N/Y*	*N/N*	*NA*	*NA*
Puyallup River		*47.226749/-122.367863 RM 4.2*	*N/Y*	*N/Y*	*NA*	*NA*
Nisqually River		*46.965017/-122.573776 RM 19*	*Y/Y*	*Y/Y*	*NA*	*NA*
	Muck Creek	*47.031049/-122.493035*	*N/Y*	*N/Y*	*NA*	*NA*
	Lacomas Creek	*47.002852/-122.527834*	*N/Y*	*N/N*	*NA*	*NA*
Deschutes		*46.851427/-122.694519*	*Y/Y*	*N/N*	*NA*	*NA*
Lower Cowlitz		*46.429769/-122.871323, RM 32*	*N/Y*	*Y/Y*	*N/Y*	*N/Y*
	Lacamas Creek	*46.480786/-122.865054*	*N/Y*	*N/Y*	*Y/Y*	*N/Y*
	Hill Creek	*46.385837/-122.871591*	*N/Y*	*N/N*	*N/Y*	*N/N*
	Foster Creek	*46.416551/-122.870719*	*N/Y*	*N/Y*	*N/Y*	*N/N*
	Salmon Creek	*46.288174/-122.885992*	*Y/Y*	*N/Y*	*N/Y*	*N/N*
Toutle		*46.335653/-122.881983 RM4*	*N/Y*	*N/Y*	*N/Y*	*N/Y*
Ostrander Creek		*46.195132/-122.885557 RM 0.75*	*N/Y*	*N/Y*	*Y/Y*	*N/N*
Coweeman		*46.140682°/-122.876370 RM 4.1*	*N/Y*	*N/Y*	*N/Y*	*N/Y*
Kalama		*46.038157/-122.842089 RM 2.25*	*Y/Y*	*Y/Y*	*Y/Y*	*N/Y*
	Schoolhouse Creek	*45.991538/-122.808018*	*N/Y*	*N/N*	*N/Y*	*N/N*
	Bybee Creek	*455.973558/-122.793091*	*N/Y*	*N/N*	*N/Y*	*N/N*
	Mill Creek	*46.021185/-122.830158*	*N/Y*	*N/N*	*N/Y*	*N/N*
	Canyon Creek	*45.956755/-122.781146*	*N/Y*	*N/N*	*N/Y*	*N/N*
	Burke Creek	*45.944348/-122.772284*	*N/Y*	*N/N*	*N/Y*	*N/N*

River	Streams	Pipeline Crossing Location	Steelhead spawning/ rearing and migration	Chinook spawning/ rearing and migration	Coho spawning/ rearing and migration	Chum spawning/ rearing and migration
	Burris Creek	45.932474°/ -122.765106°	N/N	N/Y	N/Y	N/N
	Wallace Slough	45.879547°/ -122.749312°	N/Y	N/N	N/Y	N/N
Lewis		45.868590/-122.746398 RM 1.9	N/Y	N/Y	N/Y	N/Y
	Gee Creek	45.816481°/ -122.733213°	N/Y	N/N	N/Y	N/Y
	Flume Creek	45.788457°/ -122.733484°	N/Y	N/N	N/Y	N/N
	Whipple Creek	45.755651°/ -122.735046°	N/Y	N/Y	N/Y	N/N
Lake		45.726721/-122.740651RM 9	N/Y	N/Y	N/Y	N/Y
Columbia		45.669916°/-122.768454°	N/Y	N/Y	N/Y	N/Y
Willamette		45.572497°/ -122.739378°	N/Y	N/Y		
Willamette		45.291502°/ -122.790343°	N/Y	N/Y		
Willamette		44.141743°/ -123.119916°	Y/Y	Y/Y		

2.3.2 Columbia River, Clearwater River and Lochsa River

The proposed action includes response activities in the Columbia River from the mouth to the city of Pasco, Washington and so the action area includes this stretch of the river too. BNSF oil trains intercept the Columbia River at Pasco, Washington and follow the River to Vancouver, Washington where they turn north to the terminals in Ferndale and Anacortes Washington. Tidewater barges transport fuel oils up the Columbia River from their terminal in Portland, Oregon to their terminal in Pasco, Washington. Ocean going oil tankers and barges deliver oil from the mouth of the Columbia River to terminals in Portland, Oregon and Vancouver, Washington.

The proposed action includes response activities on the Clearwater and Lochsa Rivers in Idaho. Fuel and hazardous materials are transported by tanker truck on Highway 12 along these rivers.

2.3.3 Puget Sound

The proposed action includes response activities in the entirety of Puget Sound including Hood Canal and so the action area includes these areas as well. Crude oil tanker vessels cross Puget Sound to deliver crude oil to refineries in Ferndale and Anacortes. Vessels and barges transport fuel oil from refineries to terminals in Seattle and Tacoma. Oil spilled by these vessels and barges can be transported virtually throughout Puget Sound. The BNSF railroad travels alongside Puget Sound from Dupont, Washington to Tacoma, Washington, from downtown Seattle, Washington to Everett, Washington and from Blanchard, Washington to Bellingham, Washington.

2.3.4 Marine Waters and the Pacific Ocean off the coast of Washington and Oregon

The proposed action includes response activities in the Strait of Georgia, Rosario Strait, Strait of Juan de Fuca, and the Pacific Ocean (out to the EEZ boundary) off of the coast of Washington and Oregon because oil tanker vessels and fuel oil barges transport crude oil to Ferndale and Anacortes refineries and refined fuel oil from the refineries down the Washington and Oregon coast. The action area therefore includes these coastal waters as well.

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).

Rivers and streams that are crossed by pipelines and railroads from Ferndale to Eugene are spawning and rearing habitat to salmon and steelhead populations.

Table 5. Tributary and salmon and steelhead populations affected by pipeline and railroad spills.

River	Listed salmon and steelhead populations that could be affected by the response actions
Nooksack*	Steelhead (2): Nooksack, South Fork Nooksack. Chinook populations (2): North/Middle Fork Nooksack, South Fork Nooksack
Samish	Strays from Nooksack and Skagit populations
Skagit River*	Steelhead populations (4): Baker River, Nookachamps Creek, Sauk River, and Skagit River. Chinook populations (6): Upper Cascade River, Suiattle, Upper Sauk, Lower Sauk, Lower Skagit, Upper Skagit.
Pilchuck River	Steelhead (1): Pilchuck River. Chinook (0)
Stillaguamish River*	Steelhead (3): Stillaguamish River, Deer Creek, Canyon Creek. Chinook (2): North Fork Stillaguamish River, South Fork Stillaguamish River

River	Listed salmon and steelhead populations that could be affected by the response actions
Snohomish River*	Steelhead (5): Snohomish River, Skykomish River, Pilchuck River, Snoqualmie River, Tolt River. Chinook (2): Skykomish River, Snoqualmie River
Sammamish	Steelhead (2): North Lake Washington, Lake Sammamish. Chinook (2): Sammamish, Cedar River,
Cedar River	Steelhead (1): Cedar River. Chinook (2): Cedar River, North Lake Washington/Sammamish River
Green River*	Steelhead (1): Green River. Chinook (1): Green/Duwamish River
Green River	Steelhead (1): Green River. Chinook (1): Green/Duwamish River
Puyallup*	Steelhead (2): Puyallup River, White River. Chinook (2): Puyallup River, White River
Nisqually*	Steelhead (1): Nisqually River. Chinook (1): Nisqually River
Lower Cowlitz*	Steelhead (4): Tilton, Upper Cowlitz, Lower Cowlitz, Cispus. Chinook (2): Upper Cowlitz, Lower Cowlitz Coho: Upper Cowlitz River, Cispus River, Tilton River, Lower Cowlitz River. Coho: Lower Cowlitz, Tilton, Upper Cowlitz, Cispus River. Chum (1): Cowlitz
Toutle	Steelhead (2): North Fork Toutle River, South Fork Toutle River. Chinook (1): Toutle River. Coho (2): North Fork Toutle, South Fork Toutle.
Ostrander Creek	Steelhead: Lower Cowlitz. Chinook: Lower Cowlitz. Coho: Lower Cowlitz.
Coweeman River	Steelhead (1): Coweeman. Chinook (1): Coweeman. Coho (1) Coweeman.
Kalama River	Steelhead (1): Kalama River. Chinook (1): Kalama River. Coho (1): Kalama. Chum (1): Kalama.
Lewis River	Steelhead (2): North Fork Lewis, East Fork Lewis. Chinook (1): Lewis River. Coho (2): North Fork Lewis, South Fork Lewis. Chum (1): Lewis
Lake River	Steelhead (1): Salmon Creek. Chinook (1): Salmon Creek. Coho (1): Salmon Creek. Chum (1): Salmon Creek
Willamette River	Steelhead (1): UWR Steelhead. Chinook (1): UWR Chinook

The Nooksack River action area is a low gradient, leveed, single thread channel that flows through agricultural fields before transitioning into a braided channel network through an intertidal salt marsh delta entering Puget Sound. Large lengths of the levees are virtually unvegetated but there are also wide riparian buffers in places, particularly on the east side of the channel. Nooksack and South Fork Nooksack steelhead and North/Middle Fork Nooksack and South Fork Nooksack Chinook salmon migrate and rear in the Nooksack River action area.

Juvenile steelhead likely migrate to deep Puget Sound water when they leave the Nooksack River but Chinook "ocean type" salmon smolts pause their migration to rear and grow in the shallow salt marsh delta. The Lummi River was the main outflow channel of the Nooksack River to Lummi Bay until the Nooksack flow was redirected into the smaller southern channel into Bellingham Bay. The Lummi River remains connected to the Nooksack River by a high flow culvert in the levee. The Lummi River is rearing habitat for Chinook salmon.

The action area includes one Nooksack River tributary, Silver Creek. It also includes five streams where Nooksack River steelhead or Chinook strays produce Nooksack River offspring; Schell Ditch, Whatcum Creek, Squalicum Creek, Spring Creek and Chuckanut Creek. Silver Creek is Chinook salmon rearing habitat. It is listed on the Washington State 303(d) list as impaired for dissolved oxygen and fecal coliform. Schell Ditch is migration rearing habitat for Chinook salmon. Whatcum Creek provides spawning and rearing habitat to Nooksack River steelhead and Chinook salmon. Squalicum Creek provides spawning and rearing habitat to stray Nooksack River steelhead and rearing habitat to Nooksack River Chinook. Squalicum Creek water quality exceeds Washington State standards for temperature, dissolved oxygen, and fecal coliform bacteria. Spring Creek and Chuckanut Creek provide spawning and rearing habitat to Nooksack River steelhead.

The Samish River action area is a low gradient, leveed, single thread channel that flows through agricultural fields before transitioning into a braided network through an intertidal salt marsh delta and entering Puget Sound. There is sparse riparian vegetation on both sides of the channel. There is not a Samish River steelhead or Chinook salmon population but steelhead and salmon from nearby populations stray into the Samish River and Chinook smolts are likely to rear in the salt marsh delta. The action area includes four tributaries and sloughs associated with the Samish River; Bear Creek, Colony Creek Edison Slough and Joe Leary Slough. Only Bear Creek has steelhead and Chinook salmon spawning and rearing at the Pipeline crossing. There are no listed fish in the other streams although a spill would be transported to the Puget Sound nearshore. The Olympic pipeline crosses the Samish River at river mile 6.5 and crosses Bear Creek, Colony Creek, Edison Slough, and Joe Leary Slough. The BNSF crosses the Samish River at river mile 8.6 and does not cross any of the tributaries or sloughs.

North Fork and South Fork Skagit River action areas are low gradient, diked, single thread channels through agricultural fields before they turn into braided channel networks through salt marsh deltas in Puget Sound. There is riparian buffer on both sides of the channels. Because of the low gradient, the channel substrate is sand and there is no spawning habitat in the action area. Critical habitat productivity is limited by levees and dikes, agriculture, water withdrawals, urban development, temperature, lost delta habitat in the action area as well as degraded riparian habitat, dams, peak flows, and sediment from the high road density in the timberlands above the action area (NMFS, 2006b; Shared Strategy for Puget Sound, 2007). Baker River, Nookachamps Creek, Sauk River, and Skagit River steelhead populations and Upper Cascade, Suiattle, Upper Sauk, Lower Sauk, Upper Skagit, and Lower Skagit Chinook populations migrate through the action area to and from upstream spawning habitat. The action area includes three tributaries and sloughs connected to the Skagit River; Britt Slough, Hill Ditch and Fisher Creek. The Olympic pipeline crosses the Skagit River at River Mile 7 just before it splits into the North Fork Skagit River and the South Fork Skagit River. The Olympic pipeline crosses Britt Slough and Hill

Ditch, which provide rearing habitat for steelhead and Chinook salmon. The Olympic pipeline also crosses Fisher Creek which does not contain listed fish but is connected to Hill Ditch. The BNSF railroad crosses the Skagit River at river mile 13 and is adjacent to the river at river mile 10 and river mile 3.6.

The Stillaguamish River and Cooks Slough are low gradient, diked, single thread channels through agricultural fields before they recombine at river mile 6.5 and the Stillaguamish River turns into braided channel networks through salt marsh deltas in Puget Sound. Because of the low gradient the channel substrate is sand and mud and there is no spawning habitat downstream from the pipeline crossing. Productivity of steelhead and Chinook is limited by the levees and dikes, agriculture, and high water temperature below the pipeline crossing and high peak flows and sediment from the high road density in the timberland upstream from the pipeline crossing (Shared Strategy for Puget Sound, 2007). Stillaguamish River, Deer Creek, and Canyon Creek steelhead populations and North Fork Stillaguamish and South Fork Stillaguamish Chinook populations migrate past the pipeline crossing to and from upstream spawning habitat. The Olympic pipeline crosses four Stillaguamish River tributaries that are migration and rearing habitat for steelhead and Chinook salmon; Portage Creek, Middle Fork Quilceda Creek and Quilceda Creek are spawning habitat for Chinook salmon. The Olympic pipeline crosses the Pilchuck Creek tributary to the Stillaguamish River at River Mile 1 and then crosses the Stillaguamish River at river mile 11, just before it splits into the Stillaguamish River and Cooks Slough. The BNSF crosses the Stillaguamish River at river mile 6.2.

The Snohomish River action area is a low gradient, leveed, single thread channel through agricultural fields before it splits into a braided network of sloughs and channels as it passes east of the city of Everett. Because of the low gradient, the channel substrate is sand and mud. Critical habitat quality is limited by loss of estuarine, floodplain and off-channel from levees and dikes for cities and agriculture below the pipeline crossing and poor riparian forests, habitat complexity and high peak flows and sediment from the high road density in the timberland above the action area (Shared Strategy for Puget Sound, 2007). Snohomish, Skykomish, Pilchuck, Snoqualmie and Tolt steelhead populations and Skykomish and Snoqualmie Chinook populations migrate past through the action area to and from upstream spawning habitat. Three creeks or sloughs are part of the Snohomish River action area; Allen Creek, Ebey Slough and Beadwater Slough. The Olympic pipeline crosses the Snohomish River at river mile 11. The Olympic pipeline also crosses Allen Creek which provides spawning habitat for Chinook salmon and it crosses Ebey Slough and Beadwater Slough which provide rearing habitat for steelhead and Chinook salmon. The BNSF crosses or intercepts the Snohomish River at three points in the estuary.

The Sammamish River action area is a low gradient, leveed, single thread channel through Bellevue before it enters Lake Washington. Lake Washington is connected to Puget Sound by the Lake Washington Ship Canal and the Ballard Locks. Action area critical habitat quality is limited by urbanization and population growth that limit restoration opportunities, lowered base flows, increased peak flows, eliminated side channels and off channels, removed riparian vegetation and large woody debris and supplies stormwater pollutants (Shared Strategy for Puget Sound, 2007). Sammamish Chinook populations migrate through the action area to and from upstream spawning habitat. Valley Creek, Kelsey Creek, Richards Creek, Sunset Creak, Coal

Creek, May Creek are part of the Sammamish River action area. The Olympic pipeline crosses the Sammamish River at RM 5. The pipeline also crosses Valley Creek, Kelsey Creek, Richard Creek, Sunset Creek which provide migration and rearing habitat to Chinook salmon. The pipeline crosses Coal Creek which provides rearing habitat to Chinook salmon and to steelhead. The pipeline crosses May Creek which provides spawning and rearing habitat to Chinook salmon and provides rearing habitat to steelhead. The BNSF railroad runs along the Puget Sound shoreline from Everett to downtown Seattle and crosses the outlet of the Sammamish River below the Ballard Locks.

The Cedar River action area is a low gradient, leveed, single thread channel through Renton before it enters Lake Washington. Lake Washington is connected to Puget Sound by the Ship Canal and the Ballard Locks. Action area critical habitat quality is limited by urbanization and population growth that limit restoration opportunities, lowered base flows, increased peak flows, eliminated side channels, off channels, riparian vegetation and large woody debris and supplies stormwater pollutants to the river (Shared Strategy for Puget Sound, 2007). Cedar River Chinook migrate through the action area to and from upstream spawning habitat. The Olympic pipeline crosses the Cedar River at River Mile 3.

The Green River action area is a low gradient, leveed, single thread channel through Kent and Tukwila before it enters the Duwamish Waterway and Puget Sound. Action area critical habitat quality is limited by urbanization and population growth that limit restoration opportunities, lowered base flows, increased peak flows, eliminated side channels, off channels, riparian vegetation and large woody debris and supplies stormwater pollutants to the river. The Green/Duwamish Chinook population is an integrated wild-hatchery population. The Olympic pipeline crosses the Cedar River at River Mile 12.5 and 24.

The Puyallup River in the action area is a straightened, leveed, single channel through the city of Tacoma. Critical habitat quality is limited by loss of estuarine, floodplain and off-channel habitat from levees and dikes for the cities and harbors below the pipeline crossing. Upstream hydropower dams cause high peak flows and high road density in timberland above the action area supplies sediment. The original 5900 acre Puyallup River estuary was dredged and filled into the Port of Tacoma Commencement Bay harbor, drastically limiting the capacity for smolts to grow in the estuary. Commencement Bay sediments are also contaminated with pollutants. White River and Puyallup spring Chinook, and White River and Puyallup River steelhead populations migrate through the action area (Shared Strategy for Puget Sound, 2007). The Olympic pipeline crosses the Puyallup River at river mile 4. The BNSF crosses the Puyallup River at river mile 2.5.

The Nisqually River is a low gradient naturally meandering channels through a well vegetated riparian buffer just east of the city of Yelm. Below the pipeline crossing, large sections of land adjacent to the Nisqually River are protected from urban development because they are enclosed by Joint Base Lewis McCord, the Nisqually Indian Reservation, and the USFWS Nisqually Wildlife Refuge. There is Chinook and steelhead spawning habitat at the pipeline crossing. Productivity of Nisqually steelhead and Chinook is limited by two upstream hydropower projects and sediment from roads and past timber harvest practices in the Gifford Pinchot National Forest and private timberland. The Nisqually River steelhead population and Nisqually River Chinook population migrate past the pipeline crossing to and from upstream spawning habitat. The Olympic pipeline crosses the Nisqually River at river mile 19 and crosses Muck Creek and Lacomas Creek that are also spawning habitat for Chinook salmon. The BNSF railroad crosses the Nisqually River just upstream from the estuary.

The Lower Cowlitz River is a naturally meandering channel through a vegetated riparian buffer and agricultural pastures near Toledo, Washington. The Lower Cowlitz is spawning, rearing and migration habitat for the Lower Cowlitz steelhead, Lower Cowlitz Chinook and Lower Cowlitz coho populations and is migration habitat for Upper Cowlitz coho, Chinook and steelhead populations transported around three hydropower dams. The dams attenuate peak flood flows in the Lower Cowlitz. Downstream from the pipeline crossing the Lower Cowlitz River flows through Castle Rock, Lexington and Kelso/Longview and is heavily diked and channelized for flood control. The Lower Cowlitz is still recovering from the enormous mass of fine sediment added during the 1980 eruption of Mount Saint Helens. There is LCR coho and Chinook spawning habitat at the pipeline crossing. The Olympic pipeline crosses the Cowlitz River at river mile 32 and crosses Lacamas Creek, Hill Creek, Foster Creek, and Salmon Creek.

The Toutle River is a large tributary to the Cowlitz River with LCR coho, Chinook and steelhead populations. The US Army Corps of Engineer constructed a large sediment retention structure (SRS) at river mile 26 of the North Fork Toutle River to stop and store sediment from the Mount Saint Helens avalanche from accumulating in the Lower Cowlitz River and taking up flood water space. The Toutle River was heavily inundated by sediment after the 1980 Mount Saint Helens eruption and is slowly recovering. There is no coho or steelhead spawning habitat in the lower Toutle River mainstem.

After the Olympic pipeline crosses the Toutle River, it travels south near the I-5 corridor next to the Cowlitz River and the Columbia River until it crosses the Columbia River at river mile 92. The pipeline crosses Sauvie Island and the Multnomah Channel and then follows the west side of the Willamette River to its termination at the McCall Oil and Chemical Terminal. Tidewater Barge Lines transport fuel oils up the Columbia River to be distributed from their terminal in Pasco. The BNSF also follows the I-5 corridor along the Cowlitz and Columbia Rivers into Vancouver and then turns east and travels up the Columbia River Corridor to Pasco. A crude oil spill or fuel oil spill is possible virtually anywhere between the mouth and Pasco.

Summary of recent documented oil spills in rivers and streams included in the action area:

- In September 1983 Olympic pipeline spilled 4000 barrels of diesel fuel at the Allen pump station in Skagit County.
- In November 1985, 738 barrels of jet fuel spilled into Des Moines Creek near Sea-Tac Airport south of Seattle.
- In May 1986, 1785 barrels of gasoline, jet fuel and diesel fuel leaked from the Olympic pipeline in the Renton Area of south King county.
- In February 1988, 4000 barrels of diesel fuel spilled from an Olympic pipeline rupture at the Allen Station. The oil was contained in an adjacent field and didn’t reach surface water.

- In February1990, 285 barrels of diesel fuel spilled from a failed gasket at the Olympic pipeline Woodinville pump station.
- In January 1992, 71 barrels of diesel fuel spilled from a ruptured Olympic pipeline fitting at the Rainier pump station.
- In June 1994, 95 barrels of diesel fuel spilled from an Olympic pipeline equipment monitor probe connection at the Spanaway pump station.
- In March 1996, the Olympic pipeline cracked and leaked near Kalama as a result of ground movement after extensive rains.
- In 1996, the Olympic Pipeline leaked 24 barrels of gasoline and diesel due to a small crack in the line near Everett, next to Ebey Slough
- In 1999, the Olympic pipeline ruptured and spilled 4762 barrels of gasoline into Whatcom creek in Bellingham (NTSB, 2002).

2.4.1 Environmental Baseline in the Columbia River

The Columbia River is rearing and migration habitat for juvenile and adult salmonids and for migration habitat for eulachon. The development of hydropower and water storage projects within the Columbia River Basin inundated many mainstem spawning and shallow-water rearing areas, altered water quality and water quantity, increased water temperature, decreased water velocity, altered salmonid food webs and increased salmonid predators (Ferguson et al. 2005; Williams et al. 2005). The Columbia River has also been degraded by the effects of road construction, forest management, agriculture, mining, transportation, urbanization, and water development. Each of these economic activities contributes changes in stream channel morphology, degradation of spawning substrates, reduced instream roughness and cover, loss and degradation of estuarine rearing habitats, loss of wetlands, loss and degradation of riparian areas, water quality degradation (e.g., temperature, sediment, dissolved oxygen), blocked fish passage, direct take, and loss of habitat refugia.

Salmon and steelhead are exposed to high rates of predation during all life stages in the Columbia River. Fish, birds, and marine mammals, including harbor seals, sea lions, and killer whales all prey on juvenile and adult salmon. The Columbia River Basin has a diverse assemblage of native and introduced fish species, some of which prey on salmon, steelhead, and eulachon. The primary resident fish predators of salmonids in many areas of the Columbia River inhabited by anadromous salmon are northern pikeminnow (native), smallmouth bass (introduced), and walleye (introduced). Other predatory resident fish in the action area include channel catfish (introduced), Pacific lamprey (native), yellow perch (introduced), largemouth bass (introduced), and bull trout (native). Increased predation by non-native predators has and continues to decrease population abundance and productivity. Avian predation also limits salmonid recovery in the Columbia River Basin. Throughout the basin, piscivorous birds congregate near hydroelectric dams and in the estuary near manmade islands and structures. Avian predation has been exacerbated by environmental changes associated with river developments. Water clarity caused by suspended sediments settling in impoundments increases the vulnerability of migrating smolts to avian predation. Delay in migration through project reservoirs due to slack water, particularly immediately upstream from the dams, increases smolt exposure to avian predators, and juvenile bypass systems at dams concentrate smolts, creating potential feeding stations for birds. Dredge spoil islands, associated with maintaining the

Columbia River navigation channel, provide habitat for nesting Caspian terns and other piscivorous birds. Caspian terns, double-crested cormorants, glaucous winged/western gull hybrids, California gulls, and ring-billed gulls are the principal avian predators in the basin. As with piscivorous predators, predation by birds has and continues to decrease population abundance and productivity.

In general, the aquatic habitat of the Columbia River provides habitat for a variety of benthic, epibenthic, and water column organisms. The shape, composition, and configuration of benthic topography are in a state of relatively constant change in the Lower Columbia River due to natural processes. Sand waves naturally form and propagate along the channel and the adjacent river bottom, with the estimated volume of sand in a single large sand wave in a range of between 100,000 to 200,000 cubic yards. Substrate within both subtidal and intertidal benthic environments consists largely of silts and medium-to-coarse alluvial sands.

Columbia River turbidity, pH, and dissolved oxygen are generally within the range needed to support aquatic life but most of the Columbia River mainstem below the John Day River confluence is on the Washington State Department of Ecology 303(d) list for elevated water temperature. Data published by the U.S. Geological Survey in 2012 indicate that summer water temperatures downstream of Bonneville Dam routinely exceed 70°F (Tanner et al., 2013), compared to optimal 55°F for incubation of eggs to 68°F for adult migration.

In addition to development-related actions (e.g. marinas, moorage facilities) that have adversely affected salmon and steelhead in the action area, the environmental baseline also includes restoration actions that have improved habitat conditions for salmon and steelhead. Some restoration actions like the removal of the Hemlock and Condit tributary dams, removing and breaching dikes in portions of the estuary, and planting riparian and floodplain native woody vegetation allow for restoring habitat forming processes and should result in the eventual achievement of self-sustaining habitat. The preservation and restoration of other high quality habitats also are likely to contribute to the recovery of ESA-listed stocks. Other restoration actions including digging chum salmon spawning channels, developing side channels for rearing, and placing large woody material (LWM) largely focus on improving short-term to mid-term habitat conditions, though their ability to delay the decline of listed salmonids is equivocal (Roni et al., 2002).

Finally, there have been three petroleum hydrocarbon transportation accident spills where more than 10,000 gallons reached the Columbia River. On Jan 1, 1978 a Columbia River barge spilled 100,000 gallons of diesel fuel on the Columbia River. On March 20, 1984, the tank ship MobilOil grounded on the Columbia River neat St. Helens, Oregon and spilled 200,000 gallons of heavy fuel oil. NOAA (1985) reported that the MobilOil spill was rapidly flushed out to sea by high spring flows. Oil that reached the channel bottom was more slowly transported downstream by bedload transport. Oil intercepted by tidal marsh vegetation was also flushed out to sea when the vegetation died. Bioassays showed no lethal effects of the mixed oil concentrations to fish.

The most recent crude oil spill occurred on June 3, 2016 when a Union Pacific train with 96 tank cars carrying Bakken oil from New Town, North Dakota to U.S. Oil and Refining in Tacoma, Washington derailed in the Columbia River Gorge near Mosier, Oregon. Sixteen (16) of the 96 cars derailed after the train's emergency brake system and several cars then caught fire and large explosions occurred from the tank cars. All of the tank cars were modern CPC-1232 design. 42,000 US gallons (160,000 liters) of oil were spilled. Much of the crude oil was consumed by fire, and 10,000 US gallons (38,000 liters) were recovered from the city's sewage treatment plant. A small portion went into the Columbia River, however the exact amount is unknown.

- In 1985 the tanker ship MobilOil leaked 5,548 barrels of heavy fuel oil into the Columbia River when rudder failure caused it to ran aground and rip a long gash through its starboard cargo tanks, ten miles downstream from Portland.
- On April 20, 1996 a train derailment near Wind River spilled 65,000 gallons of diesel fuel (WSDOE, 1997).
- In 2015 16 Union Pacific tank cars derailed near Mosier, Oregon spilling 1,000 barrels of crude oil. An unknown amount of oil entered the Columbia River.

2.4.2 Environmental Baseline in Puget Sound

Approximately 5 million people live in the six counties containing the Puget Sound action area. The past effect of those populations is expressed as changes to physical habitat and loadings of pollutants contributed to Puget Sound. These changes were caused by residential, commercial, industrial, agricultural, and other land uses. The collective effects of these activities tend to be expressed most strongly in lower river systems where the impacts of numerous upstream land management actions aggregate to influence natural habitat processes and water quality.

Human activities have degraded extensive areas of salmon spawning and rearing habitat in Puget Sound. Watershed development and associated urbanization throughout the Puget Sound, Hood Canal, and Strait of Juan de Fuca regions have created impermeable surfaces (roads, buildings, parking lots, sidewalks etc.), and polluting waterways and dredged and filled estuarine rearing areas (Bishop and Morgan, 1996). Hardening of nearshore bank areas with riprap or other material has altered marine shorelines; changing sediment transport patterns and reducing important juvenile habitat (Shared Strategy for Puget Sound, 2007). In general, habitat has been degraded from its pristine condition, and this trend is likely to continue with further population growth and resultant urbanization in the Puget Sound region. Estuarine areas have been dredged and filled, resulting in the loss of important juvenile rearing areas (Shared Strategy for Puget Sound, 2007).

NMFS has completed several section 7 consultations on large scale projects affecting listed species in Puget Sound. Among these are the Washington State Forest Practices Habitat Conservation Plan (NMFS, 2006a), and consultations on Washington State Water Quality Standards (NMFS 2008b), Washington State Department of Transportation Preservation, Improvement, and Maintenance Activities (NMFS 2013a), the National Flood Insurance Program (NMFS 2008c), and the Elwha River Fish Restoration Plan (Ward et al. 2008). NMFS completed 8 consultations with the EPA on the registration of pesticides (NMFS, 2008, 2009, 2010, 2011b, 2012a, c, 2015c, 2017).

Documents such as these considered the effects of the proposed actions that would occur up to the next 50 years on the ESA listed salmon and steelhead species in the Puget Sound basin. Information on the status of these species, the environmental baseline, and the effects of the proposed actions are reviewed in detail. The environmental baselines in these documents consider the effects from timber, agriculture and irrigation practices, urbanization, hatcheries and tributary habitat, estuary, and large scale environmental variation. These biological opinions and HCPs, in addition to the watershed specific information in the Puget Sound Salmon Recovery Plan mentioned above, provide a current and comprehensive overview of baseline habitat conditions in Puget Sound and are incorporated here by reference.

Past oil spills and responses within the action area include the following:

- In 1988 the tank barge MCN-5 capsized and sank in Rosario Strait spilling 1595 barrels of heavy cycle gas oil while being towed from the Texaco refinery in Anacortes to Seattle.
- In 1988 the barge Nestucca spilled 5500 barrels of bunker fuel when it ran aground and collided with its tug.
- In 1991 the Japanese vessel Tenyo Maru sank with 11,309 barrels of fuel with it collided with the Chinese freighter Tuo Hai about 25 miles northwest of Cape Flattery.
- In 1991 the Japanese vessel Tenyo Maru sank with 11,309 barrels of fuel with it collided with the Chinese freighter Tuo Hai about 25 miles northwest of Cape Flattery.
- In 1994 a Crowley Marine Services' barge cargo tank ruptured after running aground somewhere on Clements Reef north of Sucia Island and leaked 641 barrels of diesel oil into Rosario Strait north of Anacortes.
- In 1998 crews accidentally overfilled the cargo vessel Anadyr's fuel tanks and spilled 178 barrels of fuel oil into the Sitcum Waterway.
- In 2003 Crews loading a tank barge with heavy fuel oil at the Point Wells ChevronTexaco terminal near Shoreline overfilled the barge's cargo tanks and spilled approximately 112 barrels into Puget Sound.
- In 2004 the Polar Texas spilled oil in Puget Sound off of Vashon Island. Cleanup crews recovered 59 tons of oily debris from the shorelines and 163 barrels of oily water with skimming operations.
- In 2011 the barge Davy Crockett Par sank near Camas, Washington and leaked fuel oil. https://www.westcoast.fisheries.noaa.gov/images_template/noaa-wcr-logo.png. Cleanup efforts recovered 1.6 million gallons of oily water and an additional 904 barrels of bunker oil.

2.4.2 Environmental Baseline in the Strait of Georgia, Strait of Juan de Fuca, Pacific Ocean off the coast of Oregon and Washington

Completed consultations include the following: NMFS issued four opinions on the effects of ocean fisheries on listed species (NMFS, 1999, 2001, 2011a, 2015a). NMFS issued a biological opinion of the effects of United States Navy testing and training in the Pacific Ocean off the Coast of Washington (NMFS, 2015b).

To protect their shoreline property from erosion, many waterfront homeowners construct bulkheads between their land and the beach. Ironically, one consequence of bulkheads is the loss of sand from the beach and beach erosion. The natural process of bluff erosion provides a supply of sand and rocks to the beach. Construction of bulkheads cuts off this supply of beach-building material and prevents the wave's energy from dissipating. The loss of sand and pebbles affects small fish that use this habitat for spawning. These small fish form the base of the food chain for larger fish.

Marine shipping plays a key role in Washington and Oregon's economy. Dredging, filling, and other alterations of shallow estuarine areas to create ports were devastating to the fish that depended on the habitat as a transition from freshwater to saltwater. Over time, the increased demand for shipping facilities led to more dredging and filling. Not only are there more ships, but the ships are being built bigger. To accommodate larger ships, ports expand and shipping channels are dredged deeper. Dredging the bottom of bays and rivers displaces plants and animals living there and can stir up contaminated sediments. Dumping dredged materials elsewhere in the water smothers habitat.

The Strait of Georgia and Strait of Juan de Fuca connect Puget Sound to the Pacific Ocean. Oil tankers have a history of oil spills in these waters.

- In 1964 a barge carrying 56,000 barrels of gasoline, diesel and stove oil from the Ferndale refineries grounded on a sandbar several hundred yards offshore between Moclips and Pacific Beach just south of the Quinault Indian Reservation. 28,572 barrels of petroleum leaked into the water.
- In 1972 the USS General M.C. Meigs got loose from tow and drifted into rocks offshore the southwest corner of the Makah Indian Reservation spilling 54,763 barrels of heavy fuel oil into the water over 10 months.
- In 1985 the Arco Anchorage ran aground while anchored in Port Angeles Harbor, tearing two long holes in the hull and spilling 5690 barrels of Alaskan crude had spilled into the harbor.
- In 1988 the tank barge MCN-5 capsized and sank in Rosario Strait spilling 1595 barrels of heavy cycle gas oil while being towed from the Texaco refinery in Anacortes to Seattle.
- In 1988 the barge Nestucca spilled 5500 barrels of bunker fuel when it ran aground and collided with its tug.
- In 1991 the Japanese vessel Tenyo Maru sank with 11,309 barrels of fuel with it collided with the Chinese freighter Tuo Hai about 25 miles northwest of Cape Flattery.
- In 1994 a Crowley Marine Services' barge cargo tank ruptured after running aground somewhere on Clements Reef north of Sucia Island and leaked 641 barrels of diesel oil into Rosario Strait north of Anacortes.
- In 1998 crews accidentally overfilled the cargo vessel Anadyr's fuel tanks and spilled 178 barrels of fuel oil into the Sitcum Waterway.
- In 2003 Crews loading a tank barge with heavy fuel oil at the Point Wells ChevronTexaco terminal near Shoreline overfilled the barge's cargo tanks and spilled approximately 112 barrels into Puget Sound.

- In 2004 the Polar Texas spilled oil in Puget Sound off of Vashon Island. Cleanup crews recovered 59 tons of oily debris from the shorelines and 163 barrels of oily water with skimming operations.
- In 2011 the barge Davy Crockett Par sank near Camas, Washington and leaked fuel oil. Cleanup efforts recovered 1.6 million gallons of oily water and an additional 904 barrels of bunker oil.

Olympic Pipeline Consultations

- WCR 2018-9288, Informal, Pipeline maintenance.
- WCR-2018-9807, Informal, Pipeline maintenance.
- WCR 2018-6386, Informal, Pile removal.
- WCR-2016-4367, Informal, Pipeline maintenance.
- WCR-2016-4504, Informal, Pipeline maintenance.
- NWR-2010-1431, Informal, Pipe removal.
- NWR-2010-5200, Informal, Pipeline construction.
- NWR-2009-4677, Informal, Fish passage repair.
- NWR-2008-1205, Informal, Colony Creek bank stabilization.
- NWR-2005-305, Informal, North Ebey Slough pipeline crossing.
- NWR-2004-897, Informal, Pipeline inspection and repair.
- NWR-2002-1508, Informal.
- NWR-2002-53, Informal, Rehabilitation and repair of salmon rearing habitat in Whatcom Creek, Bellingham.

BNSF consultations

- WCR-2016-4101, Formal, Burlington Northern Santa Fe Swinomish Channel Padilla Bay Bridge.
- WCR-2015-3628, Formal, Burlington Northern Santa Fe Padilla Bay Bridge Replacement.
- WCR-2015-3564, Formal, Culvert Repair.
- NWR-2006-264, Informal, Skykomish Levee Remediation Project.
- NWR-2005-5987, Informal, Dog Creek Culvert Maintenance and Outlet Dredge, Skamania County.
- NWR-2005-5976, Informal, Lyle Siding Improvement.
- NWF-2001-1045, Informal, Snohomish County BNSF Railway.
- NWR-2003-651, Informal, BNSF Toutle River Bridge 84.8 Repair Project.

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).

Removing spilled oil and hazardous substances from water and shorelines has benefits to listed species and critical habitat and our analysis takes place in the context of that general beneficial effect. The focus of our analysis is on the effects of the specific response activities and how they are conducted. To account for each effect pathway, including proposed BMPs to minimize or offset effects, NMFS assigned a rating of low, moderate or high to each exposure pathway and associated stressor to characterize the: 1) likelihood of PBF exposure, 2) magnitude of PBF response, and 3) consequence of PBF exposure and response. To account for each effect pathway on listed species, NMFS applied PBF stressor response magnitudes to applicable life stages to qualitatively estimate a likelihood of individual exposure, magnitude of individual response and consequence of individual exposure and response to fitness. Finally, NMFS estimated the probability of individual exposure, magnitude of individual response and consequence of individual exposure and response to fitness for the direct effect pathways that do not go through a PBF. NMFS combined all the stressors for each PBF and each individual fish and assigned a low, moderate or high rating to the PBF. The results of this analysis are summarized in tables at the start of each section.

The action agencies anticipate that any response conducted under this proposed action will take less than four-days to complete, thus we assume that response actions will take no more than four-days to complete. Our effects analysis is based on that assumption.

<u>2.5.1 Salmon and steelhead</u>

Table 6. Summary of salmon and steelhead critical habitat PBF effects and direct effects. E=likelihood of exposure, R=magnitude of response, C=consequence of exposure and response to individual fitness. (Green = low, yellow = medium and red = high)

River and streams stressors	PBF (Direct)	Effect	E	R	C	Life stage	E	R	C	Life Stage	E	R	C	Life Stage	E	R	C
Removed riparian ground cover	Water quality	Erosion-Suspended sediment				Eggs in redds				Juvenile				Adult			
	Water quality	Shade-Temperature															
	Forage	Aquatic insects															
Dams, barriers and culvert blocks	Passage	Obstructed passage								Juveniles				Adults			

River and streams stressors	PBF (Direct)	Effect	E	R	C	Life stage	E	R	C	Life Stage	E	R	C	Life Stage	E	R	C
Vessel and boom anchors	Direct	Damage				Eggs/fry in redds											
Lights, noise at night	Direct	Predation				Eggs fry in redds				Juveniles				Adults			
Skimming/vacuuming	Direct	Entrainment								Juveniles							
Columbia River stressors	PBF (Direct)	Effect	E	R	C	Life stage	E	R	C	Life Stage	E	R	C	Life Stage	E	R	C
In situ burn	Water quality	Temperature															
In situ burn	Forage	Benthic invertebrates															
Vessel and boom anchors	Direct	Crushing				Eggs and larvae											
Lights, noise at night	Direct	Predation				Eggs fry in redds				Juveniles				Adults			
Skimming/vacuuming	Direct	Entrainment								Juveniles							
Puget Sound stressors	PBF (Direct)	Effect	E	R	C	Life stage	E	R	C	Life Stage	E	R	C	Life Stage	E	R	C
Removal of ground cover-erosion	Water quality	Suspended sediment															
Vessel and boom anchors	Benthic forage	Crushing															
In situ burn	Water quality	Temperature															
In situ burn	Benthic prey	Smothering															
Removing surface oils with vacuums and skimmers	Direct	Entrainment								Juveniles							
Lights, noise, presence	Direct	Avoidance								Juveniles				Adults			
Removal of surface oils with sorbents	Direct	Toxicity															
Dispersing surface oil with chemicals	Direct	Toxicity												Adults			
Dispersing surface oil with chemicals	Direct	Toxicity to prey												Adults			
Pacific Ocean stressors	PBF (Direct)	Effect	E	R	C	Life stage	E	R	C	Life Stage	E	R	C	Life Stage	E	R	C
Dispersing surface oil with chemicals	Water quality	Toxicity												Adults			

2.5.1.1 Effects to salmon and steelhead critical habitat PBFs and to life stages through these PBF effects in rivers and streams

Stressor: Actions that remove ground cover exposing soil to erosion (**water quality (suspended sediment, temperature), forage**)

Effect of erosion on water quality-suspended sediment

*Likelihood of suspended sediment that degrades water quality-**low***

Establishing staging areas, foot traffic, manual and mechanical oil removal, dam and barrier construction, oiled vegetation removal and ambient temperature, low pressure flooding/flushing disrupt soil and remove ground cover on streambanks or in the riparian area exposing sediment to erosion. In nearly all cases, spill responders will be able to position staging areas in locations that have already been developed (e.g., cleared and paved with nearby access to water to deploy vessels, areas identified in GRPs) because the location of spills will be near established oil transportation corridors. In a small number of remote locations, staging areas may have to be established but vegetation clearing can be minimized by establishing points of access in the least-sensitive areas possible (e.g., areas with sparse vegetation), and by not clearing vegetation from an area unless approved by the EU. Engineered controls (e.g., silt fences and fiber rolls) will be put into place to minimize the erosion of soils and siltation of streams. BMPs stabilize some exposed areas.

*Magnitude of response on water quality due to suspended sediment-**moderate***

For responses covered by this opinion, the limited response time and the BMPs will prevent suspended sediment concentrations sourced from response action from exceeding tens of milligrams per liter for one day. For example, the cleanup of 2000 barrels (300 cubic meters) of spilled oil spread over 6000 square meters (i.e. 77 meters by 77 meters by .05 meters) could exposed up to 6000 square meters of erodible sediment. If overland flow from a large rainstorm eroded all the underlying sediment 0.01 meters deep into the channel discharging 20 cubic meters per second over 24 hours, the average concentration of suspended sediment in the plume would be 70 milligrams per liter[3].

*Consequence of exposure and response to suspended sediment on water quality-**low***

The use of established staging areas, BMPs and engineering controls will render exposure of river and stream water quality to suspended sediment infrequent and that the areas of ground cover removed by the four-day limit of the biological opinion and the action area terrain will minimize the size of erodible sediment sources should BMPs fail.

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[3] $$\frac{6000\ m^2 x .01\ m\ x\ 2000\ \frac{kg}{m^3}\ x\ 10^6\ \frac{mg}{kg}}{20\ \frac{m^3}{s}\ x\ 86400\ \frac{s}{day}\ x\ 1000\ \frac{L}{m^3}} = 70\ \frac{mg}{L}$$

Effects of suspended sediment to eggs and embryos

Likelihood of exposure to suspended sediment that reduces fitness of eggs and embryos-**low**

Freshwater spawning and incubation substrates may be impacted by increased siltation after vegetation removal and a concomitant reduction in dissolved oxygen in spawning substrates. Suspended sediment mixes with bedload and increases the fine sediment fraction of substrate used to construct redds. Successful salmon spawning requires substrates with low fine sediment embeddedness to permit a high flow of oxygenated water into the space between gravel. However, our effects analysis is based on our confidence (from past experience with erosion control BMPs) that BMPs will effectively limit the amount of sediment delivered to streams. For the direct effects to salmon and steelhead exposed to degraded habitat PBFs (i.e. water quality degraded by suspended sediment) we set the value of the direct effects stressor at the midpoint between the value if the BMP were not used and the value if the BMP is 100 percent effective. For suspended sediment, we expect maximum concentrations of suspended sediment to be tens of milligrams per liter for less than one day.

*Magnitude of egg and embryo response to suspended sediment-**moderate***

The response of eggs or embryos in redds exposed to tens of milligrams per liter suspended sediment for 24 hours would be 0 to 20 percent mortality (Jensen et al., 2009; Newcombe et al., 1996).

*Consequence of exposure and response to suspended sediment at the fitness level-**low***

The use of established staging areas, BMPs and engineering controls will render exposure of redds to suspended sediment infrequent and that response of eggs and embryos in redds to our anticipated suspended sediment concentrations should BMPs fail would be minimal mortality.

Effects of suspended sediment to juveniles and adults

*Likelihood of exposure to tens of milligrams per liter suspended sediment for less than one day-**low***

The likelihood that juvenile and adult salmon and steelhead will be exposed to suspended sediment plumes from the response site with an average concentration of tens of milligrams per liter for less than one day is low because as described above, the likelihood that response sites will source such a suspended sediment plume is low.

*Magnitude of response to tens of milligrams per liter suspended sediment for less than one day-**low***

The response of juvenile and adult salmon and steelhead to suspended sediment concentrations of tens of milligrams per liter for less than one day is sublethal, moderate physiological stress (Newcombe et al., 1996).

*Consequence of exposure and response to suspended sediment at the fitness level-**low***

The consequence of exposure and response to suspended sediment from the response site is low because the likelihood of exposure is low and the response is short duration, sublethal physiological stress.

Effects of removed vegetation on water quality-temperature

*Likelihood of exposure to solar heating that degrades water quality-**low***

Establishing staging areas, foot traffic, manual and mechanical oil removal, and oiled vegetation removal eliminates small amounts of shading vegetation on streambanks or in the riparian areas, exposing rivers and streams to increased solar heating. In nearly all cases, spill responders will be able to position staging areas in locations that have already been developed (e.g., cleared and paved with nearby access to water to deploy vessels, areas identified in GRPs) because the location of spills will be near established oil transportation corridors. In a small number of remote locations, staging areas may have to be established but vegetation clearing could be minimized by areas establishing points of access in the least-sensitive areas possible (e.g., areas with sparse vegetation), and by not clearing vegetation from an area unless approved by the EU.

*Magnitude of response of water quality to solar heating-**low***

For responses covered by this opinion, the limited response time and the BMPs will prevent a water temperature increase from removed shade from exceeding a few hundredths of a degree Celsius. For example, unshaded streams receive approximately 1000 Watts per square meter (240 calories per square meter-second) from the overhead sun. If responders removed all vegetation from a 10-meter wide swath through the riparian area to access the oil spill at a wide, shallow stream, the rate of temperature increase would be 0.00024 degrees Celsius per second. If the stream flow velocity is 0.1 meters per second, the increase in temperature would be 0.0024 degrees Celsius per meter so the total change in temperature in the 10 meter swath would be 0.024 degrees Celsius.

*Consequence of exposure and response to solar heating that degrades water quality-**low***

The presence of established staging areas will render exposure of river and stream water quality to increased solar heating infrequent and that the area of any vegetation removed will be minimized by the four-day limit of the biological opinion, BMPs and the action area terrain.

Effects of removed vegetation on aquatic insect forage

*Likelihood of riparian vegetation clearing that reduces forage-**low***

Establishing staging areas, foot traffic, manual and mechanical oil removal, and oiled vegetation removal removes aquatic insect on streambanks or in the riparian areas. Adult insects live in riparian vegetation and vegetation detritus is the base of their food web. These aquatic flies lay their eggs in the channel substrate and when the eggs hatch larvae drift downstream and upwards through the water column until they reach the surface. While they are in the water column, they are easy prey for juvenile salmon and steelhead.

*Magnitude of response to riparian vegetation clearing that reduces forage-**low***

For responses covered by this opinion, the limited response time and the BMPs will prevent significant areas of vegetation from being removed. The aquatic forage supply in rearing habitat is likely to experience a very slight, temporary decrease that is too low to meaningfully measure. Relatively small response site areas covered by this biological opinion are a small fraction of the riparian zones that are already altered and degraded by urbanization and agriculture but aquatic insect forage remains available.

*Consequence of riparian vegetation clearing that reduces forage-**low***

Established staging areas and BMPs will render exposure to decreased aquatic insect forage infrequent, and as a result of the four-day limit in the proposed action, any areas of vegetation removed will experience a minimal change in aquatic insect habitat should vegetation removal be necessary. The response site will likely represent an extremely small fraction of the riparian zone of the affected river or stream. Any reduction in insect forage could be offset by a shift to other food such as zooplankton such that the change in juvenile salmon or steelhead growth and energy is too small to measure.

Stressor: Construction of dams, barriers and culvert blocks **(passage)**

Effects of constructed barriers on passage

*Likelihood of obstructed passage from response actions-**moderate***

Responders will use culvert blockages, barriers and underflow dams to prevent oil from moving downstream into more sensitive habitat. While in place, culvert blocks and dams obstruct passage into or out of tributary streams. If culverts are blocked or dams are built during a seasonal migration period, then either method could have an impact on the spawning success or development of downstream-migrating juveniles.

*Magnitude of response to obstructed passage-**low***

For responses to spills covered by this biological opinion, the limited response time and BMPs will minimize the effect of passage obstructions on critical habitat. Responders will construct culvert blocks and dams to stop floating oil, allowing water to continue to flow under them. They will remove obstructions as soon as the threat of oiling to sensitive habitats has ended (usually a matter of days), thereby minimizing the potential impediment of migrations. The EU will provide responders with a list of resources at risk, which will include information about salmon spawning and migration times. This information will inform the use of instream barriers and minimize their impacts on salmon.

*Consequences of exposure and response-**low***

Although responders are likely to construct culvert blocks and dams at times of the year that obstruct passage, these obstructions will not block passage and will only be in place for up to four-days.

Effects of passage barriers on juveniles and adults

*Likelihood of exposure to passage barriers-**moderate***

Juvenile and adult salmon and steelhead are likely to be exposed to culvert blocks and dams because they rear in freshwater for months to years. Adult salmon and steelhead are likely to be exposed to passage obstructions during spawning runs into tributaries

*Magnitude of response to passage barriers-**low***

The response of juveniles and adults to culvert blocks and dams will be minimal because they include provisions for passage and will only be in place for up to four-days. The response of adults to culvert blocks and dams will be minimal because they include provisions for passage and will only be in place for up to four-days.

*Consequence of exposure and response to passage barriers- **low***

The consequence of juvenile and adult exposure and response to culvert blocks and dams to individual fitness is a very slight alteration of behavior.

2.5.1.2 Direct effects to salmon and steelhead life stages in rivers and streams

Stressor: Vessel and boom anchors and foot traffic **(redds)**

Effect of anchors and foot traffic on eggs and embryos

*Likelihood of exposure of active redds to vessel and boom anchors-**low***

At times responders may wade in and use vessels in streams while redds are present but it is unlikely that responders will step on or place anchors on redds. For all responses covered by this biological opinion, responders will be know if the spill is in spawning habitat at a time of year when redds are likely to be present. BMPs call for vessels and booms to be anchored to shorelines when redds are present.

*Magnitude of response of active redds to vessel or boom anchors-**high***

The impacts to redds from wading and anchors is damage to the redd that would likely cause many eggs, embryos or fry to be killed. Even if they are not crushed, damage to the redd would likely cause it to fail to protect eggs and embryos inside. When salmon construct a salmon redd they sort smaller gravel from the substrate so that the redd is coarser and better sorted than the substrate. The mounded shape accelerates flow over and through the structure leaving it vulnerable to scour. Damage to the redd by an anchor increases the risk that high flows will scour the redd, entraining and killing eggs or fry inside the redd. (Buxton et al., 2015).

*Consequence of exposure and response to anchors at the fitness level-**low***

Because redds are susceptible to damage from wading and anchors that would result in death of eggs or embryos, responders will emphasize protocols, GRPs and BMPs that minimize the possibility that they will be exposed to wading and anchors.

Stressor: Lights, noise and presence **(predation)**

Effects of lights to eggs/embryo and fry life stages

*Likelihood of fry exposure to response lights-**moderate***

Nighttime operations that require the use of lights will likely be necessary in streams when redds are present. For all responses covered by this biological opinion, responders will be know if the spill is in spawning habitat at a time of year when redds are likely to be present. Nighttime operations are limited to the first few days of a spill, when the goal is to collect as much of the mobile oil as possible.

*Magnitude of response to lights-**high***

The use of lights in freshwater spawning habitats may affect the timing and speed of the emergence of salmon fry from gravels. Tabor et al. (2004) demonstrated in laboratory and field studies that above-natural intensities of nighttime light decreased the emergence of salmon fry from redds. We also anticipate that lights also allow predators (e.g., sculpins) to consume salmon fry more easily (Vogel and Beauchamp, 1999).

*Consequence of exposure and response to lights-**high***

Fry in redds may be killed by predators as a result of the use of lights at night, and because the use of lights may be necessary or essential in spite of this risk, the consequence of lights in spawning habitat is likely increased death of individuals.

Effect of lights to juvenile and adult life stages

*Likelihood of exposure to response lights, noise and presence-**low***

Nighttime operations that require the use of lights will be necessary in streams when juveniles and adults. Nighttime operations are limited to the first few days of a spill, when the goal is to collect as much of the mobile oil as possible.

*Magnitude of response to lights-**low***

The use of lights during nighttime operations is generally not expected to impact salmonid juvenile, subadult, and adult life stages. In fact, avoidance of light in response areas by juvenile and adult salmon may reduce their exposure to spill response actions in estuarine and marine waters. Temporary avoidance (i.e., during the response action) of the immediate response area is not expected to significantly alter the access of salmon to forage habitat.

*Consequence of exposure and response to lights-**low***

There will be no adverse consequences to juveniles and adults from the use of lights.

Stressor: Removal of surface oil with vacuums **(entrainment)**

Effects of vacuums on juveniles and smolts

*Likelihood of exposure of juveniles to vacuums-**low***

Responders will likely use vacuums to remove floating oil in rivers and streams, exposing early-life-stage salmonid species to entrainment. Vacuuming works in slow moving water along the streambank that provides rearing habitat for juvenile salmonids. The likelihood of entrainment is decreased because responders place flat-head nozzles (referred to sometimes as "duckbills") over vacuum hoses to minimize the amount of water collected and reduce unnecessary liquid waste (EPA, 2017). These hose attachments reduce the entrainment of fish by decreasing the size of objects that can be entrained (limited to approximately 18 inch by 2 inch rectangular area). Exposure to entrainment is also minimized because vacuums are used where oil accumulates in small areas relative to all available habitat.

*Magnitude of response to vacuums-**high***

Juveniles and smolts may be of a size that could be entrained, even if flat-head nozzles are used, though older life stages are unlikely to fit into vacuums. The result of such entrainment could be death.

*Consequences of exposure and response to vacuums-**high***

Because juveniles are somewhat likely to be exposed to and killed by entrainment in vacuums and the use of vacuums may be necessary or essential in spite of this risk, the use of vacuums may result in the unavoidable injury or death of individuals.

2.5.1.3 Effects to salmon and steelhead critical habitat PBFs and to life stages through these PBF effects in the Columbia River

Stressor: Removal of surface oil with in situ burn **(water quality (temperature))**

Effects of in situ burn on water temperature

*Likelihood of exposure of critical habitat in the Columbia River to heat from in situ burn-**moderate***

Responders will likely use in situ burn in the Columbia River to remove surface oil within the four-day response limit under this biological opinion. Columbia River critical habitat water quality will be exposed to heat from these in situ burns. The Services will be contacted prior to an in situ burn in the freshwater environment.

*Magnitude of response of water temperature to in situ burn heat-**low***

The response of water temperature to in-situ burns will likely be very small. In situ burn can only be used remote locations of large water bodies. Most of the heat from the burn (99%) is carried into the atmosphere with the combustion gases. The remaining 1% radiates back to the surface of the slick where a smaller percentage makes it into the underlying water (Buist et al., 1999; NOAA et al., 2010).

*Consequences of exposure and response-**low***

Although water quality will be exposed to heat from in situ burns, the resulting increase in temperature will be unmeasurably small.

Stressor: Removal of surface oil with in situ burn **(benthic forage)**

Effects of in situ burn on benthic forage

*Likelihood of exposure of benthic forage to in situ burn residue-**low***

Responders will likely use in situ burn in the Columbia River to remove surface oil within the four-day response limit under this biological opinion and that Columbia River benthic forage will be exposed to solid residues from in situ burn. The Services will be contacted prior to an in situ burn in the freshwater environment.

*Magnitude of response of benthic forage to in situ burn residue-**low***

The area of benthic habitat exposed to in situ burn residues will be extremely small. BMPs call for responders to use nets to capture and collect as much of the in situ burn residue as possible, reducing the amount that will sink to the bottom. Because the toxic components of oil are combustible and removed, the only effect of the residue is burial of benthic forage. Since Columbia River bedload is regularly transported annually by large flows, in situ burn residue will be mixed with and dispersed with bedload relatively soon. Burn residues are not toxic to fish (NOAA, 2017).

*Consequences of exposure and response-**low***

Although in situ burn residue will be deposited on and bury small areas of Columbia River substrate, the buried area will be too small to affect effect benthic forage supply with be diminished by the next bedload moving flow.

2.5.1.4 Direct effects to salmon and steelhead life stages in the Columbia River

Stressor: Vessel and boom anchors and foot traffic **(chum redds)**

Effect of anchors on eggs and embryos

*Likelihood of exposure of active redds to vessel and boom anchors: **low***

At times responders will likely use vessels and booms in the Columbia River while chum salmon redds are present but that it is unlikely that responders will place anchors on redds. For all responses covered by this biological opinion, responders will be know if the spill is in spawning habitat at a time of year when redds are likely to be present. BMPs call for vessels and booms to be anchored to shorelines when redds are present.

*Magnitude of response of active redds to vessel or boom anchors: **high***

The response of redds to wading and anchors is damage to the redd that would likely cause many eggs, embryos or fry to be killed. Even if they are not crushed, damage to the redd would likely cause it to fail to protect eggs and embryos inside. When salmon construct a salmon redd they sort smaller gravel from the substrate so that the redd is coarser and better sorted than the substrate. The mounded shape accelerates flow over and through the structure leaving it vulnerable to scour. Damage to the redd by an anchor increases the risk that high flows will scour the redd, entraining and killing eggs or fry inside the red (Buxton et al., 2015).

*Consequence of exposure and response to anchors at the fitness level: **low***

Because redds are susceptible to damage from wading and anchors that would result in death of eggs or embryos, responders will emphasize protocols, GRPs and BMPs that minimize the possibility that they will be exposed to wading and anchors.

Stressor: Lights, noise and presence **(predation)**

Effects of lights to eggs and fry

*Likelihood of exposure of eggs and embryos to lights-**moderate***

Nighttime operations that require the use of lights may be necessary in the Columbia River when redds are present. For all responses covered by this biological opinion, responders will be know if the spill is in spawning habitat at a time of year when redds are likely to be present. Nighttime operations are limited to the first few days of a spill, when the goal is to collect as much of the mobile oil as possible.

Magnitude of response of eggs and fry to lights-**high**.

The use of lights in Columbia River spawning habitats may affect the timing and speed of the emergence of salmon fry from gravels. Tabor et al. (2004) demonstrated in laboratory and field studies that above-natural intensities of nighttime light decreased the emergence of salmon fry from redds. We also anticipate that lights also allow predators (e.g., sculpins) to consume salmon fry more easily.

Consequence of exposure and response-**high**

Fry in redds may be killed by predators as a result of the use of lights at night, and because the use of lights may be necessary or essential in spite of this risk, the consequence of lights in spawning habitat is likely increased death of individuals.

Effects of lights to juveniles and adults

*Likelihood of exposure to lights-**moderate***

Nighttime operations that require the use of lights will be necessary in streams when juveniles and adults. Nighttime operations are limited to the first few days of a spill, when the goal is to collect as much of the mobile oil as possible.

*Magnitude of response to lights-**low***

The use of lights during nighttime operations is generally not expected to impact salmonid juvenile, subadult, and adult life stages. In fact, avoidance of light in response areas by juvenile and adult salmon may reduce their exposure to spill response actions in estuarine and marine waters. Temporary avoidance (i.e., during the response action (days) of the immediate response area is not expected to significantly alter the access of salmon to forage habitat.

*Consequence of exposure and response-**low***

There will be no adverse consequences to juveniles and adults from the use of lights.

Stressor: Removal of surface oil with vacuums and skimmers **(entrainment)**

Effects of vacuums on juveniles and smolts

*Likelihood of exposure of juveniles to vacuums-**low***

Responders will likely use vacuums and skimmers to remove floating oil in the Columbia River, exposing early-life-stage salmonid species to entrainment. Vacuuming works in slow moving water along the streambank that provides rearing habitat for juvenile salmonids. The likelihood of entrainment is decreased because responders place flat-head nozzles (referred to sometimes as "duckbills") over vacuum hoses to minimize the amount of water collected and reduce unnecessary liquid waste (EPA, 2017). These hose attachments reduce the entrainment of fish by decreasing the size of objects that can be entrained (limited to approximately 18 inch by 2 inch rectangular area).

*Magnitude of response to vacuums-**high***

Juveniles and smolts may be of a size that could be entrained, even if flat-head nozzles are used, though older life stages are unlikely to fit into vacuums. The result of such entrainment could be death.

*Consequences of exposure and response to vacuums-**high***

Because juveniles are likely to be exposed to and killed by entrainment in vacuums and skimmers and the use of vacuums and skimmers may be necessary or essential in spite of this risk, the use of vacuums will result in the injury or death of individuals.

2.5.1.5 Effects to salmon and steelhead critical habitat PBFs and to life stages through these PBF effects in Puget Sound

Stressor: Removal of ground cover exposing soil to erosion **(water quality (suspended sediment))**

Effects of erosion on water quality-suspended sediment

*Likelihood of exposure of water quality to erosion-**low***

Establishing staging areas, foot traffic, manual and mechanical oil removal, oiled vegetation removal and ambient temperature, low pressure flooding/flushing disrupt soil and remove ground cover on shorelines exposing sediment to erosion. In nearly all cases, spill responders will be able to position staging areas in locations that have already been developed (e.g., cleared and paved with nearby access to water to deploy vessels, areas identified in GRPs) because the location of spills will be near established oil transportation corridors. In a small number of remote locations, staging areas may have to be established but vegetation clearing could be minimized by areas establishing points of access in the least-sensitive areas possible (e.g., areas with sparse vegetation), and by not clearing vegetation from an area unless approved by the EU.

Engineered controls (e.g., silt fences and fiber rolls) will be put into place to minimize the erosion of soils and siltation of streams. BMPs also stabilize some exposed areas.

*Magnitude of response of water quality to suspended sediment-**low***

For responses covered by this biological opinion, the limited response time and the BMPs will prevent suspended sediment concentrations sourced from response action from exceeding tens of milligrams per liter for hours. Even in quiet parts of the estuary, pulses of suspended sediment disperse and settle over less than one hour (Weston Solutions, 2006).

*Consequence of exposure & response of water quality to suspended sediment-**low***

The use of established staging areas, BMPs and engineering controls will render exposure of Puget Sound water quality to suspended sediment infrequent and that the areas of ground cover removed by the four-day limit of the biological opinion and the action area terrain will minimize the size of erodible sediment sources should BMPs fail.

Stressor: Vessel and boom anchors

Effects of anchors on benthic forage

*Likelihood of exposure-**moderate***

At times the Puget Sound estuarine critical habitat PBF of benthic forage will likely be exposed to responder vessel and boom anchors. Anchors have the potential to cause highly localized (low-magnitude), potentially long-term impacts in soft substrates (e.g., in estuarine forage habitat). The use of anchors could cause long-term impacts on benthic invertebrate communities in highly localized areas. Equipment (e.g., booms) will be anchored to shore, if possible.

Magnitude of response-**low**

Benthic invertebrate communities impacted by anchors would be disturbed, causing a temporary reduction in productivity (possibly lasting several years) but the magnitude of disturbance to benthic forage is low because responders anchors will contact such a small fraction of the benthic forage in Puget Sound.

Consequences of exposure and response to benthic forage-**low**

Due to the small area, anchors are expected to have a low-magnitude impact on the PBFs of Pacific salmon and steelhead trout critical habitat.

Stressor: Removal of surface oil with in situ burn **(water quality (temperature))**

Effects of in situ burn on water quality-temperature

*Likelihood of exposure of water quality to heat from in situ burning-**moderate***

Responders will likely use in situ burn in Puget Sound to remove surface oil within the four-day response limit under this biological opinion. Puget Sound critical habitat water quality will be exposed to heat from these in situ burns. In situ burning could be used in marine water and marine nearshore where Pacific salmon and steelhead trout species may be present. The use of in situ burn will be decided on a case-by-case basis and the Natural Resource Trustees will be contacted regarding threatened and endangered species and critical habitat in the vicinity of the planned burn.

*Magnitude of response-**low***

The response of water temperature to in-situ burns will be very small. In situ burn can only be used remote locations of large water bodies. Most of the heat from the burn (99%) is carried into the atmosphere with the combustion gases. The remaining 1% radiates back to the surface of the slick where a smaller percentage makes it into the underlying water (Buist et al., 1999; NOAA et al., 2010).

*Consequence of exposure and response-**low***

Although water quality will be exposed to heat from in situ burns, the resulting increase in temperature will be unmeasurably small.

Effect of in-situ burn on benthic forage

*Likelihood of exposure-**moderate***

Responders will use in situ burn in Puget Sound to remove surface oil within the four-day response limit under this biological opinion and that Puget Sound benthic forage will be exposed to solid residues from in situ burn. The Services will be contacted prior to an in situ burn in the freshwater environment.

*Magnitude of response-**low***

The area of benthic habitat exposed to in situ burn residues will be extremely small. BMPs call for responders to use nets to capture and collect as much of the in situ burn residue as possible, reducing the amount that will sink to the bottom. Because the toxic components of oil are combustible and removed, the only effect of the residue is burial of benthic forage.

*Consequence of exposure and response-**low***

Although in situ burn residue will be deposited on and bury small areas of Puget Sound substrate, the buried area will be too small to affect effect benthic forage supply.

2.5.1.6 Direct effects to salmon and steelhead life stages in the Puget Sound

Stressor: Removal of surface oil with vacuums and skimmers **(entrainment)**

Effects of vacuums and skimmers on juvenile salmon and steelhead

*Likelihood of exposure to vacuums and skimmers-**low***

Responders will likely use vacuums and skimmers to remove floating oil in Puget Sound, exposing early-life-stage salmonid species to entrainment. Vacuuming works in slow moving water along the streambank that provides rearing habitat for juvenile salmonids. Skimmers work on larger spill areas. The likelihood of entrainment is decreased because responders place flat-head nozzles (referred to sometimes as "duckbills") over vacuum hoses to minimize the amount of water collected and reduce unnecessary liquid waste (EPA, 2017). These hose attachments reduce the entrainment of fish by decreasing the size of objects that can be entrained (limited to approximately 18 inch by two-inch rectangular area).

*Magnitude of response-**high***

Juveniles and smolts may be of a size that could be entrained, even if flat-head nozzles are used, and that older life stages are unlikely to fit into vacuums. The result of such entrainment could be death.

*Consequence of exposure and response-**high***

Because juveniles are likely to be exposed to and killed by entrainment in vacuums and the use of vacuums may be necessary or essential in spite of this risk, the use of vacuums will result in the injury or death of individuals.

Stressor: Lights, noise and presence

Effects of lights to juveniles and adults

*Likelihood of exposure of juveniles and adults to lights at night-**low***

Nighttime operations that require the use of lights will likely be necessary in streams when juveniles and adults. Nighttime operations are limited to the first few days of a spill, when the goal is to collect as much of the mobile oil as possible.

*Magnitude of response of juveniles and adults to lights at night-**low***

The use of lights during nighttime operations is generally not expected to impact salmonid juvenile, subadult, and adult life stages. In fact, avoidance of light in response areas by juvenile and adult salmon may reduce their exposure to spill response actions in estuarine and marine waters. Temporary avoidance (i.e., during the response action (days) of the immediate response area is not expected to significantly alter the access of salmon to forage habitat.

*Consequences to juveniles and adults to lights at night-**low.***

We anticipate that there will be no adverse consequences to juveniles and adults from the use of lights.

Stressor-Removal of surface oil with sorbents **(toxicity)**

Effects of sorbents on smolts

*Likelihood of exposure to sorbents-**low***

Salmon are not expected to come into contact with passive collection responses (e.g., sorbent booms) in the marine environments because salmon are present much deeper in the water column than booms.

*Magnitude of response-**moderate***

Sorbents concentrate oil so the water accommodated fraction of PAHs in the vicinity of sorbents may be greater than at the spill. Salmon and steelhead that swim near sorbents will therefore be exposed to slightly higher concentrations of PAHs.

*Consequences of exposure and response-**low***

Salmon will not be exposed to concentrated oil on sorbent booms in Puget Sound.
Stressor-Dispersion of surface oil with chemicals (**toxicity**)

Effect of dispersed oil on salmon and steelhead

*Likelihood of exposure-**low***

Responders may chemically disperse floating oil in the Strait of Juan de Fuca (Pacific Ocean) during the four-day limit of responses covered by this biological opinion. We anticipate that chemical dispersion will expose salmon and steelhead in the water column to higher concentrations of oil constituent compounds, including PAHs, than mechanical dispersion. Pacific salmon and steelhead trout are generally found within the 200 meter (656 foot) isobath (Pool et al., 2012) that extends beyond the 3 mile buffer where dispersants will not be used in both the pre-approved and with RRT approval zones.

*Magnitude of response-**low***

Salmon and steelhead will likely experience essentially the same acute toxic effects from chemically dispersed oil constituent compounds that they would from mechanically dispersed oil. The available literature shows that chemical dispersants either increase or decrease the acute toxicity (i.e., lethality) of oil under laboratory conditions. Dispersed oil is generally thought to be more toxic than oil alone (McFarlin et al., 2011; Ramachandran et al., 2004; Singer et al., 1998), because dispersants increase the solubility of the toxic components of oil (e.g., PAHs) (Ramachandran et al., 2004; Wolfe et al., 1998, 2001). Increased toxicity is generally associated with increased solubility of toxic PAHs or other hydrocarbons. Bioavailability is assumed to increase via the spatial redistribution of oil into the water column, the spread of the oil-water interface on the ocean's surface as droplets form, and the increased solubility of hydrophobic constituent components drawn into solution by surface active components and solvents in dispersants. The formation of oil droplets is facilitated by the surface active chemicals (i.e., surfactants) in dispersants (e.g., DOSS, Tween®80, Tween®85, and Span® 80). Individual salmon and steelhead in the upper few meters of the water column could be exposed to high concentrations of chemically dispersed oil. For example, a small portion of 0- to 2-year-old Chinook salmon are present at shallow depths (<7.5 m [25 feet]) in open marine water (Orsi and Wertheimer, 1995), where exposures to dispersed oil could be relatively high (Appendix B; EPA and USCG 2015). Literature explains decreased toxicity of chemically dispersed oil by the variable oil chemical compositions, variable rates of oil and dispersant degradation, and the relatively low toxicity of dispersants alone (Pollino and Holdway, 2002). Fucik et al. (1995) speculated that the creation of oil droplets increased the rate of volatilization of the lighter toxic components of oil (NRC, 2005), but it has since been shown that volatilization is reduced after chemical dispersion due to the increased solubility of lighter volatile components (NRC, 2013). However, dispersed oil tends to dilute rapidly into the water column, biodegrade or coalesce, and then resurface, so exposures with the potential to cause acutely toxic responses in sensitive marine fish and invertebrates are generally expected to be short term (e.g., less than 24 hours) (Winward Environmental, 2014). Based on the entire dataset for comparable 46- to 96-hour acutely lethal LC50 values, approximately 54% of comparable studies had decreased toxicity when oil was dispersed, and approximately 46% had increased toxicity. Thus, contrary to popular opinion, it is slightly more likely that toxicity may decrease once dispersants have been applied.

*Consequences of exposure and response-**low***

We conclude that salmon and steelhead in the water column beneath chemically dispersed oil will experience increased exposure to toxic constituents of oil but that increased exposure will not translate into increased acute toxicity.

2.5.1.7 Direct effects to salmon and steelhead life stages in the Pacific Ocean

Stressor: Dispersing surface oil with chemicals **(toxicity)**

Effect of chemical dispersion on adults

*Likelihood of exposure to dispersed oil-**low***

Responders will likely chemically disperse floating oil in the Pacific Ocean during the four-day limit of responses covered by this biological opinion. We anticipate that chemical dispersion will expose salmon and steelhead in the water column to higher concentrations of oil constituent compounds, including PAHs, than mechanical dispersion. Juvenile and adult Pacific salmon and steelhead trout are generally found within the 200 meter (656 feet) isobath (Pool et al., 2012) that extends beyond the three-mile buffer where dispersants will not be used (in both the pre-approved and with RRT approval zones).

*Magnitude of response-**low***

Salmon and steelhead will experience essentially the same acute toxic effects from chemically dispersed oil constituent compounds that they would from mechanically dispersed oil. The available literature shows that chemical dispersants either increase or decrease the acute toxicity (i.e., lethality) of oil under laboratory conditions. Dispersed oil is generally thought to be more toxic than oil alone (McFarlin et al., 2011; Ramachandran et al., 2004; Singer et al., 1998), because dispersants increase the solubility of the toxic components of oil (e.g., PAHs) (Ramachandran et al., 2004; Wolfe et al., 1998, 2001). Increased toxicity is generally associated with increased solubility of toxic PAHs or other hydrocarbons. Bioavailability is assumed to increase via the spatial redistribution of oil into the water column, the spread of the oil-water interface on the ocean's surface as droplets form, and the increased solubility of hydrophobic constituent components drawn into solution by surface active components and solvents in dispersants. The formation of oil droplets is facilitated by the surface active chemicals (i.e., surfactants) in dispersants (e.g., DOSS, Tween®80, Tween®85, and Span® 80). Individual salmon and steelhead in the upper few meters of the water column could be exposed to high concentrations of chemically dispersed oil. For example, a small portion of 0- to 2-year-old Chinook salmon are present at shallow depths (<7.5 m [25 feet]) in open marine water (Orsi and Wertheimer, 1995), where exposures to dispersed oil could be relatively high. Literature explains decreased toxicity of chemically dispersed oil by the variable oil chemical compositions, variable rates of oil and dispersant degradation, and the relatively low toxicity of dispersants alone (Pollino and Holdway, 2002). Fucik et al. (1995) speculated that the creation of oil droplets increased the rate of volatilization of the lighter toxic components of oil (NRC, 2005), but it has since been shown that volatilization is reduced after chemical dispersion due to the increased solubility of lighter volatile components (NRC, 2013). However, dispersed oil tends to dilute rapidly into the water column, biodegrade or coalesce, and then resurface, so exposures with the potential to cause acutely toxic responses in sensitive marine fish and invertebrates are generally expected to be short term (e.g., less than 24 hours) (Appendix B; EPA and USCG 2015). Based on the entire dataset for comparable 46- to 96-hour acutely lethal LC50 values, approximately 54% of comparable studies had decreased toxicity when oil was dispersed, and approximately

46% had increased toxicity. Thus, contrary to popular opinion, it is slightly more likely that toxicity will decrease once dispersants have been applied.

*Consequences of exposure and response-**low***

We conclude that salmon and steelhead in the water column beneath chemically dispersed oil will experience increased exposure to toxic constituents of oil but that increased exposure will not translate into increased acute toxicity.

2.5.2 Eulachon

Table 7. Summary of eulachon critical habitat PBF effects and direct effects. E=likelihood of exposure, R=magnitude of response, C=consequence of exposure and response to individual fitness

River and stream stressors	**PBF (Direct)**	**Effect**	**E**	**R**	**C**	**Life stage**	**E**	**R**	**C**	**Life Stage**	**E**	**R**	**C**	**Life Stage**	**E**	**R**	**C**
Removed riparian ground cover	Water quality	Erosion-Suspended sediment															
Vessel and boom anchors	Direct	Crushing				Eggs and larvae											
Lights, noise at night	Direct	Predation				Larvae								Adults			
Skimming/vacuuming	Direct	Entrainment				Larvae								Adults			
Columbia River stressors	PBF (Direct)	Effect	E	R	C	Life stage	E	R	C	Life Stage	E	R	C	Life Stage	E	R	C
Removed riparian ground cover	Water quality	Erosion-Suspended sediment															
Vessel and boom anchors	Direct	Crushing				Eggs and larvae											
Lights, noise at night	Direct	Predation				Larvae				Adults							
Skimming/vacuuming	Direct	Entrainment				Larvae											
In situ burn	Direct	Smothering				Larvae											
Pacific Ocean stressors	PBF (Direct)	Effect	E	R	C	Life stage	E	R	C	Life Stage	E	R	C	Life Stage	E	R	C
In situ burn	Prey	Toxicity															
Chemical dispersion	Water quality	Toxicity				Larvae											

2.5.2.1 Effects to eulachon critical habitat PBFs and to life stages through these PBF effects in rivers and streams

Stressor: Removal of ground cover exposing soil to erosion **(water quality (suspended sediment))**

Effects of erosion on water quality at spawning and incubation sites

*Likelihood of exposure of eulachon spawning habitat to suspended sediment-**low***

As with salmon and steelhead, the removal of vegetation to establish staging areas or points of access, construction of berms, pits, trenches, or other barriers and manually or mechanically removing oiled substrate or vegetation may lead to erosion of soil into the stream, degrading water quality. The establishment of a new staging area in an area that is not already developed is expected to be a rare circumstance, given that any major spills to Pacific eulachon habitat will likely occur near developed areas. These actions could result in increased suspended sediment and increased fine sediment fraction in eulachon spawning substrate. To prevent these effects, engineered controls will be implemented during construction actions (i.e., staging area establishment, soil excavation, and construction of berms and other barriers) to minimize soil erosion and siltation of streams. As noted above, GRPs will be used to identify streams where eulachon are present and when spawning occurs. Also, the EU will provide responders with additional information on eulachon to guide the spill response.

*Magnitude of response of eulachon spawning habitat to suspended sediment-**low***

For responses covered by this, the limited response time and the BMPs will prevent suspended sediment concentrations sourced from response action from exceeding tens of milligrams per liter for one day. For example, the cleanup of 2000 barrels (300 cubic meters) of spilled oil spread over 6000 square meters (i.e. 77 meters by 77 meters by .05 meters) could exposed up to 6000 square meters of erodible sediment. If overland flow from a large rainstorm eroded all the underlying sediment 0.01 meters deep into the channel discharging 20 cubic meters per second over 24 hours, the average concentration of suspended sediment in the plume would be 70 milligrams per liter.

*Consequences of exposure and response-**low***

The effect of suspended sediment on eulachon water quality is likely to be less pronounced in Pacific eulachon, which broadcast spawn over a variety of substrates (Willson et al., 2006) rather than creating redds like salmon or having interstitially dwelling larvae like sturgeon. Pacific eulachon do not require substrates with low embeddedness permitting a higher flow of oxygenated water into the space between gravel. As discussed above, spill responders will use established staging areas as much as possible, which are laid out in GRPs, and engineered controls will be put in place to minimize soil erosion into streams. These conservation measures, combined with other planning tools such as ERMA will significantly limit impacts on Pacific eulachon critical habitat.

2.5.2.2 Direct effects to eulachon life stages in rivers and streams

Stressor: Vessel and boom anchors and foot traffic **(crushing)**

Effects of anchors and foot traffic on eulachon eggs and larvae

*Likelihood of exposure-**low***

At times responders will wade in and use vessels in streams while eulachon eggs and larvae are present in bedload. GRPs are available for the Cowlitz and Lower Columbia Rivers, but provide only limited information on eulachon spawning (e.g., seasonality and major rivers, but not specific locations). The Environmental Response Management Application (ERMA) mapping tool provides spatially explicit information on the location of Pacific eulachon critical habitat, which will provide information to responders that is not described in GRPs.

*Magnitude of response-**moderate***

Anchoring vessels or equipment (e.g., booms or sorbent materials) may result in the disturbance or destruction of individual embryonic eulachon attached to sediments. Eulachon eggs and larvae are moved downstream and dispersed by bedload transport, making it impossible to know where they are.

*Consequence of exposure and response-**moderate***

Responders will avoid crushing eulachon eggs and larvae at spawning sites but will not be able to avoid crushing individual eulachon larvae as they are transported downstream.

Stressor: Response actions at night using lights **(avoidance)**

Effects of lights on larvae

*Likelihood of exposure-**low***

Nighttime operations that require the use of lights will likely be necessary in streams when eulachon eggs and larvae are present in bedload. For all responses covered by this biological opinion, responders will be know if the spill is in eulachon spawning habitat at a time of year when eggs and larvae are likely to be present. Nighttime operations are limited to the first few days of a spill, when the goal is to collect as much of the mobile oil as possible.

*Magnitude of response-**low***

The use of lights in freshwater spawning habitats may affect the behavior eulachon larvae. Spangler (2002) observed that larvae were more likely to enter the drift to migrate out of streams under low light conditions, suggesting a predator avoidance adaptation.

*Consequence of exposure and response-**low***

Eulachon larval avoidance of response lights is likely beneficial. Avoidance of light in response areas may reduce the exposure of eulachon to oil (baseline condition) or response actions at the water surface (e.g., vacuuming).

Effects of lights to adults

*Likelihood of exposure-**low***

Nighttime operations that require the use of lights will be necessary in streams when eulachon adults are migrating. Nighttime operations are limited to the first few days of a spill, when the goal is to collect as much of the mobile oil as possible.

*Magnitude of response-**low***

The use of lights during nighttime operations will likely not impact adult eulachon. Hannah and Jones (2007) describe how light is used in the marine environment to deter eulachon from entering shrimp traps. It is clear that eulachon are less active under or actively avoid light conditions. Avoidance of light in response areas may reduce the exposure of eulachon to oil (baseline condition) or response actions at the water surface (e.g., vacuuming); temporary avoidance (i.e., during the response action) of the immediate response area is not expected to significantly alter the access of Pacific eulachon to forage habitat.

*Consequences or exposure and response to lights-**low***

There will be no adverse consequences to adult eulachon from the use of lights.

Stressor: Removal of surface oil with vacuums **(entrainment)**

Effects of vacuums on larvae

*Likelihood of exposure-**low***

Responders will likely use vacuums to remove floating oil in rivers and streams, exposing eulachon larvae to entrainment. Vacuuming works in slow moving water along the streambank that provides rearing habitat for juvenile salmonids. The likelihood of entrainment is somewhat decreased because responders place flat-head nozzles (referred to sometimes as “duckbills”) over vacuum hoses to minimize the amount of water collected and reduce unnecessary liquid waste (EPA, 2017).

*Magnitude of response-**high***

Eulachon larvae in the water column could be entrained, even if flat-head nozzles are used. The result of such entrainment could be death.

*Consequence of exposure and response-**high***

Because eulachon larvae are likely to be exposed to and killed by entrainment in vacuums and the use of vacuums may be necessary or essential in spite of this risk, the use of vacuums will result in the injury or death of individual eulachon larvae.

Effects of vacuums on eulachon adults

*Likelihood of exposure-**low***

Responders will likely use vacuums to remove floating oil in rivers and streams, exposing adult eulachon to entrainment. Vacuuming works in slow moving water along the streambank that provides rearing habitat for juvenile salmonids. The likelihood of entrainment is decreased because responders place flat-head nozzles (referred to sometimes as "duckbills") over vacuum hoses to minimize the amount of water collected and reduce unnecessary liquid waste (EPA, 2017). These hose attachments reduce the entrainment of fish by decreasing the size of objects that can be entrained (limited to approximately 18 inch by 2 inch rectangular area).

*Magnitude of response-**high***

Adult eulachon may be of a size that could be entrained, even if flat-head nozzles are used. The result of such entrainment could be death.

*Consequence of exposure and response-**high***

Because adult eulachon are likely to be exposed to and killed by entrainment in vacuums and the use of vacuums may be necessary or essential in spite of this risk, the use of vacuums will result in the injury or death of individuals.

Stressor: removal of surface oil with in situ burning **(smothering)**

Effects of in situ burn residue on larvae

*Likelihood of exposure of eulachon larvae to in situ burn residue-**low***

Responders will likely use in situ burn in the Columbia River to remove surface oil within the four-day response limit under this biological opinion and that eulachon larvae in bedload will be exposed to solid residues from in situ burn. The Services will be contacted prior to an in situ burn in the freshwater environment.

*Magnitude of response of benthic forage to in situ burn residue-**high***

The area of substrate exposed to in situ burn residues will be extremely small. BMPs call for responders to use nets to capture and collect as much of the in situ burn residue as possible, reducing the amount that will sink to the bottom. Because the toxic components of oil are combustible and removed, the only effect of the residue is burial of eulachon larvae.

*Consequence of exposure and response-**high***

Although in situ burn residue will be deposited on and bury small areas of Columbia River substrate, larvae buried by residue will likely be smothered.

2.5.2.3 Effects to eulachon critical habitat PBFs and to life stages through these PBFs in the Pacific Ocean

Stressor: In situ burn on **(benthic habitats)**

Effect of in situ burn on benthic habitat

*Likelihood of exposure of benthic forage to in situ burn residue-**low***

Responders will likely use in situ burn in the Pacific Ocean to remove surface oil within the four-day response limit under this biological opinion and that Pacific Ocean benthic forage will be exposed to solid residues from in situ burn.

*Magnitude of response of benthic forage to in situ burn residue-**low***

The area of benthic habitat exposed to in situ burn residues will be extremely small. BMPs call for responders to use nets to capture and collect as much of the in situ burn residue as possible, reducing the amount that will sink to the bottom. Because the toxic components of oil are combustible and removed, the only effect of the residue is burial of benthic forage.

*Consequence of exposure and response-**low***

Although in situ burn residue will be deposited on and bury small areas of Pacific Ocean benthic forage, the buried area will be too small to affect effect benthic forage supply.

Stressor: Dispersion of surface oil with chemicals **(water quality)**

Effect of water quality on eulachon larvae

*Likelihood of exposure-**moderate***

Responders will likely chemically disperse floating oil in the Pacific Ocean during the four-day limit of responses covered by this biological opinion. We anticipate that chemical dispersion will expose eulachon larvae in the water column to higher concentrations of oil constituent compounds, including PAHs, than mechanical dispersion.

*Magnitude of response-**low***

The analysis of the toxicity of oil and dispersed oil (including PAHs as a component of both) shows that dispersed oil is less toxic to eulachon larvae than oil alone. In order to assess the potential risk of chemical dispersion to plankton, invertebrates, and larval fish, action agencies ranked from lowest to highest the crude oil water accommodated fraction acute 48- to 96-hour LC50 for 45 species and the chemically dispersed crude oil 48 to 96 hour acute LC50 for 18 species. They plotted the rank percentile as a function of the logarithmic LC50 concentration to create species sensitivity distributions (SSDs) for exposure to mechanically dispersed oil and chemically dispersed oil. They determined the hazardous concentration for the lower five percent of each SSD (HC5) to represent a concentration that was protective of 95% of aquatic species (Barron et al., 2013). The HC5 for mechanically dispersed crude oil was 0.46 parts per million total petroleum hydrocarbon and the HC5 for chemically dispersed crude oil was 1.71 parts per million total petroleum hydrocarbon. In addition, toxicity is shown to decrease in general after dispersant application even though PAHs have been shown to increase in solution as well as in tissues of various species (i.e., taken up from the water column) (Ramachandran et al., 2004).

*Consequence of exposure and response-**low***

Although eulachon larvae will likely be exposed to chemically dispersed oil in the Pacific Ocean, they will experience lower acute toxicity than they would from the mechanically dispersed oil.

2.5.3 Rockfish

Table 8. Summary of rockfish critical habitat PBF effects and direct effects. E=likelihood of exposure, R=magnitude of response, C=consequence of exposure and response to individual fitness

Puget Sound stressors	PBF (Direct)	Effect	E	R	C	Life stage	E	R	C	Life Stage	E	R	C	Life Stage	E	R	C
Vessel and boom anchors	Forage	Damage to kelp/eelgrass															
Chemical Dispersion	Water quality					Larvae								Adult			
Skimmers and vacuums	Direct	Entrainment				Larvae											
Lights at night	Direct	Avoidance															
In situ burn	Direct	Toxicity				Larvae				Subadult				Adult			

2.5.3.1 Effects to rockfish critical habitat PBFs and to life stages through these PBF effects

Stressor: Vessel and boom anchors **(kelp and eelgrass)**

Effects of anchors on nearshore shallow substrates that support kelp and eelgrass

*Likelihood of exposure-**low***

The anchoring of booms, sorbent equipment, or vessels and the use of vessels (and associated prop wash) in shallow marine nearshore habitats could result in the localized disturbance of benthic habitats, potentially impacting eelgrass and kelp habitat over a small area.

*Magnitude of response-**low***

Impacts on kelp and eelgrass could affect the quantity and availability of rockfish prey species that are associated with submerged aquatic plants, although these effects will be very limited in area.

*Consequence of exposure and response-**low***

Localized disturbance to kelp and eelgrass is unlikely to have a marked impact on the foraging efficiency of rockfish or their ability to avoid predators.

Stressor: Dispersing surface oil with chemicals **(water quality)**

Effects of chemical dispersion on water quality

*Likelihood of exposure-**low***

Responders will likely chemically disperse floating oil in the Strait of Juan de Fuca during the four-day limit of responses covered by this biological opinion. We anticipate that the use of chemical dispersants in open marine water habitat has the potential to increase exposures of rockfish critical habitat water quality to chemical dispersants and chemically dispersed oil, although the likelihood is very low because these areas are not within the pre-authorized zone. Responders will need to seek approval from the RRT before applying chemical dispersants, and application can only happen within the case-by-case zone (e.g., northern Puget Sound).

*Magnitude of response - **moderate***

The response of water quality to chemically dispersed oil is an increase of dispersed oil in the water column.

*Consequence of exposure and response-**low***

Water quality will likely be somewhat to chemically dispersed oil in the Strait of Juan de Fuca. they will experience lower acute toxicity than they would from the mechanically dispersed oil.

Effect of water quality on rockfish larvae

*Likelihood of exposure-**moderate***

We anticipate that responders will chemically disperse floating oil in the Strait of Juan de Fuca during the four-day limit of responses covered by this biological opinion. We anticipate that chemical dispersion will expose rockfish larvae in the water column to higher concentrations of oil constituent compounds, including PAHs, than mechanical dispersion.

*Magnitude of response-**low***

The analysis of the toxicity of oil and dispersed oil (including PAHs as a component of both) shows that dispersed oil is less toxic to rockfish larvae than oil alone. In order to assess the potential risk of chemical dispersion to plankton, invertebrates, and larval fish, action agencies ranked from lowest to highest the crude oil water accommodated fraction acute 48- to 96-hour LC50 for 45 species and the chemically dispersed crude oil 48 to 96 hour acute LC50 for 18 species. They plotted the rank percentile as a function of the logarithmic LC50 concentration to create species sensitivity distributions (SSDs) for exposure to mechanically dispersed oil and chemically dispersed oil. They determined the hazardous concentration for the lower five percent of each SSD (HC5) to represent a concentration that was protective of 95% of aquatic species (Barron et al., 2013). The HC5 for mechanically dispersed crude oil was 0.46 parts per million total petroleum hydrocarbon and the HC5 for chemically dispersed crude oil was 1.71 parts per million total petroleum hydrocarbon. In addition, toxicity is shown to decrease in general after dispersant application even though PAHs have been shown to increase in solution as well as in tissues of various species (i.e., taken up from the water column) (Ramachandran et al., 2004).

*Consequence of exposure and response-**low***

Although rockfish larvae will likely be exposed to chemically dispersed oil in the Strait of Juan de Fuca, they will experience lower acute toxicity than they would from the mechanically dispersed oil.

Effects of chemical dispersion on adults and subadults

*Likelihood of exposure-**low***

Due to the generally non-stratified nature of Puget Sound's open marine water salinity conditions (Moore et al., 2008), it is possible that chemical dispersion will result in exposures of deep-dwelling adult and subadult bocaccio to oil.

*Magnitude of response-**low***

However, large adult and subadult rockfish are not likely to be measurably affected by highly dilute oil (e.g., dispersed to depths of 30 meters [98 feet] or more). As noted above, the likelihood of these impacts is further minimized (for the context of this BA) because bocaccio habitat does not overlap with the pre-authorized zone for dispersant application.

*Consequence of exposure and response-**low***

2.5.3.2 Direct effects to rockfish life stages in the Puget Sound

Stressor: Removal of surface oil with skimmers and vacuums **(entrainment)**

Effects of skimmers and vacuums on rockfish larvae

*Likelihood of exposure-**low***

Responders will likely use vacuums and skimmers to remove floating oil in the Puget Sound, exposing rockfish larvae to entrainment. The likelihood of entrainment is somewhat decreased because responders place flat-head nozzles (referred to sometimes as "duckbills") over vacuum hoses to minimize the amount of water collected and reduce unnecessary liquid waste (EPA, 2017).

*Magnitude of response-**high***

Larvae in the water column could be entrained, even if flat-head nozzles are used. The result of such entrainment could be death. However, we expect that larval rockfish will be most abundant below the immediate surface (Lenarz et al., 1991), where vacuuming will not entrain them. Entrainment would occur only during spring and summer of the year when pelagic larvae are present in the Puget Sound and Georgia Basin.

*Consequence of exposure and response-**high***

We conclude that because rockfish larvae are likely to be exposed to and killed by entrainment in vacuums and skimmers and that the use of vacuums and skimmers may be necessary or essential in spite of this risk. The use of vacuums and skimmers will result in the injury or death of individual eulachon larvae.

Stressor: Response actions at night using lights **(attraction)**

Effects of lights on larvae

*Likelihood of exposure-**low***

Light disturbance may have an effect on pre-settlement rockfish larvae, which appear to be attracted to light conditions (based on the use of light traps in fish surveys) (Dauble et al., 2012).

*Magnitude of response-**high***

Attraction to lights in a spill response area could cause larval fish to be exposed to increased concentrations of oil or chemically dispersed oil (low-magnitude, short-term effects), increased predation (high-magnitude, long-term effect), or entrainment in vacuums (high magnitude, long-term effect).

*Consequence of exposure and response-**high***

We conclude that the use of lights may lead to the death of rockfish larvae.

Effects of lights on adults and subadults

*Likelihood of exposure**-low***

Adult and subadult rockfish live in deep water, which would not be affected by lights associated with spill response actions. Light effects will be limited to the duration of a spill response (days) and will affect a small area surrounding response activities.

Stressor: Removing surface oil with in situ burn

Effects of in situ burn on larvae, adults and subadults

*Likelihood of exposure-**low***

We anticipate that responders are likely to use in situ burn to remove surface oil in Puget Sound. All life stages of rockfish may be exposed to and ingest in situ burn residue.

Magnitude of response-low

We determine that the toxicity of burn residues, which are created by burning oil and could be ingested by rockfish, is negligible (NOAA, 2017). Measures will be taken to recover residues, which will reduce the potential for exposures.

*Consequence of exposure and response-**low***

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).

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).

State or private activities in the vicinity of the response to oil spills are expected to cause cumulative effects in the action area. Additionally, future state and private activities in upstream areas are expected to cause habitat and water quality changes that are expressed as cumulative effects in the action area. Our analysis considers: (1) how future activities are likely to influence habitat conditions in the action area, and (2) cumulative effects caused by specific future activities in the action area.

Approximately 5 million people live in the six counties containing the Puget Sound action area and 6 million people live in the Columbia River Basin, concentrated largely in urban parts of the lower Columbia River and the Willamette Valley. Approximately 1.13 million people live in the lower Columbia River, concentrated largely in urban parts of the lower Columbia River (U.S. Census Bureau 2017). The past effect of those populations is expressed as changes to physical habitat and loadings of pollutants contributed to Puget Sound and the Columbia River. These changes were caused by residential, commercial, industrial, agricultural, and other land uses. The collective effects of these activities tend to be expressed most strongly in lower river systems where the impacts of numerous upstream land management actions aggregate to influence natural habitat processes and water quality. These effects are expected to continue into the future with levels of intensity consistent with population growth.

Resource-based industries (e.g., agriculture, , timber harvest, fishing, and metals and gravel mining) have caused many long-lasting environmental changes, such as basin-wide loss or degradation of stream channel morphology, spawning substrates, instream roughness and cover, estuarine rearing habitats, wetlands, floodplains, riparian areas, water quality (e.g., temperature, sediment, dissolved oxygen, contaminants), fish passage, and habitat refugia. Those changes have reduced the ability of populations of ESA-listed species to sustain themselves in the natural environment by altering or interfering with their behavior in ways that reduce their survival throughout their life cycle. The environmental changes have also reduced the quality and function of critical habitat PBFs that are necessary for successful spawning, production of offspring, and migratory access necessary for adult fish to swim upstream to reach spawning areas and for juvenile fish to proceed downstream and reach the ocean. To the extent these activities are non-Federal, their continuing effects into the future are considered as cumulative effects.

While widespread degradation of aquatic habitat associated with intense natural resource extraction is no longer common, ongoing and future land management actions are likely to continue and to have a reduced level of the effects described above.

Additionally, we assume that future private and public actions will continue within the action area based on trends in development. As the human population in the action area continues to grow (OFM 2017), demand for agricultural, commercial, or residential development and supporting infrastructure is also likely to grow. We believe the majority of environmental effects related to future growth will be linked to land clearing, associated land-use changes (i.e., from forest to lawn or pasture) and increased impervious surface and related subbasin changes that contribute contaminants to area waters. Shipping and other activities associated with spills of oils and hazardous substances are expected to continue commensurate with development and so too the risk of those spills. Land use changes and development of the built environment that are detrimental to salmonid and eulachon habitats are likely to continue under existing zoning regulations. Though these existing regulations could decrease potential adverse effects on habitat function, as currently constructed and implemented, they still allow incremental degradation to occur.

Note, this review concerns responses to oil spills, and consequently it assumes that oil spills occur in order to trigger the response actions covered in this opinion. Therefore, we note here that oil spills are likely to occur as part of the ongoing private activities. However, we cannot predict the location, timing or magnitude of any spills, nor can we provide coverage in the incidental take statement accompanying this opinion for the effects to listed species for a spill event.

Non-federal restoration is occurring that is likely to benefit salmon, steelhead, rockfish and eulachon species.

To the extent that non-federal recovery actions are implemented and on-going actions continued, adverse cumulative effects may be mitigated by recovery actions, but will probably not be completely avoided.

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 Salmon and steelhead

Table 9. Summary of effects to salmon and steelhead. (A=abundance, P=productivity, SS=spatial structure, D=diversity.)

River and streams stressors	**PBF (Direct)**	**Effect**	**Consequence on action area's conservation value**	**Consequences of exposure and response at the population level (A, P, SS, D*)**
Removed riparian ground cover	Water quality	Erosion-Suspended sediment		
	Water quality	Shade-Temperature		
	Forage	Aquatic insects		
Dams, barriers and culvert blocks	Passage	Obstructed passage		
Vessel and boom anchors	Direct	Damage		
Lights, noise at night	Direct	Predation		
Skimming, vacuuming	Direct	Entrainment		
Columbia River stressors	**PBF (Direct)**	**Effect**		
In situ burn	Water quality	Temperature		
In situ burn	Forage	Benthic invertebrates		
Vessel and boom anchors	Direct	Crushing		
Lights, noise at night	Direct	Predation		
Skimming, vacuuming	Direct	Entrainment		
Puget Sound stressors	**PBF (Direct)**	**Effect**		
Removal of ground cover-erosion	Water quality	Suspended sediment		
Vessel and boom anchors	Benthic forage	Crushing		
In situ burn	Water quality	Temperature		
In situ burn	Benthic prey	Smothering		
Skimming, vacuuming	Direct	Entrainment		
Lights, noise, presence	Direct	Avoidance		
Removal of surface oils with sorbents	Direct	Toxicity		
Dispersing surface oil with chemicals	Direct	Toxicity		

River and streams stressors	PBF (Direct)	Effect	Consequence on action area's conservation value	Consequences of exposure and response at the population level (A, P, SS, D*)
Dispersing surface oil with chemicals	Direct	Toxicity to prey		
Pacific Ocean stressors	**PBF (Direct)**	**Effect**		
Dispersing surface oil with chemicals	Water quality	Toxicity		

Puget Sound Chinook salmon

PS Chinook salmon are a threatened species comprised of 22 populations. PS Chinook survival and recovery is limited by degraded environmental baseline conditions in each component of their critical habitat (freshwater, estuarine, marine). Limiting factor (impaired or insufficient PBFs) include; riparian areas and LWD, fine sediment in spawning gravel, water quality, fish passage and estuary conditions. Several PBFs in the 3 relevant action areas (PS Chinook do not occur in the Columbia River action area) are potentially affected by the proposed action because Olympic pipeline and BNSF railroad tracks cross PS Chinook freshwater habitat, BNSF railroad tracks run along the Puget Sound nearshore and oil tankers and barges operate in PS Chinook nearshore and offshore habit. If a spill occurs in any of the three described areas, the effects of oil spill response actions would also occur. The proposed action is likely to affect PS Chinook salmon. The proposed action assumes that action agencies will respond (response may be natural attenuation) to an oil spill in each of these habitats.

For PS Chinook salmon, the results of effects analysis are summarized in the Rivers and Streams, Puget Sound and Pacific Ocean sections. As shown in the effects section, PS Chinook are exposed to stressors from the removal of ground cover, passage barriers, anchors, lights, vacuums and skimmers, in situ burn, sorbents and chemical dispersion. Although some of these stressors have a moderate or high likelihood of exposure or magnitude of response rating, only lights and vacuuming/skimming have a moderate or high consequences of exposure and response to individual fitness that cannot be significantly offset by proposed BMPs. As shown in Table 9, when all the stressor effects to each PBF are combined, the consequence to the action area conservation value rating is low. Likewise, when the effects of PBF and direct effects to individuals are combined, the consequence of the PBF and direct effects at the population level rating is low.

Although response actions may temporarily worsen critical habitat PBFs, we did not identify any pathway where PBF degradation rises to the level that critical habitat is adversely modified.

PBF degradation and direct effects may kill or harm some individual fish from each PS Chinook population, we did not identify any pathway where deaths or harm rise to a level where population abundance would be significantly decreased from the combination of the environmental baseline, cumulative effects and the proposed action (NMFS did not identify any pathways whereby response actions would affect the spatial structure or diversity of PS

Chinook). The combination of the environmental baseline, response actions and cumulative effects does not decrease the abundance to a degree that productivity of any PS Chinook population would be discernibly reduced.

Puget Sound steelhead

PS steelhead is a threatened species, at a high risk of extinction, comprised of 32 populations. PS steelhead survival and recovery is limited by degraded environmental baseline conditions throughout all components of their critical habitat (freshwater, marine). Limiting factor (impaired or insufficient PBFs) include; riparian areas and LWD, fine sediment in spawning gravel, water quality, and fish passage. PBFs in the two relevant parts of the action area (PS steelhead do not occur in the Columbia River action area) are potentially worsened by the proposed action because Olympic pipeline and BNSF railroad tracks cross PS steelhead freshwater habitat and oil tankers and barges operate in PS steelhead offshore habitat. If a spill occurs in any of the two described areas, the effects of the oil spill response actions would also occur. The proposed action assumes that action agencies will respond (response may be natural attenuation) to an oil spill in each of these habitats.

For PS steelhead, the results of effects analysis are summarized in the Rivers and Streams, Puget Sound and Straits and Ocean sections. As shown in the effects section, PS steelhead are exposed to stressors from the removal of ground cover, passage barriers, anchors, lights, vacuums and skimmers, in situ burn, sorbents and chemical dispersion. Although some of these stressors have a moderate or high likelihood of exposure or magnitude of response rating, only lights and vacuuming/skimming have a moderate or high consequences of exposure and response to individual fitness that cannot be significantly offset by proposed BMPs. As shown in Table 9, when all the stressor effects to each PBF are combined, the consequence to the action area conservation value rating is low. Likewise, when the effects of PBF and direct effects to individuals are combined, the consequence of the PBF and direct effects at the population level rating is low.

Although response actions may temporarily worsen critical habitat PBFs, we did not identify any pathway where PBF degradation rises to the level that critical habitat is adversely modified.

PBF degradation and direct effects may kill or harm some individual fish from each PS steelhead population. We did not identify any pathway where deaths or harm rise to a level where population abundance would be significantly decreased from the combination of the environmental baseline, cumulative effects and the proposed action (NMFS did not identify any pathways whereby response actions would affect the spatial structure or diversity of PS steelhead). The combination of the environmental baseline, response actions and cumulative effects does not decrease the abundance to a degree that productivity of any PS steelhead population would be discernibly reduced.

Hood Canal chum salmon

Hood Canal (HC) chum are a threatened species, comprised of two populations. The proposed action is likely to affect HC chum salmon because oil tankers and barges operate in HC chum

offshore habitat and action agencies will respond (response may be natural attenuation) to an oil spill in this habitat. HC chum survival and recovery is vulnerable to the direct effects of oil spill response actions. Smolts and adults in offshore waters may be exposed to effects from lights, vacuums and skimmers, in situ burn, or chemically dispersed oil.
For HC chum salmon, the results of effects analysis are summarized in the Puget Sound and Straits and Pacific Ocean sections. As shown in effects section, HC chum are exposed to stressors from the removal of ground cover, passage barriers, anchors, lights, vacuums and skimmers, in situ burn, sorbents and chemical dispersion. Although some of these stressors have a moderate or high likelihood of exposure or magnitude of response rating, only lights and vacuuming/skimming have a moderate or high consequences of exposure and response to individual fitness that cannot be significantly offset by proposed BMPs. As shown in Table 9, when all the stressor effects to each PBF are combined, the consequence to the action area conservation value rating is low. Likewise, when the effects of PBF and direct effects to individuals are combined, the consequence of the PBF and direct effects at the population level rating is low.

Although response actions may temporarily worsen critical habitat PBFs, we did not identify any pathway where PBF degradation rises to the level that critical habitat is adversely modified.

PBF degradation and direct effects may kill or harm some individual fish from each HC chum population, we did not identify any pathway where deaths or harm rise to a level where population abundance would be significantly decreased from the combination of the environmental baseline, cumulative effects and the proposed action (NMFS did not identify any pathways whereby response actions would affect the spatial structure or diversity of HC chum). The combination of the environmental baseline, response actions and cumulative effects does not decrease the abundance to a degree that productivity of any HC chum population would be discernibly reduced.

Lake Ozette sockeye salmon

Lake Ozette sockeye are a threatened species, comprised of a single population. Predation and declining beach spawning habitat in Ozette Lake appear to be the two significant factor limiting recovery. Lake Ozette sockeye critical habitat does not include nearshore or ocean areas.

The proposed action is likely to affect Lake Ozette sockeye salmon because oil tankers and barges operate in their offshore habitat and action agencies will respond (response may be natural attenuation) to an oil spill in this habitat. Lake Ozette sockeye survival and recovery is vulnerable the direct effects of oil spill response actions, because adults in offshore waters may be exposed to effects from skimming, in situ burn residue or chemically dispersed oil.

For Lake Ozette sockeye, the results of effects analysis are summarized in the Pacific Ocean effects sections. Although some stressors have a moderate or high likelihood of exposure or magnitude of response rating, only lights and vacuuming or skimming have a moderate or high consequence of exposure and response to individual fitness rating. As shown in Table 9, when the direct effects to individuals are combined, the consequence of the direct effects at the population level rating is low.

Response action direct effects may kill or harm some individual fish from the Lake Ozette sockeye's single population, NMFS did not identify any pathway where deaths or harm rise to a level where population abundance would be significantly decreased from the combination of the environmental baseline, cumulative effects and the proposed action, and NMFS did not identify any pathways whereby response actions would affect the spatial structure or diversity of Lake Ozette sockeye). The combination of the environmental baseline, response actions and cumulative effects does not decrease the productivity of Lake Ozette sockeye.

Lower Columbia River Chinook salmon

LCR Chinook salmon are a threatened species comprised of 32 populations. LCR Chinook survival and recovery is limited by degraded environmental baseline conditions of PBFs in their freshwater, estuarine, and marine critical habitats. Limiting factor PBFs include; riparian areas and LWD, fine sediment in spawning gravel, water quality, fish passage and nearshore conditions.

For LCR Chinook salmon, the results of effects analysis are summarized in the Rivers and Streams, Columbia River and Pacific Ocean sections. As shown in these effects sections, LCR Chinook are exposed to stressors from the removal of ground cover, passage barriers, anchors, lights, vacuums and skimmers, in situ burn, and chemical dispersion. Although some of these stressors have a moderate or high likelihood of exposure or magnitude of response rating, only lights and vacuuming/skimming have a moderate or high consequences of exposure and response to individual fitness that cannot be significantly offset by proposed BMPs. As shown in Table 9, when all the stressor effects to each PBF are combined, the consequence to the action area conservation value rating is low. Likewise, when the effects of PBF and direct effects to individuals are combined, the consequence of the PBF and direct effects at the population level rating is low.

Although response actions may temporarily worsen critical habitat PBFs, we did not identify any pathway where PBF degradation rises to the level that critical habitat is adversely modified.

PBF degradation and direct effects may kill or harm some individual fish from each LCR Chinook population, we did not identify any pathway where deaths or harm rise to a level where population abundance would be significantly decreased from the combination of the environmental baseline, cumulative effects and the proposed action (NMFS did not identify any pathways whereby response actions would affect the spatial structure or diversity of LCR Chinook). The combination of the environmental baseline, response actions and cumulative effects does not decrease the abundance to a degree that productivity of any LCR Chinook population would be discernibly reduced.

Lower Columbia River steelhead

LCR steelhead are a threatened species, comprised of 23 populations. LCR steelhead survival and recovery is limited by degraded environmental baseline in fresh, estuarine, and marine critical habitats. PBFs in the several action area components that are potentially worsened by the effects of oil spill response actions, include LWD, fine sediment in spawning gravel, water quality and fish passage.

For LCR steelhead, the results of effects analysis are summarized in the Rivers and Streams, Columbia River and Pacific Ocean sections. As shown in these sections, LCR steelhead are exposed to stressors from the removal of ground cover, passage barriers, anchors, lights, vacuums and skimmers, in situ burn, and chemical dispersion. Although some of these stressors have a moderate or high likelihood of exposure or magnitude of response rating, only lights and vacuuming/skimming have a moderate or high consequences of exposure and response to individual fitness that cannot be significantly offset by proposed BMPs. As shown in Table 9, when all the stressor effects to each PBF are combined, the consequence to the action area conservation value rating is low. Likewise, when the effects of PBF and direct effects to individuals are combined, the consequence of the PBF and direct effects at the population level rating is low.

Although response actions may temporarily worsen critical habitat PBFs, we did not identify any pathway where PBF degradation rises to the level that critical habitat is adversely modified.

PBF degradation and direct effects may kill or harm some individual fish from each LCR steelhead population, we did not identify any pathway where deaths or harm rise to a level where population abundance would be significantly decreased from the combination of the environmental baseline, cumulative effects and the proposed action (NMFS did not identify any pathways whereby response actions would affect the spatial structure or diversity of LCR steelhead). The combination of the environmental baseline, response actions and cumulative effects does not decrease the abundance to a degree that productivity of any LCR steelhead population would be discernibly reduced.

Lower Columbia River coho salmon

LCR coho are a threatened species, comprised of 24 populations. LCR coho survival and recovery is limited by degraded environmental baseline conditions in freshwater, estuarine and marine critical habitats. The proposed action is likely to affect LCR coho.

For LCR coho, the results of effects analysis are summarized in the Rivers and Streams, Columbia River and Pacific Ocean sections. As shown in these sections, LCR coho are exposed to stressors from the removal of ground cover, passage barriers, anchors, lights, vacuums and skimmers, in situ burn, and chemical dispersion. Although some of these stressors have a moderate or high likelihood of exposure or magnitude of response rating, only lights and vacuuming/skimming have a moderate or high consequences of exposure and response to individual fitness that cannot be significantly offset by proposed BMPs. As shown in Table 9, when all the stressor effects to each PBF are combined, the consequence to the action area conservation value rating is low. Likewise, when the effects of PBF and direct effects to individuals are combined, the consequence of the PBF and direct effects at the population level rating is low.

Although response actions may temporarily worsen critical habitat PBFs, we did not identify any pathway where PBF degradation rises to the level that critical habitat is adversely modified.

PBF degradation and direct effects may kill or harm some individual fish from each LCR coho population, we did not identify any pathway where deaths or harm rise to a level where population abundance would be significantly decreased from the combination of the environmental baseline, cumulative effects and the proposed action (NMFS did not identify any pathways whereby response actions would affect the spatial structure or diversity of LCR coho). The combination of the environmental baseline, response actions and cumulative effects does not decrease the abundance to a degree that productivity of any LCR coho population would be discernibly reduced.

Columbia River chum salmon

CR chum are a threatened species, comprised of 17 populations. CR chum survival and recovery is limited by degraded environmental baseline conditions in fresh, estuarine, and marine areas of critical habitat. The proposed action is likely to affect CR chum.

For CR chum, the results of effects analysis are summarized in the Rivers and Streams, Columbia River and Pacific Ocean sections. As shown in these sections, CR chum are exposed to stressors from the removal of ground cover, passage barriers, anchors, lights, vacuums and skimmers, in situ burn, and chemical dispersion. Although some of these stressors have a moderate or high likelihood of exposure or magnitude of response rating, only lights and vacuuming/skimming have a moderate or high consequences of exposure and response to individual fitness that cannot be significantly offset by proposed BMPs. As shown in Table 9, when all the stressor effects to each PBF are combined, the consequence to the action area conservation value rating is low. Likewise, when the effects of PBF and direct effects to individuals are combined, the consequence of the PBF and direct effects at the population level rating is low.

Although response actions may temporarily worsen critical habitat PBFs, we did not identify any pathway where PBF degradation rises to the level that critical habitat is adversely modified.

PBF degradation and direct effects may kill or harm some individual fish from each CR chum population, we did not identify any pathway where deaths or harm rise to a level where population abundance would be significantly decreased from the combination of the environmental baseline, cumulative effects and the proposed action (NMFS did not identify any pathways whereby response actions would affect the spatial structure or diversity of CR chum). The combination of the environmental baseline, response actions and cumulative effects does not decrease the abundance to a degree that productivity of any CR chum population would be discernibly reduced.

Oregon Coast coho salmon

OC coho are a threatened species, comprised of 56 populations. OC coho survival and recovery is limited by degraded environmental baseline conditions in freshwater, estuarine, and marine critical habitats. The proposed action is likely to affect OC coho.

For OC coho, the results of effects analysis are summarized in the Rivers and Streams and Pacific Ocean sections. As shown in these sections, OC coho are exposed to stressors from the removal of ground cover, passage barriers, anchors, lights, vacuums and skimmers, in situ burn, and chemical dispersion. Although some of these stressors have a moderate or high likelihood of exposure or magnitude of response rating, only lights and vacuuming/skimming have a moderate or high consequences of exposure and response to individual fitness that cannot be significantly offset by proposed BMPs. As shown in Table 9, when all the stressor effects to each PBF are combined, the consequence to the action area conservation value rating is low. Likewise, when the effects of PBF and direct effects to individuals are combined, the consequence of the PBF and direct effects at the population level rating is low.

Although response actions may temporarily worsen critical habitat PBFs, we did not identify any pathway where PBF degradation rises to the level that critical habitat is adversely modified.

PBF degradation and direct effects may kill or harm some individual fish from each OC coho population, we did not identify any pathway where deaths or harm rise to a level where population abundance would be significantly decreased from the combination of the environmental baseline, cumulative effects and the proposed action (NMFS did not identify any pathways whereby response actions would affect the spatial structure or diversity of OC coho). The combination of the environmental baseline, response actions and cumulative effects does not decrease the abundance to a degree that productivity of any OC coho population would be discernibly reduced.

Upper Willamette River Chinook salmon

UWR Chinook salmon are a threatened species comprised of 32 populations. LCR Chinook survival and recovery is limited by degraded environmental baseline conditions in fresh, estuarine, and marine critical habitats. Limiting factor PBFs include; riparian areas and LWD, fine sediment in spawning gravel, water quality, fish passage and nearshore conditions.

For UWR Chinook salmon, the results of effects analysis are summarized in the Rivers and Streams, Columbia River and Pacific Ocean sections. As shown in these sections, UWR Chinook are exposed to stressors from the removal of ground cover, passage barriers, anchors, lights, vacuums and skimmers, in situ burn, and chemical dispersion. Although some of these stressors have a moderate or high likelihood of exposure or magnitude of response rating, only lights and vacuuming/skimming have a moderate or high consequences of exposure and response to individual fitness that cannot be significantly offset by proposed BMPs. As shown in Table 9, when all the stressor effects to each PBF are combined, the consequence to the action area conservation value rating is low. Likewise, when the effects of PBF and direct effects to individuals are combined, the consequence of the PBF and direct effects at the population level rating is low.

Although response actions may temporarily worsen critical habitat PBFs, we did not identify any pathway where PBF degradation rises to the level that critical habitat is adversely modified.

PBF degradation and direct effects may kill or harm some individual fish from each UWR Chinook population, we did not identify any pathway where deaths or harm rise to a level where population abundance would be significantly decreased from the combination of the environmental baseline, cumulative effects and the proposed action (NMFS did not identify any pathways whereby response actions would affect the spatial structure or diversity of UWR Chinook). The combination of the environmental baseline, response actions and cumulative effects does not decrease the abundance to a degree that productivity of any UWR Chinook population would be discernibly reduced.

Upper Willamette River steelhead

UWR steelhead are a threatened species comprised of 4 populations. UWR steelhead survival and recovery is limited by degraded environmental baseline in freshwater, estuarine and marine critical habitats. The proposed action is likely to affect UWR steelhead.

For UWR steelhead, the results of effects analysis are summarized in the Rivers and Streams, Columbia River and Pacific Ocean sections. As shown in these sections, UWR steelhead are exposed to stressors from the removal of ground cover, passage barriers, anchors, lights, vacuums and skimmers, in situ burn, and chemical dispersion. Although some of these stressors have a moderate or high likelihood of exposure or magnitude of response rating, only lights and vacuuming/skimming have a moderate or high consequences of exposure and response to individual fitness that cannot be significantly offset by proposed BMPs. As shown in Table 9, when all the stressor effects to each PBF are combined, the consequence to the action area conservation value rating is low. Likewise, when the effects of PBF and direct effects to individuals are combined, the consequence of the PBF and direct effects at the population level rating is low.

Although response actions may temporarily worsen critical habitat PBFs, we did not identify any pathway where PBF degradation rises to the level that critical habitat is adversely modified.

PBF degradation and direct effects may kill or harm some individual fish from each UWR steelhead population, we did not identify any pathway where deaths or harm rise to a level where population abundance would be significantly decreased from the combination of the environmental baseline, cumulative effects and the proposed action (NMFS did not identify any pathways whereby response actions would affect the spatial structure or diversity of UWR steelhead). The combination of the environmental baseline, response actions and cumulative effects does not decrease the abundance to a degree that productivity of any UWR steelhead population would be discernibly reduced.

Middle Columbia River steelhead trout

MCR steelhead are a threatened species, comprised of 17 populations. MCR steelhead survival and recovery is limited by degraded environmental baseline conditions in freshwater, estuarine, and marine critical habitats. The proposed action is likely to affect MCR steelhead.

For MCR steelhead, the results of effects analysis are summarized in the Rivers and Streams, Columbia River and Pacific Ocean sections. As shown in these sections, MCR steelhead are exposed to stressors from the removal of ground cover, passage barriers, anchors, lights, vacuums and skimmers, in situ burn, and chemical dispersion. Although some of these stressors have a moderate or high likelihood of exposure or magnitude of response rating, only lights and vacuuming/skimming have a moderate or high consequences of exposure and response to individual fitness that cannot be significantly offset by proposed BMPs. As shown in Table 9, when all the stressor effects to each PBF are combined, the consequence to the action area conservation value rating is low. Likewise, when the effects of PBF and direct effects to individuals are combined, the consequence of the PBF and direct effects at the population level rating is low.

Although response actions may temporarily worsen critical habitat PBFs, we did not identify any pathway where PBF degradation rises to the level that critical habitat is adversely modified.

PBF degradation and direct effects may kill or harm some individual fish from each MCR steelhead population, we did not identify any pathway where deaths or harm rise to a level where population abundance would be significantly decreased from the combination of the environmental baseline, cumulative effects and the proposed action (NMFS did not identify any pathways whereby response actions would affect the spatial structure or diversity of MCR steelhead). The combination of the environmental baseline, response actions and cumulative effects does not decrease the abundance to a degree that productivity of any MCR steelhead population would be discernibly reduced.

Southern Oregon/Northern California Coastal coho salmon

SONCC coho are a threatened species, comprised of 45 populations. SONCC coho survival and recovery is limited by degraded environmental baseline conditions in freshwater, estuarine and marine critical habitats. The proposed action is likely to affect SONCC coho.

For SONCC coho, the results of effects analysis are summarized in the Rivers and Streams and Pacific Ocean sections. As shown in these sections, SONCC coho are exposed to stressors from the removal of ground cover, passage barriers, anchors, lights, vacuums and skimmers, in situ burn, and chemical dispersion. Although some of these stressors have a moderate or high likelihood of exposure or magnitude of response rating, only lights and vacuuming/skimming have a moderate or high consequences of exposure and response to individual fitness that cannot be significantly offset by proposed BMPs. As shown in Table 9, when all the stressor effects to each PBF are combined, the consequence to the action area conservation value rating is low. Likewise, when the effects of PBF and direct effects to individuals are combined, the consequence of the PBF and direct effects at the population level rating is low.

Although response actions may temporarily worsen critical habitat PBFs, we did not identify any pathway where PBF degradation rises to the level that critical habitat is adversely modified.

PBF degradation and direct effects may kill or harm some individual fish from each SONCC coho population, we did not identify any pathway where deaths or harm rise to a level where population abundance would be significantly decreased from the combination of the environmental baseline, cumulative effects and the proposed action (NMFS did not identify any pathways whereby response actions would affect the spatial structure or diversity of SONCC coho). The combination of the environmental baseline, response actions and cumulative effects does not decrease the abundance to a degree that productivity of any SONCC coho population would be discernibly reduced.

Upper Columbia River spring-run Chinook salmon

UCR Chinook salmon are an endangered species comprised of 3 populations. UCR Chinook survival and recovery is limited by degraded environmental baseline conditions in fresh, estuarine and marine critical habitats. The proposed action is likely to affect UCR Chinook. For UCR Chinook salmon, the results of effects analysis are summarized in the Columbia River and Pacific Ocean sections. As shown in these sections, UCR Chinook are exposed to stressors from the lights, vacuums and skimmers, in situ burn, and chemical dispersion. Although some of these stressors have a moderate or high likelihood of exposure or magnitude of response rating, only vacuuming/skimming have a moderate or high consequences of exposure and response to individual fitness that cannot be significantly offset by proposed BMPs. As shown in Table 9, when all the stressor effects to each PBF are combined, the consequence to the action area conservation value rating is low. Likewise, when the effects of PBF and direct effects to individuals are combined, the consequence of the PBF and direct effects at the population level rating is low.

Although response actions may temporarily worsen critical habitat PBFs, we did not identify any pathway where PBF degradation rises to the level that critical habitat is adversely modified.

PBF degradation and direct effects may kill or harm some individual fish from each UCR Chinook population, we did not identify any pathway where deaths or harm rise to a level where population abundance would be significantly decreased from the combination of the environmental baseline, cumulative effects and the proposed action (NMFS did not identify any pathways whereby response actions would affect the spatial structure or diversity of UCR Chinook). The combination of the environmental baseline, response actions and cumulative effects does not decrease the abundance to a degree that productivity of any UCR Chinook population would be discernibly reduced.

Upper Columbia River steelhead trout

UCR Chinook salmon are an endangered species comprised of 3 populations. UCR Chinook survival and recovery is limited by degraded environmental baseline conditions in fresh, estuarine and marine critical habitats. The proposed action is likely to affect UCR Chinook.

For UCR steelhead, the results of effects analysis are summarized in the Columbia River and Pacific Ocean sections. As shown in these sections, UCR steelhead are exposed to stressors from lights, vacuums and skimmers, in situ burn, and chemical dispersion. Although some of these stressors have a moderate or high likelihood of exposure or magnitude of response rating, only vacuuming/skimming have a moderate or high consequences of exposure and response to individual fitness that cannot be significantly offset by proposed BMPs. As shown in Table 9, when all the stressor effects to each PBF are combined, the consequence to the action area conservation value rating is low. Likewise, when the effects of PBF and direct effects to individuals are combined, the consequence of the PBF and direct effects at the population level rating is low.

Although response actions may temporarily worsen critical habitat PBFs, we did not identify any pathway where PBF degradation rises to the level that critical habitat is adversely modified.

PBF degradation and direct effects may kill or harm some individual fish from each UCR steelhead population, we did not identify any pathway where deaths or harm rise to a level where population abundance would be significantly decreased from the combination of the environmental baseline, cumulative effects and the proposed action (NMFS did not identify any pathways whereby response actions would affect the spatial structure or diversity of UCR steelhead). The combination of the environmental baseline, response actions and cumulative effects does not decrease the abundance to a degree that productivity of any UCR steelhead population would be discernibly reduced.

Snake River fall-run Chinook salmon

SR Fall Chinook salmon are a threatened species composed of one population. SR Fall Chinook survival and recovery is limited by degraded environmental baseline critical habitat PBFs in the action area that are potentially worsened by the effects of oil spill response actions, including forage, LWD and water quality. The proposed action is likely to affect SR Fall Chinook salmon.

For SR fall Chinook salmon, the results of effects analysis are summarized in the Columbia River and Pacific Ocean sections. As shown in these sections, SR fall Chinook are exposed to stressors from the lights, vacuums and skimmers, in situ burn, and chemical dispersion. Although some of these stressors have a moderate or high likelihood of exposure or magnitude of response rating, only vacuuming/skimming have a moderate or high consequences of exposure and response to individual fitness that cannot be significantly offset by proposed BMPs. As shown in Table 9, when all the stressor effects to each PBF are combined, the consequence to the action area conservation value rating is low. Likewise, when the effects of PBF and direct effects to individuals are combined, the consequence of the PBF and direct effects at the population level rating is low.

Although response actions may temporarily worsen critical habitat PBFs, we did not identify any pathway where PBF degradation rises to the level that critical habitat is adversely modified.

PBF degradation and direct effects may kill or harm some individual fish from each SR fall Chinook population, we did not identify any pathway where deaths or harm rise to a level where population abundance would be significantly decreased from the combination of the environmental baseline, cumulative effects and the proposed action (NMFS did not identify any pathways whereby response actions would affect the spatial structure or diversity of SR fall Chinook). The combination of the environmental baseline, response actions and cumulative effects does not decrease the abundance to a degree that productivity of any SR fall Chinook population would be discernibly reduced.

Snake River spring/summer-run Chinook salmon

SR spring/summer Chinook salmon are an endangered species comprised of 3 populations. UCR Chinook survival and recovery is limited by degraded environmental baseline conditions in fresh, estuarine and marine critical habitats. The proposed action is likely to affect SR spring/summer Chinook.

For SR spring/summer Chinook salmon, the results of effects analysis are summarized in the Columbia River and Pacific Ocean sections. As shown in these sections, SR spring/summer Chinook are exposed to stressors from the lights, vacuums and skimmers, in situ burn, and chemical dispersion. Although some of these stressors have a moderate or high likelihood of exposure or magnitude of response rating, only vacuuming/skimming have a moderate or high consequences of exposure and response to individual fitness that cannot be significantly offset by proposed BMPs. As shown in Table 9, when all the stressor effects to each PBF are combined, the consequence to the action area conservation value rating is low. Likewise, when the effects of PBF and direct effects to individuals are combined, the consequence of the PBF and direct effects at the population level rating is low.

Although response actions may temporarily worsen critical habitat PBFs, we did not identify any pathway where PBF degradation rises to the level that critical habitat is adversely modified.

PBF degradation and direct effects may kill or harm some individual fish from each SR spring/summer Chinook population, we did not identify any pathway where deaths or harm rise to a level where population abundance would be significantly decreased from the combination of the environmental baseline, cumulative effects and the proposed action (NMFS did not identify any pathways whereby response actions would affect the spatial structure or diversity of SR spring/summer Chinook). The combination of the environmental baseline, response actions and cumulative effects does not decrease the abundance to a degree that productivity of any SR spring/summer Chinook population would be discernibly reduced.

Snake River Basin steelhead

SR Basin steelhead are a threatened species composed of 24 populations. SR Basin steelhead survival and recovery is limited by degraded environmental baseline critical habitat PBFs in the action area that are potentially worsened by the effects of oil spill response actions, including forage, LWD and water quality. The proposed action is likely to affect SR Basin steelhead.

For SRB steelhead, the results of effects analysis are summarized in the Columbia River and Pacific Ocean sections. As shown in these sections, SRB steelhead are exposed to stressors from the lights, vacuums and skimmers, in situ burn, and chemical dispersion. Although some of these stressors have a moderate or high likelihood of exposure or magnitude of response rating, only vacuuming/skimming have a moderate or high consequences of exposure and response to individual fitness that cannot be significantly offset by proposed BMPs. As shown in Table 9, when all the stressor effects to each PBF are combined, the consequence to the action area conservation value rating is low. Likewise, when the effects of PBF and direct effects to individuals are combined, the consequence of the PBF and direct effects at the population level rating is low.

Although response actions may temporarily worsen critical habitat PBFs, we did not identify any pathway where PBF degradation rises to the level that critical habitat is adversely modified.

PBF degradation and direct effects may kill or harm some individual fish from each SRB steelhead population, we did not identify any pathway where deaths or harm rise to a level where population abundance would be significantly decreased from the combination of the environmental baseline, cumulative effects and the proposed action (NMFS did not identify any pathways whereby response actions would affect the spatial structure or diversity of SRB steelhead). The combination of the environmental baseline, response actions and cumulative effects does not decrease the abundance to a degree that productivity of any SRB steelhead population would be discernibly reduced.

Snake River sockeye salmon

SR sockeye salmon are an endangered species composed of one population. SR sockeye survival and recovery is limited by degraded environmental baseline critical habitat PBFs in the action area that are potentially worsened by the effects of oil spill response actions, including forage, LWD and water quality. The proposed action is likely to affect SR sockeye salmon.

For SR sockeye, the results of effects analysis are summarized in the Columbia River and Pacific Ocean sections. As shown in these sections, SR sockeye are exposed to stressors from the lights, vacuums and skimmers, in situ burn, and chemical dispersion. Although some of these stressors have a moderate or high likelihood of exposure or magnitude of response rating, only vacuuming/skimming have a moderate or high consequences of exposure and response to individual fitness that cannot be significantly offset by proposed BMPs. As shown in Table 9, when all the stressor effects to each PBF are combined, the consequence to the action area conservation value rating is low. Likewise, when the effects of PBF and direct effects to individuals are combined, the consequence of the PBF and direct effects at the population level rating is low.

Although response actions may temporarily worsen critical habitat PBFs, we did not identify any pathway where PBF degradation rises to the level that critical habitat is adversely modified.

PBF degradation and direct effects may kill or harm some individual fish from each SR sockeye population, we did not identify any pathway where deaths or harm rise to a level where population abundance would be significantly decreased from the combination of the environmental baseline, cumulative effects and the proposed action (NMFS did not identify any pathways whereby response actions would affect the spatial structure or diversity of SR sockeye). The combination of the environmental baseline, response actions and cumulative effects does not decrease the abundance to a degree that productivity of any SR sockeye population would be discernibly reduced.

2.7.2 Pacific Eulachon

Table 10. Summary of effects to eulachon (A=abundance, P=productivity, SS=spatial structure, D=diversity.)

River and stream stressors		PBF (Direct)	Effect	Consequence on action area's conservation value	Consequences of exposure and response at the population level (A, P, SS, D*)
Removed riparian ground cover		Water quality	Erosion-Suspended sediment		
Vessel and boom anchors		Direct	Crushing		
Lights, noise at night		Direct	Predation		
Skimming/vacuuming		Direct	Entrainment		
Columbia River stressors		PBF (Direct)	Effect		
Removed riparian ground cover		Water quality	Erosion-Suspended sediment		
Vessel and boom anchors		Direct	Crushing		
Lights, noise at night		Direct	Predation		
Skimming/vacuuming		Direct	Entrainment		
In situ burn		Direct	Smothering		
Pacific Ocean stressors		PBF (Direct)	Effect		
In situ burn		Prey	Toxicity		
Chemical dispersion		Water quality	Toxicity		

Eulachon are a threatened species at a high risk of extinction. Eulachon survival and recovery is limited by degraded environmental baseline in their freshwater, estuarine, and marine critical habitats because of impaired PBFs in the rivers and streams, the Columbia River, and estuarine and marine action areas.

For eulachon, the results of effects analysis are summarized in the Rivers and Streams, Columbia River and Pacific Ocean sections. As shown in these sections, eulachon are exposed to stressors from the removal of ground cover, anchors, lights, vacuums and skimmers, in situ burn and chemical dispersion. Although some of these stressors have a moderate or high likelihood of exposure or magnitude of response rating, only vacuuming/skimming has a moderate or high consequences of exposure and response to individual fitness that cannot be significantly offset by proposed BMPs. As shown in Table 10, when all the stressor effects to each PBF are combined, the consequence to the action area conservation value rating is low. Likewise, when the effects of PBF and direct effects to individuals are combined, the consequence of the PBF and direct effects at the population level rating is low.

Although response actions may temporarily worsen critical habitat PBFs, we did not identify any pathway where PBF degradation rises to the level that critical habitat is adversely modified.

PBF degradation and direct effects may kill or harm some individual eulachon, we did not identify any pathway where deaths or harm rise to a level where abundance would be significantly decreased from the combination of the environmental baseline, cumulative effects and the proposed action (NMFS did not identify any pathways whereby response actions would affect the spatial structure or diversity of eulachon). The combination of the environmental baseline, response actions and cumulative effects does not decrease the abundance to a degree that productivity of eulachon would be discernibly reduced.

2.7.3. Yelloweye and Bocaccio Rockfish

Table 11. Summary of effects to rockfish (A=abundance, P=productivity, SS=spatial structure, D=diversity.)

Puget Sound stressors	**PBF (Direct)**	**Effect**	**Consequence on action area's conservation value**	**Consequences of exposure and response at the population level (A, P, SS, D*)**
Vessel and boom anchors	Forage	Damage to kelp/eelgrass		
Chemical Dispersion	Water quality			
Skimmers and vacuums	Direct	Entrainment		
Lights at night	Direct	Avoidance		
In situ burn	Direct	Toxicity		

Yelloweye rockfish are threatened and boccacio are endangered. Critical habitat for these species includes nearshore habitat for boccacio juveniles, and deepwater habitat for yelloweye rockfish and bocaccio, as well as some deepwater areas in Hood Canal (79 FR 68070; 2014). Water quality and abundant prey are PBFs of these two habitat types. Both species are vulnerable to the direct effects of response actions because the proposed action is likely to affect the PBFs and the two species because BNSF railroad tracks run along nearshore habitat and oil tankers and barges operate in nearshore and offshore habitat. Action agencies will respond (response may be natural attenuation) if an oil spill occurs in each of these habitats.

For yelloweye rockfish and boccacio, the results of effects analysis are summarized in the Puget Sound section. As shown in Table 25, no direct effect stressor has a moderate or high likelihood of individual exposure and magnitude or individual response rating leading to a moderate or high consequence of exposure and response to individual fitness rating. Larvae may be entrained by oil skimmers and vacuums operating in nearshore areas and may be exposed to effects from in situ burn residue, chemical dispersants or chemically dispersed oil.

In conclusion, direct effects may kill or harm some individual yelloweye or boccacio larvae, NMFS did not identify any pathway where deaths or harm rise to a level where population abundance would be significantly decreased from the combination of the environmental baseline, cumulative effects and the proposed action. NMFS did not identify any pathways whereby response actions would affect the spatial structure or diversity of yelloweye rockfish or boccacio. Similarly, because the effects of the response would all be temporary, we did not find a degradation to conservation values of the critical habitat.

2.8. Conclusion

After reviewing and analyzing the current status of the listed species, 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 of; PS Chinook salmon, PS steelhead, HC Chum, Yelloweye rockfish, Bocaccio rockfish, Eulachon, Lake Ozette Sockeye Salmon, LCR Chinook salmon, LCR steelhead, LCR coho salmon, CR chum salmon, UWR Chinook salmon, UWR steelhead, OC coho salmon, SONCC coho salmon, MCR steelhead, UCR Spring-run Chinook salmon, UCR steelhead, SR Spring/Summer run Chinook salmon, SR Fall-run Chinook salmon SR Sockeye Salmon or SR Basin steelhead or destroy or adversely modify the designated critical habitat of any of these species.

Table 12. Jeopardy and Adverse Modification Conclusion

ESA-Listed Species	Does action reduce the Abundance, Productivity, Spatial Structure or Diversity of any population	Is Action Likely To Jeopardize the Species?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Puget Sound Chinook salmon	No	No	No
Puget Sound Steelhead	No	No	No
Hood Canal chum salmon	No	No	No
Lake Ozette sockeye salmon	No	No	No
Lower Columbia River Chinook salmon	No	No	No
Lower Columbia River steelhead	No	No	No
Lower Columbia River coho salmon	No	No	No
Columbia River chum salmon	No	No	No
Oregon Coast coho salmon	No	No	No
Southern Oregon/Northern California Coastal coho salmon	No	No	No
Upper Willamette River Chinook salmon	No	No	No
Upper Willamette River steelhead	No	No	No
Middle Columbia River steelhead trout	No	No	No
Upper Columbia River spring-run Chinook salmon	No	No	No
Upper Columbia River steelhead trout	No	No	No
Snake River fall-run Chinook salmon	No	No	No
Snake River spring/summer-run Chinook salmon	No	No	No
Snake River sockeye salmon	No	No	No
Snake River steelhead	No	No	No
Pacific eulachon	No	No	No
Bocaccio rockfish	No	No	No
Yelloweye rockfish	No	No	No

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

The amount of incidental take from each of the above sources of harm or death cannot be measured because of the highly variable nature of species presence at any given life stage, and uncertainty as to location and timing of response action relative to species presence. When estimating an amount of take is impracticable, we rely on a take surrogate measure. A take surrogate provides an observable measure that can be monitored, and is based a causal relationship between the measure and the type of take that will occur.

For this consultation, the take surrogate relates to the number of days for a response action. There is a causal relationship between all the take pathways identified above and the number of days for a response because more take occurs under each pathway the longer a response continues. Our effects analysis assumed response actions will last for up to 4 days. Accordingly, the extent of take is that which can occur over up to 4 days' duration for a response. If a response action exceeds this maximum extent of take will have been exceeded. This surrogate can be reliably monitored by tracking the number of days of a response. For responses that are estimated to take longer than four-days or that are estimated to take up to four-days and then take longer, action agencies will conduct an emergency consultation with NMFS.

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 U.S. Coast Guard, the EPA, and their contractors or agents shall:

1. Minimize salmon and steelhead eggs and embryos in redds injured or killed in their freshwater critical habitat when water quality is degraded by suspended sediment.
2. Minimize salmon and steelhead eggs and embryos in redds injured or killed in their freshwater critical habitat by vessel and boom anchors.
3. Minimize salmon and steelhead fry emerging from redds in their freshwater critical habitat killed by predators aided by responder lights at night.
4. Minimize juvenile salmon and steelhead killed by becoming entrained by vacuums or skimmers.
5. Minimize eulachon larvae killed by vessel and boom anchors.
6. Minimize eulachon larvae and adults killed by becoming entrained by vacuums and skimmers.
7. Minimize eulachon larvae killed by smothering beneath in situ burn residue.
8. Minimize rockfish larvae killed by becoming entrained in vacuums and skimmers.
9. Minimize rockfish larvae killed by predators aided by responder lights at night.
10. For responses to spills with potential take stressors (suspended sediment, lights, anchors, entrainment or in situ burn residue) in locations where vulnerable species life stages may

be present (salmon and steelhead spawning and rearing habitat and eulachon and rockfish larvae habitat) at times of the year when these life stages may be present, ensure that responders provide the EPA or USCG with the response date, location, response stressor and BMPs used to minimize incidental take.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the Coast Guard, and the EPA or any contractors or agents must comply with them in order to implement the RPMs (50 CFR 402.14). The Coast Guard and the EPA, or any contractors or agents have 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 (Minimize salmon and steelhead eggs and embryos in redds injured or killed when water quality is degraded by suspended sediment.)

    a. Use all necessary BMPs proposed in this biological opinion to minimize the likelihood that sediment will be eroded from the response site and transported to the stream and river channels.
    b. Notify NOAA SSC of the spill location within 24 hours to determine if fish are spawning at or downstream from the spill.

2. The following terms and conditions implement reasonable and prudent measure 2 (Minimize salmon and steelhead eggs and embryos in redds injured or killed by vessel and boom anchors.)

    a. Use all necessary BMPs to minimize the likelihood that boat and vessel anchors will damage redds.

3. The following terms and conditions implement reasonable and prudent measure 3. (Minimize salmon and steelhead fry emerging from redds killed by predators aided by responder lights at night.)

    a. Use all necessary BMPs to minimize the use of lights in spawning habitat when fry are emerging from redds.

4. The following terms and conditions implement reasonable and prudent measure 4. (Minimize juvenile salmon and steelhead killed by becoming entrained by vacuums or skimmers.)

    a. Use all necessary BMPs to minimize the likelihood that fry and juveniles will become entrained in vacuums and skimmers.

5. The following terms and conditions implement reasonable and prudent measure 5. (Minimize eulachon larvae killed by vessel and boom anchors.)

    a. Use all necessary BMPs to minimize the likelihood that boat and vessel anchors will harm eulachon larvae in bedload.

6. The following terms and conditions implement reasonable and prudent measure 6. (Minimize eulachon larvae and adults killed by becoming entrained by vacuums and skimmers.

    a. Use all necessary BMPs to minimize the likelihood that eulachon larvae and adults will become entrained in vacuums and skimmers.

7. The following terms and conditions implement reasonable and prudent measure 7. (Minimize eulachon larvae killed by smothering beneath in situ burn residue.)

    a. Use all necessary BMPs to minimize the likelihood that fry will be smothered by in situ burn residues.

8. The following terms and conditions implement reasonable and prudent measure 8. (Minimize rockfish larvae killed by becoming entrained in vacuums and skimmers.)

    a. Use all necessary BMPs to minimize the likelihood that rockfish larvae and adults will become entrained in vacuums and skimmers.

9. The following terms and conditions implement reasonable and prudent measure 9. (Minimize rockfish larvae killed by predators aided by responder lights at night.)

    a. Use all necessary BMPs to minimize the use of lights in nearshore areas when rockfish larvae are present.

10. The following terms and conditions implement reasonable and prudent measure 10. (Monitoring)

    a. The EPA and USCG shall participate in an annual conference call organized by NMFS to discuss adaptive management updates to this biological opinion based on experience from the years' response actions.

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 USCG and EPA should ensure training and education is provided to all delegated agencies and contract personnel involved with oil spill response on: (1) "Best Management Practices," as outlined in the proposed action; and (2) Reasonable and Prudent Measures and their corresponding Terms and Conditions, as outlined in this Biological Opinion.

2.11. Reinitiation of Consultation

This concludes formal consultation for Northwest Area Contingency Plan for the Response to Spills of Oil and Hazardous Substances

As 50 CFR 402.16 states, reinitiation of consultation is required and shall be requested by the Federal agency or by the Service where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) The amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

2.12. "Not Likely to Adversely Affect" Determinations

The USCG and EPA determined, and NMFS concurs, that the proposed action is not likely to adversely affect;

1. Southern DPS green sturgeon (*Acipenser medirostris*),
2. Leatherback sea turtle (*Dermochelys coriacea*),
3. Humpback whale (*Megaptera novaeangiliae*),
4. Southern Resident Killer Whale (*Orcinus orca*),
5. Fin whale (*B. physalus*),
6. North Pacific right whale (*Eubalena japonica*),
7. Sei whale (B. borealis),
8. Sperm whale (Physeter macrocephalus),
9. Gray whale (*Eschrichtius robustus*),
10. Blue whale (*Balaenoptera musculus*),
11. green sea turtle (*Chelonia mydas*),
12. olive ridley sea turtle (*Lepidochelys olivacea*),
13. loggerhead turtle (*Caretta caretta*),
14. guadalupe fur seal (*Arctocephalus townsendi*) or their critical habitat.

2.12.1 Southern DPS Green Sturgeon

Green sturgeon are present in the action area in deep water along the Oregon and Washington coast and feeding in estuaries and bays as subadults and adults. Green sturgeon do not spawn in the action areas, and at the life stages present in the action areas, are too large to be vulnerable to entrainment by skimming or vacuuming. Green sturgeon predominantly rest and feed in deeper water and are unlikely to be exposed to heat from in-situ burning, oil contained in devices such as booms, or suspended sediment from erosion. Therefore, these effects are discountable to green sturgeon.

The PBFs of southern DPS green sturgeon estuarine critical habitat include abundant benthic prey for normal behavior, growth, and viability. Responders will likely operate vessels and anchor vessels and booms in the Columbia River and in the Pacific Ocean, disturbing or destroying benthic prey organisms. These effects will be highly localized and have a low-magnitude effect on benthic invertebrate communities. The area impacted by anchors will be very small and not likely to have a significant effect on green sturgeon prey because benthic invertebrate populations will likely recolonize disturbed areas within a matter of days and form mature communities forming after a year or more.

Responders will likely use in situ burn in the Columbia River and the Pacific Ocean to remove surface oil within the four-day response time of this biological opinion and Columbia River benthic forage will be exposed to solid in situ burn residues. NOAA SSC will be contacted prior to an in situ burn in freshwater to advise responders on the likelihood of green sturgeon presence. The area of benthic habitat exposed to in situ burn residues will be extremely small. BMPs call for responders to use nets to capture and collect as much of the in situ burn residue as possible, reducing the amount that will sink to the bottom. Because the toxic components of oil are combustible and removed residue that reaches the bottom is not overtly toxic (NOAA, 2017) and exposure and response are thus insignificant. The only effect of the residue is burial of benthic forage. Since Columbia River bedload is regularly transported annually by large flows, in situ burn residue will be mixed with and dispersed by bedload relatively rapidly, minimizing the effects on benthic prey.

Responders will likely use chemical dispersion in open marine water portions of southern DPS green sturgeon Pacific Ocean critical habitat within the four-day response limit under this biological opinion. In the summer and fall, Adult green sturgeon aggregate in large embayments along the Washington and Oregon coasts. Chemical dispersion will not occur in within 3 nautical miles of the coast without authorization from the RRT. Chemically dispersed oil in open marine water portions of southern DPS green sturgeon critical habitat would be highly dilute in at 20 to 60 meter depths where green sturgeon migrate and is not likely to significantly affect the availability of benthic prey or fish at these depths.

12.1.2 Leatherback sea turtles

Leatherback sea turtles are present in the action area along the coast of Washington and Oregon during summer and fall and may be exposed to spill response actions.

Designated critical habitat for the leatherback sea turtle within the Action Area includes coastal waters east of the 2,000 meter depth contour from Cape Flattery, Washington, south to Cape Blanco, Oregon. The single critical habitat PBF is the presence of prey species, primarily *scyphomedusae* jellyfish, of sufficient condition, distribution, diversity, abundance, and density to support the individual and population growth, reproduction, and development of leatherback sea turtles (77 FR 4170). Jellyfish may be exposed to chemically dispersed oil. The decreasing concentration of chemically dispersed oil as it mixes deeper into the water column offsets its effect on jellyfish. Large adult jellyfish make daily vertical movements between the ocean surface and the deeper, hypoxic layers of water (Moriarty et al., 2012) where chemically dispersed oil is dilute. Jellyfish larvae live as polyps in benthic habitats (Whiteman L., 2008) in deep waters, where chemically dispersed oil will be highly dilute. Even if jellyfish are killed by dispersed oil, the jellyfish population is not expected to be significantly affected because jellyfish have a fast and effective reproductive strategy (Whiteman L., 2008), as evidenced by their propensity to bloom under suitable conditions (Ruzicka et al., 2016). Overall, the chemical dispersion of oil will not affect the condition, distribution, diversity, abundance, or density of jellyfish on a scale that will reduce the growth, reproduction, or development of individual leatherback sea turtles (i.e., negligible effect).

Leatherback sea turtles may be exposed to the direct effects of response vessel strikes, vessel and aircraft noise, in situ burns and chemically dispersed oil.

Wildlife monitors will observe the response area for sea turtles. Leatherback sea turtles are readily detectable because they are large and spend more than 75% of their time in the upper 5 meters of the water column (NMFS, 2012b). Once detected, responders will maintain a buffer area around the turtle and response actions will be suspended until they are no longer present. The risk of a vessel strike is insignificant. Vessel or aircraft noise may cause turtles to expend energy by diving but vessels and aircraft will only be in the spill area for up to four-days and any additional energy expenditure is insignificant. Before conducting an in situ burn, responders will either use hazing to get turtles to leave the area or move the oil with a fire boom to a location away from the turtles. Responders will not use in situ burning if turtles are downwind so the risk of exposure to the fire and smoke is insignificant. Undetected submerged turtles could be exposed to sinking in situ burn residue. The toxic components of the oil are removed by combustion (NOAA, 2017) and responders will mechanically collect as much of the burn residue as possible so the effect of any exposure is insignificant.

Undetected submerged turtles could also be exposed to chemically dispersed oil as it mixes into the water column. As chemically dispersed oil mixes in the water column it becomes dilute and increasingly less toxic than untreated oil at the ocean surface. Surface oil causes mortality in sea turtles, as evidenced by strandings of dead individuals after the Deepwater Horizon Oil Spill (Barron, 2012) and other major oil spills. This is likely related to PAHs in oil, which have been shown to significantly impact developing turtles (Albers and Loughlin, 2003; Van Meter et al., 2006) and respiration, skin, blood chemistry, and salt gland functioning (Albers and Loughlin, 2003). However, exposure of adults to rapidly diluting PAHs is not likely to result in acute toxicity and reptiles are able to efficiently metabolize and excrete ingested hydrocarbons (Albers and Loughlin, 2003), which should limit the bioaccumulation of PAHs after a dispersant application. Chemical dispersants also reduce the formation of buoyant tarballs (Shigenaka G, 2003) that have been found in turtle stomachs (Shigenaka, 2003). Therefore, chemical dispersion of surface oil will have a discountable effect on marine turtles relative to mechanically dispersing surface oil.

12.1.3 Humpback whales

Whales from the Central American DPS feed almost exclusively offshore of California and Oregon in the eastern Pacific, with only a few individuals identified at the northern Washington-southern British Columbia feeding grounds. Critical habitat is proposed for the Central American (CAM) and Mexican (MX) humpback whale DPSs. The critical habitat PBF is prey species such as euphausiids and small pelagic schooling fishes of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth.

Chemical dispersal of oil could have an impact on larval life stages of humpback whale prey. Krill and fish at the larval life stage tend to be concentrated in the photic zone of shallower nearshore waters where chemical dispersion would increase the concentrations of small oil droplets relative to physical dispersion (other life stages of prey species occupy deeper portions of the water column that are not significantly affected by chemical dispersion). Larvae may consume and bioaccumulate these oil droplets leading to narcosis and acute mortality that temporarily reduces the prey base of humpback whales. Studies have shown that zooplankton will rapidly recolonize an impacted area (Abbriano et al., 2011; NRC, 2005; Symons and Arnott, 2013; Varela et al., 2006). Given the small area of oil spills relative to proposed critical habitat, such reductions would not persist or be widespread and the effect on humpback whale prey is insignificant.

The potential direct effects of response actions on humpback whales are vessel strikes, vessel and aircraft noise, in situ burn and chemical dispersion.

Wildlife monitors on response vessels will observe the response area for marine mammals and sea turtles. These animals are readily detectable because they are large and spend most of their time at or near the surface of the water column (NMFS, 2012b). Once detected, responders will maintain a buffer area around the animal and response actions will be suspended until they are no longer present. Therefore, the likelihood of a response vessel strike is insignificant. The presence and noise of response vessels equipment and aircraft could block humpback whales from a localized resource (e.g., aggregation of fish or plankton). This exclusion will last up to four-days but humpback whales will be able to feed elsewhere during the spill response. Considering the size of the area likely to be occupied by spill responders in relation to the large foraging area of an individual humpback whale, this exclusion will have an insignificant impact on individual humpback whales.

Humpback whales are very unlikely to be exposed to smoke and residue from in situ burn. In order to conduct an in situ burn, responders must implement the Special Monitoring of Applied Response Technologies (SMART) protocol and gain approval from the RRT. As part of SMART, responders will monitor the area for the presence of wildlife as well as local weather conditions (e.g., wind direction). The process for use of in-situ burning described in the NWACP includes early coordination with the Services, in part to help the EPA and USCG know if ESA-listed species may be present in the area and what steps may be needed to minimize impacts. In situ burning operations can be moved (using vessel-mounted fire booms) to avoid a humpback whale, or burning can be halted until the whale leaves the area. Because humpback whales are easy to detect, in situ burn-related injuries to humpback whales are insignificant. Undetected submerged whales may swim into to burn residue sinking through the water column. Residues have low toxicity, but if a whale were to be engulfed during feeding, residues could foul its baleen and cause a short-term reduction in feeding efficiency (58 FR 3121). Responders will attempt to mechanically recover burn residues. Combined with the SMART protocol described above, the effect of in situ burn residue is insignificant.

12.1.4 Southern Resident killer whales (SRKW)

SRKW generally stay around Puget Sound in late spring through fall. They have also been tracked along outer coast of Washington and Oregon in the fall and winter to feed on salmon entering the Columbia River. In 2006, NMFS designated critical habitat for the Southern Resident killer whales DPS of killer whale (71 FR 69054). The three specific areas in Washington are the Summer Core Area in Haro Strait and waters around the San Juan Islands; Puget Sound; and the Strait of Juan de Fuca. On September 19, 2019, NMFS proposed to revise the critical habitat designation for SRKWs by expanding it to include six new areas along the U.S. West Coast (84 FR 49214), while keeping the current designated critical habitat area in Washington. The proposed new areas along the U.S. West Coast include roughly 16,167 square miles of marine waters between the 6.1-meter depth contour and the 200-meter depth contour from the U.S. international border with Canada south to Point Sur, California. The physical and biological features of proposed coastal critical habitat that are essential to the conservation of Southern Resident killer whales DPS of killer whales are: water quality to support growth and development; prey species of sufficient quantity, quality, and availability to support individual growth, reproduction and development, as well as overall population growth; and inter-area passage conditions to allow for migration, resting, and foraging.

The effects of spill response actions on salmon in freshwater could affect SRKW critical habitat prey PBF. However, the number of juvenile salmon killed by response actions such as vacuuming and skimming in freshwater is much too small to translate into a significant effect on the quantity, quality, and availability of adult salmon prey that reduces SRKW growth, reproduction, and/or development. The chemical dispersal of oil in marine waters could expose juvenile salmon in the first few meters from the ocean surface to higher concentrations of PAHs than in physically dispersing surface oil. These concentrations become diluted over a few hours. Juvenile salmon are evenly distributed in marine waters to an approximate depth of 37 meters (Orsi and Wertheimer 1995) so combined with rapid dilution and the relatively small area of spills, chemical dispersion is anticipated to be insignificant to the prey base of SRKW. Booming, skimming/vacuuming, passive collection, and physical herding could affect SRKW passage conditions or exclude them from resources. SRKWs are able to dive under booms, so booms should not pose a barrier to movements or cause exclusion from resources. Skimming, vacuuming and passive collection are typically used in containment areas, which are small areas surrounded by booms. Whales will likely avoid these areas or swim around or under them so their effect on passage is considered insignificant. In situ burn residue or chemically dispersed oil becomes immeasurably dilute within days and the effect on SRKW critical habitat water quality is insignificant.

The possible direct effects of response actions to SRKW are response vessel strikes, exclusion from resources by vessel or aircraft noise, smoke inhalation following in situ burning and tissue irritation (i.e., skin, eye, nose, mucous membrane) from exposure to chemical dispersants and dispersed oil. SRKWs are at elevated risk during spill responses relative to other whales because SRKWs aggregate in Puget Sound and at the Columbia River Estuary, where salmon runs are strong. Spills of oil (and associated spill responses) are more likely in those locations than refineries, marine tanker lanes, and rail terminals.

As with humpback whales and turtles, response wildlife monitors will observe the spill area for SRKW and in situ burning or chemical dispersants will not be used until they are no longer present. SRKW are tracked by various organizations, so their location may be available through online resources (e.g., OrcaNetwork). This information can be provided to the response as part of planning. Furthermore, the NWACP includes provisions to use helicopters to deter SRKW from swimming into an oil spill. This deterrence will keep whales away from response activities as well. Vessel and other response noise will impair whale communication during the spill response actions but the noise levels produced by response vessels are not expected to exceed levels that cause harm (NOAA 2017a) and response vessels will adhere to regulations requiring vessels to maintain 200-yard distance from killer whales in the inland waters. Increased vessel activity and response actions will only last up to four-days.

12.1.5 Fin whales

Fin whales are found in the Action Area but the species use of the area is thought to be limited with no known calving areas. Fin whale critical habitat has not been designated.

The possible direct effects of response actions to fin whales are response vessel strikes, exclusion from resources by vessel or aircraft noise, smoke inhalation following in situ burning and tissue irritation (i.e., skin, eye, nose, mucous membrane) from exposure to chemical dispersants and dispersed oil.

Fin whales spend more than half of their time at depths from 50 meters to greater than 225 meters where they are not exposed to any response effects. Fin whales on the surface are easy to detect by wildlife monitors and as with other whales, response actions will be modified to avoid effects (e.g., vessels would be directed to reduce speed and watch for animals). Given the short duration of on-water spill response actions (four-days or less), the likelihood of temporal overlap between responders and fin whales is sufficiently low that the likelihood of direct effects is discountable.

12.1.6 North Pacific right whales

North Pacific right whales are very rarely in the Action Area. There has been one observation of a right whale in the Action Area in the past decade. Critical habitat for North Pacific right whale does not overlap with the Action Area.

The possible direct effects of response actions to fin whales are response vessel strikes, exclusion from resources by vessel or aircraft noise, smoke inhalation following in situ burning and tissue irritation (i.e., skin, eye, nose, mucous membrane) from exposure to chemical dispersants and dispersed oil.

Wildlife observers can easily detect right whales from the air but they are more difficult to detect from the surface because they do not display much surface activity. Nonetheless, because the species is so rarely observed in the action area and on-water spill response operation last four-days or less any effects of spill response actions on North Pacific right whale are extremely unlikely and therefore discountable.

12.1.7 Sei whales

Sei whales have an extensive home range and are rarely present in the Action Area. They prefer open water, offshore habitat. Critical habitat has not been designated for sei whales. Sei whales are unlikely to be in the action area the likelihood that they would be exposed to response actions is discountable.

12.1.8 Sperm whales

Sperm whales are very rarely present in the Action Area. Critical habitat has not been designated for sperm whales. Sperm whales are found over deep, open marine water where they spend much time diving deeply to forage for prey where they are not exposed to direct effects of response actions. Sperm whales will be easily detected by wildlife observers when they are at the ocean surface. Sperm whales are so unlikely to be exposed to response actions, the direct effects are discountable.

12.1.9 Western North Pacific gray whales

Western North Pacific gray whales have an extensive home range that extends from Russia to Mexico. Critical habitat has not been designated for gray whales. The Western North Pacific DPS makes up only a small fraction of observed gray whales on the US West Coast and they are very rarely encountered in the action area. They are most often found in deep, open marine water and are easily detected by wildlife observers when they aggregate in foraging areas. The combination of the low density of Western North Pacific gray whales and the four-day limit of responses actions make the exposure of this species to response effects discountable.

12.1.10 Blue Whales

Blue whales migrate through the Northwest marine habitat in the fall and early winter and may forage in open marine water off the coast of northern Washington. The species does not calve in the Action Area. Critical habitat has not been designated for blue whales. Blue whales prefer open water, offshore habitat. During migration, there are a large number of animals, though usually at a lower density than at feeding areas. Individuals are easy to detect by wildlife observers from both the water and the air and response actions would be modified to avoid effects. Because the species has an extensive home range, is rarely in the Action Area, does not feed or calve in the Action Area, and response actions only last up to four-days, any effects of spill response actions on blue whales are discountable.

12.1.11 Green sea turtles

Green sea turtles cannot survive the cold water conditions in the Action Area. The typical distribution of this species is in tropical and subtropical waters. Critical habitat for green sea turtles does not overlap with the Action Area. Green sea turtles are sometimes brought to the area by warm currents and are occasionally found in the Northwest cold-stunned and dead or dying. The up to four-day duration of response actions combined with the unlikely presence of green sea turtles makes their exposure to response effects discountable.

12.1.12 Olive ridley sea turtles

Olive ridley sea turtles live in tropical and subtropical waters and cannot survive the cold water conditions in the action area. Critical habitat has not been designated for olive ridley sea turtles. Olive ridley sea turtles are occasionally brought to the area by warm currents and are found cold-stunned and dead or dying. The up to four-day duration of response actions combined with the unlikely presence of olive ridley sea turtles makes their exposure to response effects discountable.

12.1.13 Loggerhead sea turtles

Loggerhead sea turtles do not nest or feed in the Action Area. Critical habitat for loggerhead sea turtles does not overlap with the action area. They may be brought to the area by warm currents. Their lack of presence in the action area combined with the four-day limit on response actions makes response effects on loggerhead sea turtles discountable.

12.1.14 Guadalupe fur seals

Guadalupe fur seals are very rarely present in the action area and may not survive for extended periods of time in the cold water conditions of the marine action area. Critical habitat for Guadalupe fur seals does not overlap with the action area. The combination of their unlikely presence and the four-day limit of response action make the response effects discountable on Guadalupe fur seals.

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

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA , EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the physical, biological, and chemical properties that are used by fish (50 CFR 600.10). Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on

EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) of the MSA also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH [CFR 600.905(b)]

This analysis is based, in part, 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

Pacific Coast Salmon
Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other waterbodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable artificial barriers (as identified by PFMC 1999), and longstanding, naturally impassable barriers (i.e. natural waterfalls in existence for several hundred years) (PFMC 1999).

Pacific Coast Groundfish
Pacific Coast Groundfish includes 90 different types of groundfish, flatfish, rockfish, sharks, and skates off the West Coast. Groundfish EFH is all waters and substrate in areas less than or equal to 3,500 meters (1,914 fathom) to mean higher high water level or the upriver extent of saltwater intrusion and seamounts in depths greater than 3,500 meters (1,914 fathom) (PFMC 2019).

Coastal Pelagic Species (CPS)
Coastal pelagic species includes northern anchovy, Pacific sardine, Pacific mackerel, jack mackerel, market squid and krill. The east-west geographic boundary of EFH for CPS is defined to be all marine and estuarine waters from the shoreline along the coasts of California, Oregon, and Washington offshore to the limits of the EEZ and above the thermocline where sea surface temperatures range between 10° C to 26° C. The southern boundary is the United States-Mexico maritime boundary. The northern boundary is more dynamic, and is defined as the position of the 10°C isotherm, which varies seasonally and annually. Designated EFH for CPS includes all marine and estuarine waters above the thermocline from the shoreline to 200 nm offshore. The northern population of Pacific sardine ranges from Southern California to British Columbia (Kuriyama et al., 2020). Pacific mackerel are produced off of Southern California and Mexico but adult fish migrate north to feed off of the Columbia River plume (Crone et al., 2019). Northern anchovy are distributed from British Columbia to Mexico. Market squid range from the southern tip of Baja California to southeastern Alaska but they live less than a year and the population replaces itself every year. Krill are small shrimp-like crustaceans that are an important base of the marine food chain.

3.2. Adverse Effects on Essential Fish Habitat

NMFS determined the proposed action would adversely affect EFH as described in the effects to critical habitat section of the accompanying biological opinion.

Pacific Coast salmon EFH water quality may be degraded by response actions that create suspended sediment in the river or stream. Response actions that remove ground cover on streambanks or in the riparian area expose sediment to erosion. Response actions include the operation of equipment in the riparian zone or on the streambank, the construction of pits or trenches in the streambank, the removal of oiled vegetation and woody debris from the streambank and low pressure, ambient temperature flushing of oil down the riparian area and streambank and into trenches. Overland flow from rainstorms carries exposed sediment toward the stream channel. If the rain storm happens during the response, suspended sediment can mix with and become contaminated by floating oil.

Pacific Coast salmon EFH water quality may be degraded by oil sorbent pads used to keep oil contained within booms from sloshing over the top of the booms or smearing along streambanks. If oil contaminated sorbent pads are carried by the river downstream and become lost, the oiled sorbent pad becomes a source of TPAH back into the environment, degrading water quality.

Pacific Coast salmon EFH water quality may be degraded by response action that remove shade such that summer water temperature increases. Proposed response actions that can remove shade are clearing space for a staging area, clearing access for heavy equipment to the spill and removing oiled vegetation from streambanks.

Pacific Coast salmon EFH substrate may be degraded by response actions that create suspended sediment in the stream as described above. Suspended sediment mixes with floating oil to increase the density of the oil and cause it to sink and contaminate the channel bottom substrate (Shigenaka, 2010). Organic carbon in suspended sediment increases the phase transfer of PAH from the oil to the sediment phase and adds to the substrate contamination wherever it is deposited. During peak flow events that move substrate, suspended sediment in the water column mixes with the substrate and increases the fraction of sand and fine sediment in the substrate (Parker and Toro-Escobar 2002, Cui, Parker et al. 2003). Redds constructed of substrate that includes sediment that contacted and incorporated spill oil exposes eggs and embryos to PAH. When salmonids construct their redd they winnow some fine sediment from the substrate but the higher the fraction of fine sediment in the substrate, the higher the fraction of fine substrate that remains in the redd gravel.

Pacific Coast salmon EFH forage may be degraded by response actions that clear vegetation from staging areas and access routes through the riparian zone and remove oiled vegetation from riparian zones and streambanks also reduces the number of insects produced. Vegetation detritus is the base of the food web that includes the aquatic insects. These aquatic flies lay their eggs in the channel substrate and when the eggs hatch larvae drift downstream and upwards through the water column until they reach the surface. While they are in the water column, they are easy prey for juvenile salmon and steelhead.

Pacific Coast salmon EFH LWD will be degraded by response actions that remove heavily oiled LWD in streams and in riparian zones to keep it from being or becoming a continuing source of oil to the stream. The removal of oiled LWD from stream channels reduces natural cover in the stream and the removal of oiled down trees in riparian areas reduces the potential for future LWD in the stream.

Pacific Coast salmon EFH passage may be degraded by the construction of berms, underflow dams or other barriers in small streams, and the use of culvert blocks to contain oil in small tributaries and stop them from reaching larger streams, will obstruct salmon and steelhead spawning and smolt migrations.

Pacific Coast salmon EFH, Pacific Coast groundfish EFH and coastal pelagic species forage may be degraded by in-situ burn residues that sink physically smother benthic habitats.

Pacific Coast salmon EFH, Pacific Coast groundfish EFH and coastal pelagic species water quality may be degraded by chemical dispersant (Corexit 9500) and chemically dispersed oil.

Pacific Coast salmon EFH, Pacific Coast groundfish EFH and coastal pelagic species forage may be degraded by exposure to chemical dispersants and chemically dispersed oil.

In addition to effects on EFH of Pacific Coast salmonids, the EFH of ground fish and pelagic species will also likely be affected comparably. The analysis for the EFH of these fishes will be included in the final version of this document.

3.3. Essential Fish Habitat Conservation Recommendations

The proposed action contains a large number of best management practices and non-discretionary minimization measures. At this time, NMFS has no additional EFH conservation recommendations that would supplement these measures. No response is triggered per section 3.

3.4. Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the USCG and EPA 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)).

3.5. Supplemental Consultation

The USCG and the EPA must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH (50 CFR 600.920(l)).

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are [*name of Federal action agency(ies)*]. Other interested users could include [*e.g., permit or license applicants, citizens of affected areas, others interested in the conservation of the affected ESUs/DPS*]. Individual copies of this opinion were provided to the [*name of action agency(ies)*]. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adheres to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

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6. APPENDICES

Appendix 6.1 Table of proposed actions and best management practices from the EPA and USCG Biological Assessment

Table 2-2 Response Actions, Exposure/Stressor Pathways, and Conservation Measures

Response Action	Related Response Actions[a]	Areas Implemented	Factors Affecting Where/ When Used	Elements Influencing Exposure	Stressors[b, c]	Conservation Measures[d]
Supporting Actions Common to Most Responses Actions[e]						
Use of vessels	Decontamination of vessels	Rivers/Lakes Shoreline Marine nearshore Open marine water	Type of vessel used determined based on its capabilities relative to spill-specific needs. Adverse weather (e.g., thunderstorms, low visibility) may limit use. Draft of vessel may limit use in shallow areas.	Vessel types range from small tenders to large ships, with smaller vessels providing access to shallow or narrow habitats. Larger vessels are associated with deep water and responses to large volumes of oil. Most spills are minor so smaller vessels are used and would primarily be used to place/replace boom. There is limited loitering or need to anchor or ground. Fueling and launch locations further from the spill require travel over greater distances and at greater speeds. Vessels are generally deployed at the time of or immediately after a spill and repeatedly, as necessary, for the duration of the spill; may be used at night. The use of vessels for on-water recovery is short term (hours to days). Given the nature of oil dissipation and degradation (particularly in the NW environment), on-water recovery periods are short. Use of vessels for on-water recovery of more than four days is not typical, although vessels may be used for shoreline clean-up for weeks in areas that are difficult to access from land.	Vessel strikes may occur. Wildlife may be disturbed due to noise, light, and presence. Benthic habitat and organisms may be destroyed by anchoring, grounding, or prop wash.	The use of vessels would take into consideration sensitive habitats (e.g., nesting areas or spawning areas) based on presence and distribution of wildlife such as birds and mammals (to the extent that information is available in GRPs), and avoid these areas when possible. Observe instructions in GRPs that outline boat and watercraft use restrictions within 183 m (200 yards) of National Wildlife Refuge sites or other sensitive areas. Obtain maps of sanctuary zones and vessel BMPs and SOPs for marine mammals. Do not stage boats such that shoreline vegetation is crushed. Boats should not rest on or press against vegetation at any time. Avoid anchor or prop-scarring of submerged vegetation. Maintain a buffer of at least 91 m (100 yards) from marine mammals (e.g., whales) and 183 m (200 yards) from Southern Resident Killer Whales. Do not move into the path of whales. If approached by a marine mammal, put the engine in neutral and allow it to pass.
Use of vehicles or heavy machinery	Decontamination Staging area establishment and use to support heavy machinery	Terrestrial Riparian Shorelines	Type of vehicle used determined based on its capabilities relative to spill-specific needs. Adverse weather (e.g., thunderstorms, low visibility) may limit use. Response very rarely involves establishing staging areas in undeveloped environments. Most staging areas are in developed areas such as parking lots.	Vehicle types range from small ATVs to large earth movers. Vehicles or equipment may be operated in sensitive areas (e.g., soft substrates, vegetated areas, or intertidal beaches). Operation of vehicles may adversely affect shoreline habitats that are susceptible to erosion. The presence of durable surfaces in the path of ingress/egress to staging area limits physical impacts. Staging locations further from the spill location require travel over greater distances and at greater speeds. Vehicles are generally deployed at the time of or immediately after spill and repeatedly, as necessary, for duration of spill; may be used at night. Establishing staging areas in undeveloped areas is very rarely done.	Plants may be crushed or otherwise destroyed. Habitat may be disturbed or destroyed (e.g., soil compaction, erosion from truck or foot traffic, destruction of vegetation). Vehicle strikes may occur. Wildlife may be disturbed due to noise, light, and presence of responders.	Minimize traffic through oiled areas on non-solid substrates (e.g., sand, gravel, dirt) to reduce the likelihood that oil will be worked into the sediment. The use of heavy machinery is rare; when necessary, its use will take into consideration sensitive habitats (e.g., nesting areas or spawning areas) based on presence and distribution of fish and wildlife in the area and avoid these areas when possible. Consult GRPs, if established for the response area, to set staging area in location already identified for the purpose and having minimal additional impact on threatened and endangered species and designated critical habitat. Generally, vehicles are used on sand beaches and restricted to transiting outside of the oiled areas along the upper part of the beach. Use vehicles near listed plants or wildlife only if the benefits outweigh potential impacts.

Table 2-2 Response Actions, Exposure/Stressor Pathways, and Conservation Measures

Response Action	Related Response Actions[a]	Areas Implemented	Factors Affecting Where/ When Used	Elements Influencing Exposure	Stressors[b, c]	Conservation Measures[d]
Staging area establishment and use	Use of vehicles or heavy equipment Foot traffic Solid waste management Liquid waste management	Terrestrial Riparian	Establishing a new staging area (beyond using an existing parking lot or otherwise already developed area) is rare. Typically, response vessels launch from existing marinas. Equipment staging for routine spills is minimal and typically contained in small cargo trailers. Spills nearshore and in open water are typically accessed from existing vessel locations. Spills located in remote locations may require construction of new vessel, vehicle, and personnel access locations with associated land clearing and staging of necessities such as fuel tanks.	Due to the rarity of this response action, the likelihood of exposure is low. Greater numbers of on-site personnel require more infrastructure over a larger space for eating, sleeping, and restroom facilities. Distance travelled on-site and transportation mode (e.g., foot, vehicle, vessel) determine type and magnitude of stressors (e.g., trampling). Used from time of or immediately after spill and accessed as necessary for duration of spill. May be used during night.	Habitat may be disturbed or destroyed (e.g., soil compaction, erosion from truck or foot traffic,). Wildlife may be disturbed (e.g., noise, light, presence of people).	Use same access point for repeat entries. Construct new access points only when no other options are available to reach the location (emergency consultation may be necessary). If new access points are needed, conduct preliminary survey to determine best route. Locate staging area and support facilities in the least sensitive area possible (use areas identified in GRPs, if available). Special restrictions should be established for sensitive areas where foot traffic and equipment operation may be damaging, such as soft substrates. Establish work zones and access in a manner that reduces contamination of clean areas. Observe species-specific buffer zones (e.g., 91 to 183 m (100 to 200 yards) for marine mammals, see Section 4) when planning and implementing response action. Remove all trash or anything that would attract wildlife to the site daily. Do not cut, burn, or otherwise remove vegetation unless specifically approved by the EU. Do not attempt to capture oiled wildlife. Report oiled wildlife sightings to the Wildlife Hotline.
Foot traffic at spill site	Staging area establishment and use	Terrestrial Riparian Wetlands Shorelines	Oiled shorelines may be accessed from existing roads, paths, etc. or from the water.	Occurs from time of or immediately after spill and as necessary for duration of spill response and demobilization. Most staging areas are already existing and developed areas like parking lots, so likely to be very little disturbance from foot traffic.	Habitat may be disturbed or destroyed (e.g., soil compaction, erosion from truck or foot traffic, working of oil into sediments). Wildlife may be disturbed (e.g., noise, light, presence of people).	Restrict access to specific areas for periods of time to minimize impacts on sensitive biological populations (e.g., nesting, breeding, or fish spawning). Walk on durable surfaces to the extent practicable; restrict foot traffic from sensitive areas (e.g., marshes, shellfish beds, salmon redds, algal mats, bird nesting areas, dunes, etc.) to reduce the potential for damage; use plywood or other material to reduce compaction. Minimize foot traffic through oiled areas on non-solid substrates (sand, gravel, dirt, etc.) to reduce the likelihood that oil will be worked into the sediment.
Use of aircraft (e.g., to monitor for wildlife and track spill trajectory)	None	All (over but not within habitats)	Flying is typically restricted within a 457-m (1,500-ft) radius, below 305 m (1,000 ft) from areas identified as sensitive, with some areas (e.g., Olympic Coast National Marine Sanctuary) having more restrictive zones. Adverse weather (e.g., thunderstorms, low visibility, low cloud ceiling) may limit use. Aerial surveillance usually only happens during a large spill, so it's not a typical occurrence.	Frequency of monitoring Altitude of monitoring Type of aircraft (e.g., helicopter, fixed wing, or drone) can influence exposure. Drones are able to fly at very low altitudes and can get closer to the habitat, so they may increase exposures Aircraft may be used from time of or immediately after spill and as necessary for duration of spill; may be used during night. Use is not routine and is generally limited to large spills.	Use may exclude animals from essential resources (e.g., food, refuge, nesting area) and/or critical habitat areas. Birds are subject to aircraft strikes. Wildlife may be disturbed by noise and presence.	Observe flight restriction zones specified in the GRPs, including minimum ceiling height (altitude of 305 m [1,000 ft] above ground is advised) and distance from known or suspected wildlife areas (e.g., nesting areas) in order to reduce wildlife exposure to noise or presence of airplanes or helicopters.

Table 2-2 Response Actions, Exposure/Stressor Pathways, and Conservation Measures

Response Action	Related Response Actions[a]	Areas Implemented	Factors Affecting Where/ When Used	Elements Influencing Exposure	Stressors[b, c]	Conservation Measures[d]
Solid waste management	Staging area establishment and use	All	Solid waste management is common to all response actions except natural attenuation.	The specific methods used to collect, transfer, contain, transport, and dispose of waste affect exposure. Any incineration of waste in the NW is subject to federal and state air regulations. Extreme weather may increase the likelihood of an accidental release during handling or transport. Waste management is used from time of or immediately after spill and repeated as necessary for duration of spill.	Accidental re-release of pollution, which has low likelihood of occurring, see Section 4.1 for discussion.	Oregon and Washington require that responders develop a waste management plan in accordance with the local ACP (or RCP in the absence of an ACP) that describes how waste will be stored and handled and how the possibility for disposed wastes to cause future environmental damage will be minimized. Solid waste management must be addressed in the disposal plan. Follow standard protocols for waste management actions. Waste accumulation and storage locations should meet the following criteria: spill prevention, control, and countermeasures are in place; storm water pollution prevention plans have severe weather contingency plans; ample storage for segregation of wastes; and an emergency response plan for waste accumulation/storage locations. Access to waste is restricted (temporary and semi-permanent). Waste disposal plans describe the waste tracking system. Reporting system should be established (temporary and semi-permanent). Maintain adequate response equipment during waste management actions to respond quickly and appropriately to re-release of pollution. Establish temporary upland collection sites for oiled waste materials for large spill events; collection sites should be lined and surrounded by berms to prevent secondary contamination from run-off. Coordinate the locations of any temporary waste staging or storage sites with the EU. Separate and segregate any contaminated wastes generated to optimize waste disposal stream and minimize what has to be sent to hazardous waste sites.
Liquid waste management	Staging area establishment and use Decanting Booming Skimming/vacuuming Use of vessels	Terrestrial Rivers/Lakes Shoreline Marine nearshore Open marine water	Liquid waste management is common to many response actions. Decanting of oily water may be necessary during operations involving recovery of oil. Water may be mixed with the oil during recovery and need to be returned to the response area to preserves storage space for recovery of the maximum amount of oil possible.	The specific methods used to collect, transfer, contain, transport, and dispose of waste affect exposure. Any incineration of waste in the NW is subject to federal and state air regulations. Extreme weather may increase the likelihood of an accidental release during handling or transport. Waste management is used from time of or immediately after a spill and repeated as necessary for duration of spill. Decanting is conducted in conjunction with the use of appropriate equipment in place (e.g., boom) to prevent re-release of oil to the marine environment. Use oil/water separator or allow sufficient retention time for the oil and water to separate. Decant ahead of an operating skimmer where feasible.	Accidental re-release of pollution, which has low likelihood of occurring. Authorized incidental release of the minimal amount of oil possible mixed into a large volume of water (decanting) as a way to manage limited liquid storage capacity.	Liquid waste management must be addressed in the disposal plan. The response contractor or responsible party will seek approval from the FOSC and/or SOSC prior to decanting. Follow standard protocols for waste management actions. Maintain adequate response equipment during waste management actions to respond quickly and appropriately to re-release of pollution. Minimize the amount of water collected during skimming. All decanting in a designated "Response Area" within a collection area, vessel collection well, recovery belt, weir area, or directly in front of a recovery system; a containment boom will be deployed around the collection area, where feasible, to prevent the loss of decanted oil or entrainment of species in recovery equipment. Decanting shall be monitored at all times, so that discharge of oil in the decanted water is promptly detected. Where feasible, decanting will be done just ahead of a skimmer recovery system so that discharges of oil in decanting water can be immediately recovered. Coordinate the locations of any temporary waste staging or storage sites with the EU.

Table 2-2 Response Actions, Exposure/Stressor Pathways, and Conservation Measures

Response Action	Related Response Actions[a]	Areas Implemented	Factors Affecting Where/ When Used	Elements Influencing Exposure	Stressors[b, c]	Conservation Measures[d]
Decontamination	Staging area establishment and use Solid waste management Liquid waste management Booming Sorbents	All, except wetlands	Decontamination is required anytime durable (not disposable) equipment is used on a spill response.	Extent of contaminated materials/vessels or personnel can affect exposure. Specific materials to be decontaminated can affect exposure. Decontamination is used when personnel or vehicles exit the spill site and repeated as necessary for duration of spill.	Accidental re-release of pollution, which has low likelihood of occurring, see Section 4.3 for discussion.	Decontamination areas for personnel and equipment must be addressed in the disposal plan. A decontamination/exclusion zone will be set up at each staging area. The area will be plastic lined to prevent pollution from oiled PPE and equipment. Oiled PPE and equipment will be collected in plastic barrels. Maintain adequate response equipment during decontamination to respond quickly and appropriately to re-release of pollution. The placement and containment of materials from decontamination is an important consideration during spill response, so safety controls and proper disposal areas are used to significantly reduce the risk that oil would re-enter the environment.
Mechanical Countermeasures						
Deflection/Containment						
Booming (containment, diversion, deflection, exclusion, recovery)	Use of vessels Staging area establishment and use Hazing and deterrence Solid waste management Liquid waste management Foot traffic	All, except terrestrial	Booming is a typical response tool to control the spread of a spill. Effectiveness is maximized when depth is ≥5 times the draft of the boom; not used in water <46 cm (18 inches) in depth. Booms are less effective in rough water, high winds, and fast currents. In current >1 knot booms are not set across the river, but rather at an angle to direct oil into an area where it can be collected. Booms are used to prevent oil from contacting shorelines, to prevent oil from spreading, and collect oil to enable oil recovery. Booms are also used to contain remobilized oil during decontamination (e.g., vessels, industrial equipment) and shoreline cleanup.	Boom draft varies from 15 to >229 cm (6 to >90 inches), depending on use and habitat where deployed (and may include skirting). Booms may be anchored to the shore, the sea bottom (in waters <30 m [100 ft] deep), or to vessels (in deep water, when anchoring is infeasible, or to avoid sensitive habitats). Boom may be towed by vessels to actively collect oil. Booms are generally deployed at the time of or immediately after spill and repeated as necessary. The duration of deployment is typically <1 week for booms moored in place, anchored to the shoreline, or tidal seal booms; towed boom deployment duration is shorter (hours). Short booms (<61 cm [<24 inches] in depth) are used in rivers. Larger booms are used only in open water marine areas.	Placement of boom may exclude animals from essential resources (e.g., food, refuge, nesting area). Birds or marine mammals may be exposed to oil when perching on booms. Benthic habitat and organisms may be destroyed by anchors, anchor chains, or boom contact in shallow waters or along shorelines (reduction in habitat quality and resources).	Boom strategies in the GRPs are designed to consider species occurrence and habitat use, to the extent possible. Monitor for the presence of marine mammals and seabirds. Ensure that EU provides information on possible presence and impacts to ESA-listed (protected) species or critical habitats. To the extent practicable, and when practicable, observe species-specific buffer zones (e.g., 91 to 183 m [100 to 200 yards] for marine mammal) when planning and implementing response action. Evaluate need to restrict access to sensitive habitats (e.g., nesting areas or spawning areas) based on presence and distribution of wildlife such as birds and mammals. Arrange booms to minimize impacts to wildlife and wildlife movements. Locate boom anchors using strategies identified in GRPs, if available.

Table 2-2 Response Actions, Exposure/Stressor Pathways, and Conservation Measures

Response Action	Related Response Actions[a]	Areas Implemented	Factors Affecting Where/ When Used	Elements Influencing Exposure	Stressors[b, c]	Conservation Measures[d]
Berms, dams, or other barriers; pits and trenches	Use of vehicles and heavy equipment Staging area establishment and use Foot traffic Solid waste management Liquid waste management	All, except open marine water and marine nearshore	These are tactics with the objective of containing spilled oil and limiting spreading of oil slicks. These tactics are used when oil threatens sensitive habitats (e.g., upper intertidal and back-shore areas) and other barrier options (e.g., boom, skimmers, less invasive barriers) are not effective. The water body must be small enough to dam (not more than about 3 m (10 ft) across) and have low enough flow to not blow out an underflow dam. Equipment type – Motor graders are used if beach can sustain motor traffic well; front-end loaders or bulldozers are used if beach cannot sustain motor traffic well.	These tactics disturb the upper 0.5 m (2 ft) of beach or riparian sediments. Size of underflow dam – larger dams result in a larger pool behind the dam. Water flow/rainfall mobilizes oil from upstream spill sites to downstream berm/dam collection site. Use of a berm/dam in locations subject to dramatic changes in water flow can result in blowout. Duration/frequency typically installed shortly after spill and left in place about 1 week up to 5 weeks, until upstream cleanup activity is completed. Decontamination occurs after spill has been contained and contamination removed.	Construction may result in removal of substrate; loss, trampling, or crushing of vegetation; and increased erosion or sedimentation in streams. Placement may exclude animals from essential resources (e.g., food, refuge, nesting area) or disrupt passage between critical habitat areas. Underflow dams will result in increased oiling behind the dam than would have occurred without the dam; dams are intended to stop oil from entering sensitive downstream habitats.	Coordinate with the Services. Contact the EU to determine if any permits are required. Restrict use and closely monitor operations in sensitive habitats. Line the bottom of trenches that do not reach the water table (dry) with plastic to prevent the collected oil from penetrating deeper into the substrate. Minimize erosion and sediment runoff using engineered controls (e.g., silt fences and settling ponds). Minimize suspension of sediment to limit effects on water quality. Remove structures and fill trenches once response action is completed. Coordinate with the Services prior to constructing underflow dams.
Culvert blocking	Staging area establishment and use Foot traffic	Rivers/Lakes Wetlands Shoreline	Open culverts present a potential route for spilled oil to enter otherwise unaffected areas. This tactic is often used to protect sensitive habitats that are located downstream of the barrier. This tactic is used to block tidal inflow to an upgradient waterbody. Generally only 61-cm- (<24-inch-) diameter culvert pipes are blocked. If complete blocking results in flooding, an underflow dam or booming would be used instead.	Material used (e.g., plywood, plug, plastic sheeting, sandbags) and other construction elements may affect sedimentation or other shoreline processes. Frequency/duration – typically placed shortly after spill and remains less than three days.	Construction may result in removal of substrate; loss, trampling, or crushing of vegetation; and increased erosion or sedimentation in streams. Placement may exclude animals from essential resources (e.g., food, refuge, nesting area) or critical habitat areas. It may result in increased predation, and increased exposure to spilled material.	Monitor water quality and sufficient flow downstream of barriers. Evaluate need to restrict access to sensitive habitats (e.g., nesting areas or spawning areas) based on presence and distribution of wildlife such as birds and mammals. To the extent practicable, and when practicable, observe species-specific buffer zones (e.g., 91 to 183 m [100 to 200 yards] for marine mammals) when planning and implementing response action. Minimize erosion and runoff using engineered controls (e.g., silt fences and settling ponds). Remove structures once completed.

Table 2-2 Response Actions, Exposure/Stressor Pathways, and Conservation Measures

Response Action	Related Response Actions[a]	Areas Implemented	Factors Affecting Where/ When Used	Elements Influencing Exposure	Stressors[b, c]	Conservation Measures[d]
Recovery of Spilled Material						
Skimming/ vacuuming	Staging area establishment and use Use of vessels Use of vehicles Booming Liquid waste management Berms, dams, or other barriers; pits and trenches	Rivers/Lakes Wetlands Shoreline Marine nearshore Open marine water	Skimming/vacuuming is typically deployed in areas where floating oil naturally accumulates. Oil can be collected against a shoreline or contained by a boom. Skimming only works as long as there is sufficiently thick oil, approximately 6.3 mm (0.25 inches). Shallow water prevents use of some skimmers. Emulsified oil (affected by weathering/wave action/heat/type of oil) cannot be skimmed. Skimming is less effective in rough water and strong currents. Waves, debris, seaweed, and kelp reduce efficiency.	Skimming/vacuuming often proceeds through night (with continuous presence of responders) if there is enough oil. Safe and effective night operations require floodlights. Vessel size depends on the response; since most spills are small, vessels may be small, 6 m (20 ft) or more. In the rare event of a large spill, vessels up to 61 m (200 ft) w/pump (in ocean water) could be used. Skimming vessels are slow moving. Skimming/vacuuming often generates wastewater that requires additional space for storage and treatment. Duration/frequency for shoreside skimming is typically <4 days; open water is typically <1 week; repeated as necessary. Vacuuming is done at the very top of the water to minimize the amount of water intake and maximize the amount of product removed.	Noise (in air and underwater) due to vessels and pumps can cause stress. Lighting can attract birds to oiled environment Vacuuming may entrain eggs, plankton, fish larvae.	Use methods that minimize the amount of water relative to oil taken in (e.g., flat-head nozzle [duckbill] and skim/vacuum at water surface only). Operations in sensitive areas (e.g., marshes, submerged aquatic vegetation, worm beds) must be very closely monitored, and a site-specific list of procedures and restrictions must be developed to minimize damage to vegetation. Adequate storage for recovered oil/water mixtures, as well as suitable transfer capability, must be available. Position intake to minimize plankton and larvae entrainment. To the extent practicable, and when practicable, observe species-specific buffer zones (e.g., 91 to 183 m [100 to 200 yards] for marine mammals, see Section 4) when planning and implementing response action.
Passive collection of oil with sorbents (e.g., sorbent pads, sausage boom, pom poms, peat)	Staging area establishment and use Foot traffic Use of vehicles Use of vessels Solid waste management	All, except open marine water	Use of sorbents is labor intensive, typically hand placed from light motor vehicle or shallow water craft; usually used for small quantities of oil and as indicator of oil presence (will be marked by oil). Sorbents are often used on sheen, though ineffective. There must be sufficient product to be absorbed (sheen usually not sufficient quantity). Sorbents are more likely to be used in difficult-to-access areas where skimming is infeasible in conjunction with most other response actions (not skimmers). Sorbents may be reused. Wave and tidal energy, as well as the oil type, affect efficacy.	Passive collection elements are tended more frequently immediately after spill and less frequently with time after spill. Water flows past sorbent booms. Distribution of sorbent pads on oil contained in booms can help to suppress waves and prevent splash-over. Standard practice is that, when passive collection/containment is the best practice, sorbent booms are tended to ensure they stay in place, and sorbents are routinely replaced. The effectiveness of passive collection is highest when the sorbent boom is not saturated. Pads/booms can sink if left in place for extended duration, especially if dirt is present. Lightweight pads can get caught by wind and dispersed outside of response areas. Pads are often one of the first response actions to be used because they are readily available Duration: pads generally ~1 day, sausage boom <2 weeks. Frequency: pads <3 days after spill, boom used until saturated, then replaced.	Intertidal environmental effects can occur if sorbent material is not recovered when saturated. Placement or use of sorbent booms may create concentrations of oil that could lead to additional exposure. Sunken sorbents may expose pelagic/ demersal/riverine habitats to oil, although the pads are regularly monitored to avoid this.	Retrieval of sorbent material, and at least daily monitoring to check that sorbents are not adversely affecting wildlife or breaking apart, are mandatory. Coordinate with the EU for corrective actions if entrapment of small crustaceans is observed. Continually monitor and collect passive sorbent material to prevent it from entering the environment as non-degradable, oily debris Follow appropriate cleaning and waste disposal protocols and regulations.

Table 2-2 Response Actions, Exposure/Stressor Pathways, and Conservation Measures

Response Action	Related Response Actions[a]	Areas Implemented	Factors Affecting Where/ When Used	Elements Influencing Exposure	Stressors[b, c]	Conservation Measures[d]
Removal/Cleanup						
Manual removal of oil and oiled substrate using hand tools (e.g., rakes, shovels, scrapers)	Staging area establishment and use Foot traffic Solid waste management Liquid waste management Decontamination	Terrestrial Riparian Wetlands Shorelines	This method is generally used on shorelines where the oil cannot be easily removed by mechanical means. Manual removal can be used on mud, sand, gravel, and cobble when oil is light, sporadic, and/or at or near the beach surface, or when there is no beach access for heavy equipment. Manual removal can be used to remove gross oil contamination (e.g., thick black oil, tar balls, congealed oils,) from shorelines or submerged oil that has formed semi-solid or solid masses. Manual removal is used in places that are difficult to access with heavy equipment. Adverse weather conditions (e.g., thunderstorms, snow and ice, extreme temperatures) may limit access and use.	Manual removal is a large, complex operation with a large footprint due to the logistical support necessary for workers (e.g., facilities, utilities). Manual removal may use ATV support. Duration: throughout cleanup activities (potentially long duration up to several weeks). Anything beyond a week would require consultation with Services. Frequency: repeated as necessary to remove oiled substrates. Does not occur at night. Use of hand tools and rakes typically require coordination with both the Services and other and stakeholders if there would be removal of natural debris or sand from shorelines.	Intertidal environmental effects are minimal if surface disturbance by cleanup activities and work force movement is limited. No effects on subtidal is expected. Noise from vehicles and continuous presence of crew. Trampling and loss of vegetation. Potentially increased erosion. Increased sedimentation of streams. May disturb or remove sediment and shallow burrowing organisms or cause root damage. Habitat and/or wildlife disturbance or loss from noise, crushing, lighting, and/or presence of people. Can distribute the contamination deeper into substrates.	Restrict sediment removal to supra and upper intertidal zones (or above waterline on stream banks) to minimize disturbance of biological communities. Minimize the amount of sediment removed with the oil. Sediments should be removed only to the depth of oil penetration. Protect nearby sensitive areas from increased oil runoff/sheening or siltation by the proper deployment of booms, siltation curtains, sorbents, etc.; monitor for effectiveness of protection measures. Do not remove clean wrack; instead, move large accumulations of clean wrack to above the high-water line to prevent it from becoming contaminated. If in an archaeological and/or culturally sensitive area, activities may need to be monitored or may not be appropriate.
Mechanical removal of oil and oiled substrate (with or without excavation >2.5 cm [>1 inch]) Sediment reworking	Staging area establishment and use Foot traffic Heavy equipment use Solid waste management Liquid waste management Decontamination	Terrestrial Riparian Shorelines	Mechanical removal with heavy equipment (e.g., bulldozers, backhoes) is usually implemented when the spill area/debris size exceeds the capacity of manual removal. It is typically used in sand, gravel, or cobble, where surface sediments are amenable to, and accessible by heavy equipment. The contaminated substrate is excavated to the depth of contamination. Dredging of sediments is only considered for sinking oils (rare). Sediment reworking may be used on sand or gravel beaches with high erosion rates or low sediment replenishment rates or where remoteness or other logistical limitations make sediment removal unfeasible.	Duration: throughout cleanup activities (potentially over a long duration up to several weeks) Frequency: repeated as necessary to remove oiled substrates. Very rarely occurs at night. This would be a long-term action, and the action agencies would request input from the Services if under consideration for area with critical habitat.	Intertidal environmental impacts if excessive sediment is removed without replacement. Noise, crushing, and lighting from vehicles and continuous presence of crew. Trampling and loss of vegetation. Potentially increased erosion. Increased sedimentation of streams/ nearshore environment. May disturb or remove sediment and shallow burrowing organisms or cause root damage. Can distribute the contamination deeper into substrates.	Implement after the majority of oil has come ashore, unless significant burial (sand beaches) or remobilization is expected; implement between tidal cycles to minimize burial and/or remobilization of oil. Protect nearby sensitive areas from increased oil runoff/sheening or siltation by the proper deployment of booms, siltation curtains, sorbents, etc.; monitor for effectiveness of protection measures. Minimize the amount of oiled sediment removed by closely monitoring mechanical equipment operations. In areas prone to erosion, replace removed sediment or soil with clean sediment. Minimize erosion and runoff using engineered controls. Monitor for the presence of special status animals and plants. To the extent practicable, and when practicable, observe species-specific buffer zones (e.g., 91 to 183 m [100 to 200 yards] for marine mammals, see Section 4) when planning and implementing response action.

Table 2-2 Response Actions, Exposure/Stressor Pathways, and Conservation Measures

Response Action	Related Response Actions[a]	Areas Implemented	Factors Affecting Where/ When Used	Elements Influencing Exposure	Stressors[b, c]	Conservation Measures[d]
Woody debris removal (before or after oiling) Terrestrial and aquatic cutting/removal of vegetation (before or after oiling)	Staging area establishment and use Foot traffic Solid waste management Liquid waste management Use of vessels	Terrestrial Riparian Wetlands Shorelines	Conducted before or after spill has been contained and cleanup activities begin. More likely to be used for plants that will grow back. Lightly oiled vegetation typically left in place. Vegetation is removed if it poses a contact hazard to wildlife. Beach wrack is relocated before oil comes ashore when possible. Removal of large wood is generally avoided, unless it poses a persistent source of oil.	Duration: typically occurs after progress has been made on mobile oil removal. Done within first few days of incident. UC would request input from the Services if operations are to occur in critical habitat. Frequency: typically once.	Removal of cover and forage can cause stress to juvenile fish and salmonid prey. Noise from vehicles, heavy machinery, hand tools, and cleanup crew. Along the exposed section of shoreline, the vegetation may not regrow, resulting in erosion and permanent loss of the habitat. Reduction in habitat quality because of loss of structure. Long-term subtidal impacts from increased sediment load can occur as a result of increased erosion in the intertidal area.	Resource experts are routinely consulted regarding these concerns prior to vegetation cutting activities. Strict monitoring of the operations must be conducted to minimize the degree of root destruction and mixing of oil deeper into the sediments. For plants attached to rock boulder or cobble beaches, sources of population recruitment must be considered. Access to bird nesting areas should be restricted during nesting seasons. Concentrate removal on vegetation and wood debris that is moderately to heavily oiled; leave lightly oiled and clean vegetation and wood debris in place. Do not remove clean, natural shoreline debris; instead, move large accumulations of clean debris to above the high-water line to prevent it from becoming contaminated.
Ambient temperature, low pressure flooding/flushing	Staging area establishment and use Use of vessels Foot traffic Booming Skimming Sorbents	Terrestrial Riparian Lakes Wetlands Shorelines	Flooding is applicable on all shoreline types where equipment can be effectively deployed; however, not recommended for steep intertidal or shorelines with fine grains or muddy substrates. Not generally useful on exposed rocky shorelines or submerged tidal flats because these areas are naturally well flooded. Location must accommodate a collection boom (sufficiently large area and receiving water flow needs to be slow). Works only on fresh oil (others require pressure washing).	Oil is flushed into the water where it is collected with sorbent. Method or procedures (i.e., flow rates, temperature, volume, chemicals, delivery system (by fire hose [with low pressure flow] or header pipe) can affect exposure. In marine environment, ambient marine water is typically used, though fresh water may be used if marine water is oiled. Flooding should be restricted to tidal stages when subtidal zones are under water to prevent secondary oiling. Equipment may include: deluge system (perforated pipe sprinkler system) or trash pump with hose. Duration: in freshwater environment typically about 2 days; in marine environment typically <1 week. Timing: done within first week, at the soonest 2 to 3 days after spill. This technique is only effective if conducted quickly after a spill occurs.	Physical habitat disturbance/smothering from gravel components washed down slope and sedimentation of streams/nearshore environment.	Implement after the majority of oil has come ashore, unless significant remobilization is expected; implement between tidal cycles to minimize remobilization of oil. Protect nearby sensitive areas, identified in the GRPs or under advisement of the Services, from increased oil runoff/sheening or siltation by the proper deployment of booms, siltation curtains, sorbents, etc.; monitor for effectiveness of protection measures. Use the lowest pressure that is effective and prevent suspension of bottom sediments (do not create a muddy plume). Conduct all flushing adjacent to marshes from boats. In marshes conduct at high tide either from boats or from the high-tide line to prevent foot traffic in vegetation. Closely monitor flooding of shorelines with fine sediments (mixed sand and gravel, sheltered rubble, sheltered vegetative banks, marshes) to minimize excessive siltation or mobilization of contaminated sediments into the subtidal zone. Prevent pushing or mixing oil deeper into the sediment by directing water above or behind the surface oil to create a sheet of water to remobilize oil to containment area for recovery. Restrict flushing in marshes during high tide above the high tide line to minimize mixing oil into the sediments or mechanically damaging plants.

Table 2-2 Response Actions, Exposure/Stressor Pathways, and Conservation Measures

Response Action	Related Response Actions[a]	Areas Implemented	Factors Affecting Where/ When Used	Elements Influencing Exposure	Stressors[b, c]	Conservation Measures[d]
Pressure washing/ steam cleaning or sand blasting	Staging area establishment and use Use of vessels Foot traffic Booming Skimming Sorbents	Terrestrial Riparian Shorelines	Pressure washing/steam cleaning or sand blasting are infrequently used when heavy oil residue must be removed for aesthetic reasons (ship-hulls, break-walls, man-made structures). Steam and sand blasting are very infrequently, if ever, used in the NW. Contaminated vessels are boomed with sorbents in industrial area, cleaned, and then released when clean.	The selected method for washing is always done from least intrusive to most intrusive, as acceptable based on the surface being cleaned and the presence of organisms. Ambient water is preferred to heated or pressurized water. Heated water can be used to pressure wash structures such as the hull of a ship, pier structures, or asphalt. A spray and wipe chemical may be considered prior to going with higher heats. Higher temperatures and higher pressures can be used to mobilize oil but can lead to more potential impacts. Similarly, sand is used to physically scour oil from surfaces. Endpoints for degree of removal desired (e.g., no visible sheening, no ability to wipe oil off, not able to scratch oil off). Duration/frequency: typically 1 day to weeks (for vessel cleaning, depending on size of vessels, number of vessels, and type of oiling).	Direct harm to organisms in spray zone. Heat, scouring, runoff, disturbance, flooding, and increased erosion and sedimentation. Heated water may affect freshwater or intertidal habitats. Introduction of sand into aquatic environment could smother invertebrates or contribute to suspended sediments.	Implement after the majority of oil has come ashore. Restrict use to certain tidal elevations so that the oil/water effluent does not drain across sensitive low-tide habitats. Closely monitor operations in sensitive habitats. If small volumes of warm water are used to remobilize weathered oil from rocky surface, include larger volume of ambient water at low pressure to help carry re-mobilized oil into containment area for recovery. Monitor booms and oil collection methods to prevent transport of oil and oiled sediments away from site to near shores and down coast. Monitor for wildlife such as birds and mammals (evaluate need for hazing); establish buffer zone (i.e., nesting areas, haulout areas, spawning areas). Avoid sensitive habitats (e.g., soft substrates, aquatic vegetation, spawning areas, etc.).
Physical herding	Staging area establishment and use Use of vessels Booming Skimming Sorbents	Rivers/lakes Shorelines Wetlands Marine Nearshore	Physical herding is used to move oil into containment. It is rarely used to move oil more than a few hundred feet. Sufficiently thick product is required. When oil contained in hard-to-access places (e.g., against seawalls or under docks), prop-wash from a vessel can help to push the product to a collection area (e.g., boom).	Not used at night. Frequency: typically shortly after spill on fresh oil. Duration <1 week. The exposure is based upon the method(s) used to herd the oil.	Erosion May disrupt movement patterns of fish. Generation of in-air sound from vessels.	Monitor for the presence of wildlife and plants. Minimize erosion and runoff using engineered controls (to the extent practicable).

Table 2-2 Response Actions, Exposure/Stressor Pathways, and Conservation Measures

Response Action	Related Response Actions[a]	Areas Implemented	Factors Affecting Where/ When Used	Elements Influencing Exposure	Stressors[b, c]	Conservation Measures[d]
Non-Mechanical Countermeasures						
Chemical dispersion	Use of vessels Use of aircraft	Open marine water (outside of No Dispersant Use Zone; use in Case-by-Case Zone (see Section 1.2.4.1) will require emergency consultation)	Only used in marine water bodies with sufficient depth (>18 m [60 ft] deep). Applied as soon as possible after a spill (when oil is not weathered and more concentrated. Works best when there is wave energy to mix the dispersant into the oil. Can be used in strong currents and higher sea states. Only applied to spilled oil and completion of the dispersant use checklist, as described in the NWACP. In areas where dispersant use is not pre-authorized, RRT activation and approval is necessary before use.	Dispersants have not been used in the NW for decades. Used to protect organisms at the water surface or shorelines from oiling. Can impact organisms in the upper water column (<10 m [33 ft]). Amount of oil requiring dispersion. Amount of mixing/current affects rate of dissipation Weather conditions (e.g., wind, waves, and currents) determine efficacy and dispersal area and environmental fate. Nozzles are used to give a flat, uniform spray of droplets, rather than a fog or mist. The mechanical wave energy of a wake from a boat enhances dispersion. Duration: <1 day with a few passes over spill. Too much dispersant will be ineffective and dispersion must happen soon after a spill to be effective. Frequency: once Application rate to be determined by dispersant manufacturer and the UC.	Direct exposure routes include inhalation, ingestion, absorption, and physical contact. Possible disturbance from vessels in the area, including noise; potential for vessel strikes. Possible disturbance from aircraft. Change in oil fate and transport can result in increased exposures to oil for shallow-dwelling aquatic species. Such exposures are not consistent with the baseline condition. However, if oil is not dispersed or recovered using mechanical means (e.g., booming and sorbents) the oil will break down due to wave, wind, and water activity. Naturally dispersed oil will remain at the surface longer than dispersed oil (affecting surface-active species like birds, whales, and turtles).	Requires Regional Response Team approval prior to use unless in a Pre-Authorization Zone. The EU would prepare a Net Environmental Benefit Analysis to evaluate the potential risk to animals and habitats in the area compared to not using dispersants. Monitor wildlife; establish species-specific buffer zone(s); use in water with adequate volume for dilution; apply only under conditions known to be successful; use only chemicals that are approved for use; implement wildlife deterrent techniques as needed. SMART will be used to measure efficacy. SMART is a standardized monitoring program designed to monitor chemical dispersion and in situ burning activities. Follow dispersant policy checklist of environmental conditions which dictates favorable conditions for use. Aircraft should spray while flying into the wind and avoid spraying into strong crosswinds.
In situ burning	Staging area establishment and use Booming Use of vessel Use of aircraft	Pre-authorization zone is any area that is more than 3 miles from human population (>100 or more people per square mile). All other areas need incident-specific authorization.	Conducted after containing oil slick in fire boom, soon after spill has occurred; while oil still has enough volatility to burn easily. May be ignited with gelled fuel or flares. Oil needs to be sufficiently thick. Only used where the spread of the fire can be controlled. Wind, ability to put in fire-break, meteorological conditions (e.g., no inversion); no heavy wind, offshore winds are favorable. Should not burn substances regulated by EPA (e.g., PCBs)	Duration: each burn lasts about half an hour, then fresh oil is gathered, and the burn is repeated. Frequency: typically over two days, within the first few days of a spill.	Exposure to fire, smoke, or particulates Exposure to burn residues; exposures to burn residues are not consistent with the baseline condition. Burn residues are less acutely toxic than oil because the relatively toxic components of oil are removed during the burning process.	Requires Regional Response Team approval prior to use. Prior to an in situ burn, an on-site survey must be conducted to determine if any threatened or endangered species are present or at risk from burn operations, fire, or smoke. A Net Environmental Benefit Analysis would be conducted to evaluate the possible risk to species in the area of the in-situ burn and compare it to the risk of not using in-situ burning. Protection measures may include moving the location of oil (in water) to an area where listed species are not present; temporary employment of hazing techniques, if effective; and physical removal of individuals of listed species only under the authority of the trustee agency. Provisions must be made for mechanical collection of burn residue following any burn(s) (e.g., collection with nets, hand tools, or strainers). SMART will be used to measure efficacy. SMART is a standardized monitoring program designed to monitor chemical dispersion and in situ burning activities.

Table 2-2 Response Actions, Exposure/Stressor Pathways, and Conservation Measures

Response Action	Related Response Actions[a]	Areas Implemented	Factors Affecting Where/ When Used	Elements Influencing Exposure	Stressors[b, c]	Conservation Measures[d]
Other Response Actions						
Natural attenuation (with monitoring)	Foot traffic	All	When the adverse impacts resulting from response activities outweigh the benefits. Examples include: 1) when oiling has occurred on high-energy beaches where wave action will remove most of the oil in a short time; 2) remote or inaccessible shorelines; 3) wetlands, where treatment or cleaning may cause more damage than leaving it to recover naturally; 4) other response techniques are not practical. This method may be inappropriate for areas with high numbers of people, mobile animals, or ESA-listed species.	Areas affected by small amounts of non-persistent oil can recover naturally, given appropriate circumstances. May be inappropriate for areas where high numbers of mobile animals (e.g., birds, marine mammals, crabs) use the intertidal zone (shoreline) or adjacent nearshore waters.	Wildlife disturbance from presence of people and equipment necessary for monitoring.	May consider relocation or hazing activities if appropriate. Minimize presence of people and equipment.
Places of refuge for disabled vessels	Use of vessels	Rivers Shorelines Marine nearshore Open marine water	Which resources at risk are in the area, including ESA-listed species, seasonal breeding locations, or designated critical habitat; Essential Fish Habitat; aquaculture facilities; other resources, lands and/or waters with special designations; offshore fisheries; near shore fisheries. The USCG Captain of the Port has the authority to designate a place of refuge for a specific disabled vessel.	Because many of the spills in the NW are due to vessels sinking, finding places of refuge for compromised vessels is a routine part of response. Many conditions could dictate refuge location: weather, distance to location, seaworthiness of ship, types of hazards, captain's navigation ability.	Wildlife disturbance from presence of people and vessel(s).	Follow the places of refuge decision matrix (NWACP Section 9410) when human life is not at risk. EPA must be consulted on any off shore scuttling of a vessel. States, tribes, local governments, and other stakeholders will be conferred with on a case-by-case basis.
Non-floating oil recovery	Staging area establishment and use Use of vessels Use of vehicles Foot traffic	Rivers/Lakes Marine nearshore Open marine water	Identified presence of oils (e.g., diluted bitumen, Group V residual fuel oils, low API oil, asphalt and asphalt products) that may submerge or sink when spilled.	Non-floating oils are difficult to detect and recover. Spills of non-floating oil rarely happen in the NW. Duration: responders must be capable of responding within 24 hours of discovery of a discharge of non-floating oil; duration will depend on extent of spill. Frequency: once during spill response	Disturbance of bottom substrate (habitat) by use of suction dredge, diver-directed pumping and vacuuming	Priority given to preventing, minimizing, and containing non-floating oils. Respond rapidly and aggressively to recover oils when on the surface (if safe to do so) before the oils start to sink.
Hazing and deterrence	Staging area establishment and use Use of vessels Use of aircraft Use of vehicles Foot traffic	Riparian Wetlands Shorelines Marine nearshore Open marine water	Will only be used when wildlife are observed near a spill and when deemed necessary to prevent exposure to spilled material or direct injury.	Duration: could last for the length of a response (typically less than four days) or be limited to isolated instances of wildlife presence, as needed. Will depend on the selected deterrence measures. For example, reflective tape or automated noise generators (e.g., propane cannons) would provide a near-constant deterrence, whereas vocalizations, "bird bombs" (or similar noise-makers) would be limited to short durations and isolated instances.	Noise Lights Movement/presence of hazing-related objects (e.g., silver fluttering tape tied to vegetation in wetlands and riparian areas to deter birds) Presence of personnel conducting the hazing.	Hazing or deterrence measures will be conducted only as necessary under in coordination with the Services. Hazing and deterrence will prevent direct injuries and chemical toxicity (associated with the spilled material) to wildlife at the expense of behavioral effects and temporary exclusion from resources. NMFS has granted pre-authorization to the FOSC to implement specific deterrence activities to prevent killer whales from entering oil (Section 9310).

Notes to Table 2-2:

[a] Related response actions include those actions that are typically implemented as part of this response action. It does not include those response actions that typically include this response action (e.g., skimming would include booming as a related action but booming does not include skimming).

[b] Stressors associated with related actions are described with those respective actions.

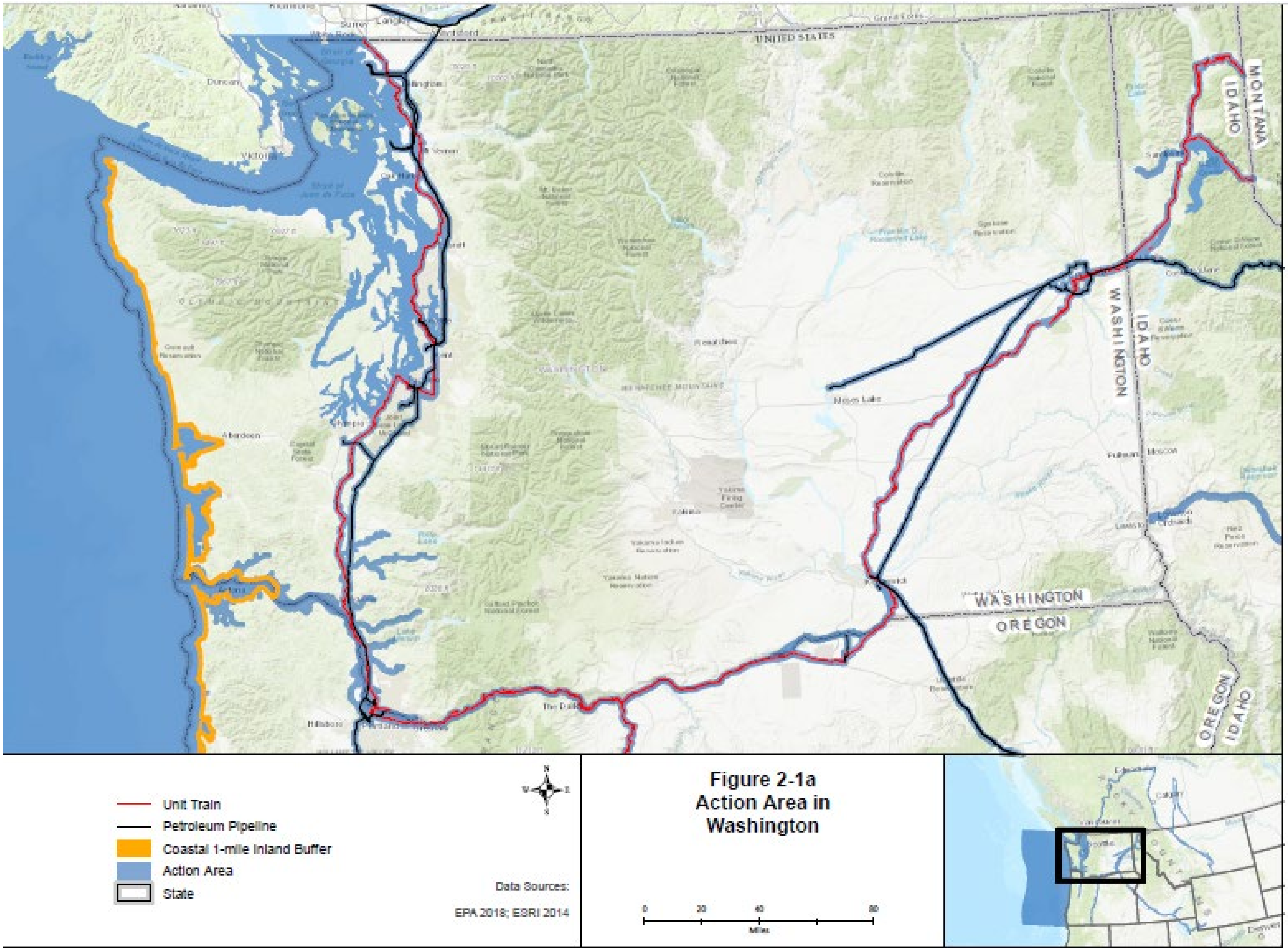
[c] Although exposures to oil is noted throughout Table 2-2, such exposures are considered to be less than or equal to the exposures associated with the baseline condition. In other words, spill response actions will typically reduce exposures to oil. However, this is not necessarily true of chemical countermeasures, which may increase exposures of aquatic species to oil.

[d] Conservation measures associated with related actions are described with those respective actions. All conservation measures provided in Table 2-2 are included in the proposed action and will be followed in the event of a spill response.

Key:

ACP	Area Contingency Plan	NW	Northwest
API	American Petroleum Institute	NWACP	Northwest Area Contingency Plan
ATV	all-terrain vehicle	PCB	polychlorinated biphenyl
BMP	best management practice	PPE	personal protective equipment
cm	centimeters	RCP	regional contingency plan
EPA	US Environmental Protection agency	RRT	Regional Response Team
ESA	Endangered Species Act	Services	USFWS and NMFS
EU	environmental unit	SMART	Special Monitoring of Applied Response Technologies
FOSC	federal on-scene coordinator	SOP	standard operating procedure
ft	feet	SOSC	State On-Scene Coordinator
GRP	geographical response plan	UC	Unified Command
m	meters	USCG	US Coast Guard
NMFS	National Marine Fisheries Service	USFWS	US Fish and Wildlife Service

Appendix 6.2 Action area maps from the EPA and USCG Biological Assessment



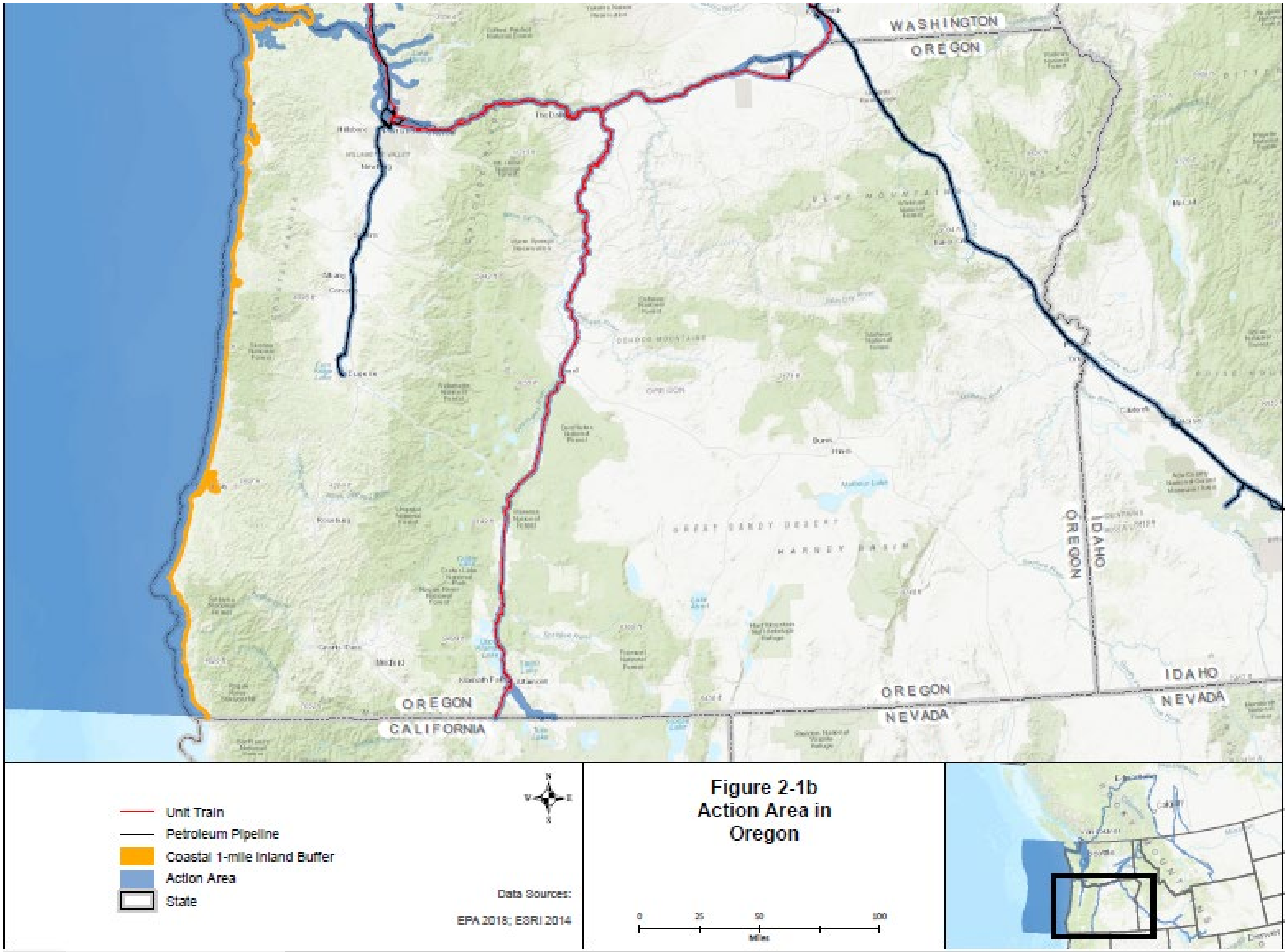


Figure 2-1b
Action Area in Oregon

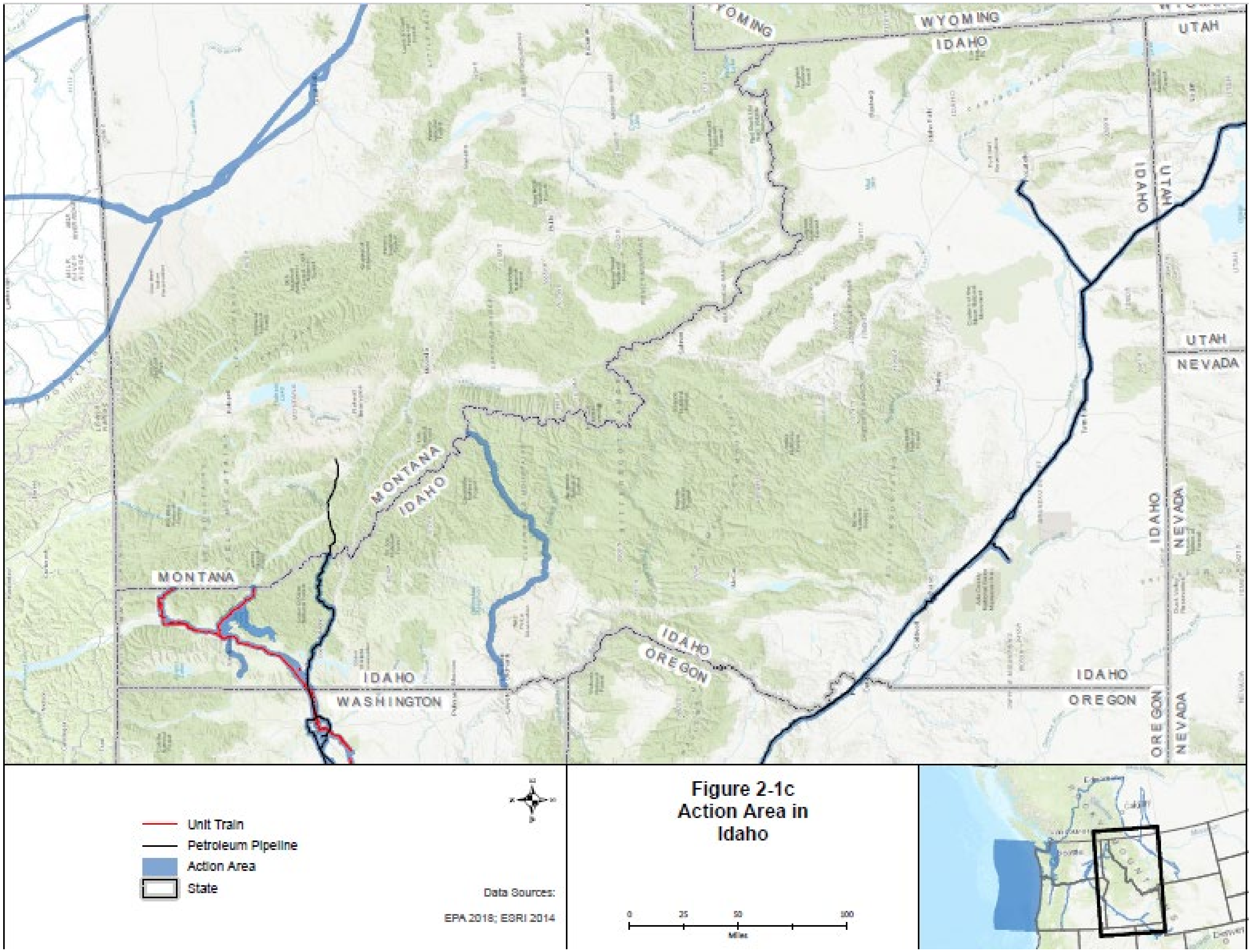


Figure 2-1c Action Area in Idaho